Oregon Standard Specifications for Construction

~~2008~~2015

OREGON DEPARTMENT OF TRANSPORTATION
~~355 CAPITOL STREET NE~~ 4040 FAIRVIEW INDUSTRIAL DRIVE SE
SALEM, OREGON ~~97301-3871~~ 97302-1142

PART 00100 - GENERAL CONDITIONS

Section 00110 - Organization, Conventions, Abbreviations, and Definitions

Organization

00110.00 Organization of Specifications - The Specifications are comprised of the following:

- The "~~2008~~2015 Oregon Standard Specifications for Construction", ~~Volume 1,~~ which contain Part 00100 "General Conditions", which deal with the solicitation process and contractual relationships~~;~~
- ~~The "2008 Oregon Standard Specifications for Construction", Volume 2, which contain~~ and Parts 00200 through 03000 ~~of~~which contain the detailed "Technical Specifications" involved in prosecution of the Work, organized by subject matter; and
- ~~Supplemental Specifications, if any; and~~
- The Special Provisions.

In addition, throughout the Specifications:

- Each Part is divided into Sections and Subsections.
- Reference to a Section includes all applicable requirements of the Section.
- When referring to a Subsection, only the number of the Subsection is used; the word "Subsection" is implied.
- Where Section and Subsection numbers are not consecutive, the interval has been reserved for use in the Special Provisions~~, Supplemental Specifications,~~ or future expansion of the Standard Specifications.

Conventions

00110.05 Conventions Used Throughout the Specifications Include:

(a) Grammar - The "~~2008~~2015 Oregon Standard Specifications for Construction", ~~Volume 1, which contain~~ Part 00100 "General Conditions", ~~are~~is written in the indicative mood, in which the subject is expressed. ~~The "2008 Oregon Standard Specifications for Construction", Volume 2, which contain~~ Parts 00200 through 03000~~ of~~, the detailed "Technical Specifications", are generally written in the imperative mood, in which the subject is implied. Therefore, throughout Parts 00200 through 03000, and on the Plans:

- The subject, "the Contractor", is implied.
- "Shall" refers to action required of the Contractor, and is implied.
- "Will" refers to decisions or actions of the Agency and/or the Engineer.
- The following words, or words of equivalent meaning, refer to the actions of the Agency and/or the Engineer, unless otherwise stated: "allowed", "directed", "established", "permitted", "ordered", "designated", "prescribed", "required", "determined".
- The words "approved", "acceptable", "authorized", "satisfactory", "suitable", "considered", and "rejected", "denied", "disapproved", or words of equivalent meaning, mean by or to the Agency and/or the Engineer, subject in each case to Section 00150 of the General Conditions.
- The words "as shown", "shown", "as indicated", or "indicated" mean "as indicated on the Plans".

- Certain Subsections labeled "Payment" contain statements to the effect that "payment will be made at the Contract amounts for the following items" (followed by a list of items). In such cases the Agency shall pay for only those Pay Items listed in the Schedule of Items.

(b) Capitalization of Terms - Capitalized terms, other than titles, abbreviations, and grammatical usage, indicate that they have been given a defined meaning in the Standard Specifications~~ and Supplemental Specifications.~~. Refer to Section 00110.20 "Definitions". Defined terms will always be capitalized in Part 00100; in Parts 00200 through 03000, defined terms will generally not be capitalized, with the notable exception of "the Contractor", "the Agency", and "the Engineer".

(c) Punctuation - In this publication the "outside method" of punctuation is employed for placement of the comma and the period with respect to quotation marks. Only punctuation that is part of the quoted matter is placed within quotation marks.

(d) References to Laws, Acts, Regulations, Rules, Ordinances, Statutes, Orders, and Permits - References are made in the text of the Specifications to "laws", "acts", "rules", "statutes", "regulations", "ordinances", etc. (collectively referred to for purposes of this Subsection as "Law"), and to "orders" and "permits" (issued by a governmental authority, whether local, State, or federal, and collectively referred to for purposes of this Subsection as "Permits"). Reference is also made to "applicable laws and regulations". The following conventions apply in interpreting these terms, as used in the Specifications.

- **Statutes and Rules** - Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OAR) referenced in the Specifications are accessible on line, including through the Oregon Legislative Counsel Committee web site and through the Oregon Secretary of State Archives Division web site.

- **Law** - In each case, unless otherwise expressly stated therein, the Law is to be understood to be the current version in effect. This also applies where a specific Law is referenced or cited, regardless of whether the text of the Law has been included in the Specifications or not, and regardless of whether the text of the Law has been summarized or paraphrased. In each case, the current version of the Law is applicable under any Contract. The reader is therefore cautioned to check the actual text of the Law to confirm that the text included in the Specifications has not been modified or superseded.

- **Permits** - Orders and permits issued by a government agency may be modified during the course of performing the Work under a Contract. Therefore, wherever the term "order" or "permit" is used in the Specifications, it is intended to refer to the then-current version. That version may be embodied in a modified, superseding order or permit, or it may consist of all terms and conditions of prior orders or permits that have not been superseded, as well as the additional terms added by amendment or supplement. In certain cases, the orders and/or permits are identified by name in the Specifications; in other cases the terms are used in the generic sense. The reader is cautioned to check the text(s) of each order and permit identified either by name or by generic reference.

- **Applicable Laws and Regulations** - Where the phrase "applicable laws and regulations" appears, it is to be understood as including all applicable laws, acts, regulations, administrative rules, ordinances, statutes, and orders and permits issued by a governmental or regulatory authority.

Abbreviations

00110.10 Abbreviations - Following are meanings of abbreviations used in the Standard Specifications, ~~the Supplemental Specifications,~~ in the Special Provisions, on the Plans, and in other Contract Documents. Other abbreviations and meanings of abbreviations may be in the

individual Sections of the Standard Specifications to which they apply, in the ~~Supplemental Specifications, in the~~ Special Provisions, and in OAR 731-005 and OAR 731~~-~~-007.

AAR - Association of American Railroads
AASHTO - American Association of State Highway and Transportation Officials
ABC - Associated Builders and Contractors, Inc.
AC - Asphalt Concrete
ACI - American Concrete Institute
ACP - Asphalt Concrete Pavement
ACWS - Asphalt Concrete Wearing Surface
AGC - Associated General Contractors of America
AIA - American Institute of Architects
AISC - American Institute of Steel Construction
AISI - American Iron and Steel Institute
AITC - American Institute of Timber Construction
ANSI - American National Standards Institute
APA - ~~American Plywood~~Engineered Wood Association
APWA - American Public Works Association
~~ARA - American Railway Association~~
~~AREA~~AREMA - American Railway Engineering and Maintenance of Right-of-Way Association
ASCE - American Society of Civil Engineers
ASME - American Society of Mechanical Engineers
ASTM - American Society for Testing and Materials
ATPB - Asphalt ~~-~~Treated Permeable Base
AWG - American Wire Gauge
AWPA - American Wood ~~Preservers~~Protection Association
AWS - American Welding Society
AWWA - American Water Works Association
CAgT - Certified Aggregate Technician
CAT-I - Certified Asphalt Technician I
CAT-II - Certified Asphalt Technician II
CBM - Certified Ballast Manufacturers
CCO - Contract Change Order
CCT - Concrete Control Technician
CDT - Certified Density Technician
CEBT - Certified Embankment and Base Technician
CMDT - Certified Mixture Design Technician
CPF - Composite Pay Factor
CRSI - Concrete Reinforcing Steel Institute
CFR - Code of Federal Regulations
CS - Commercial Standard, Commodity Standards Division, U.S. Department of Commerce
D1.1 - Structural Welding Code - Steel, American Welding Society, current edition
D1.5 - Bridge Welding Code, American Welding Society, current edition
DBE - Disadvantaged Business Enterprise
DEQ - Department of Environmental Quality, State of Oregon
DOGAMI - Department of Geology and Mineral Industries, State of Oregon
DSL - ~~Division~~Department of State Lands, State of Oregon
EAC - Emulsified Asphalt Concrete
EPA - U.S. Environmental Protection Agency
ESCP - Erosion and Sediment Control Plan

FHWA - Federal Highway Administration, U.S. Department of Transportation
FSS - Federal Specifications and Standards, General Services Administration
GSA - General Services Administration
~~HMAC - Hot Mixed Asphalt Concrete~~
ICEA - Insulated Cable Engineers Association (formerly IPCEA)
IES - Illuminating Engineering Society
IMSA - International Municipal Signal Association
ISO - International Standards Organization
ITE - Institute of Transportation Engineers
JMF - Job Mix Formula
MFTP - Manual of Field Test Procedures (ODOT)
MIL - Military Specifications
MSC - Minor Structure Concrete
MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways, FHWA, U.S. Department of Transportation
NEC - National Electrical Code
NEMA - National Electrical Manufacturer's Association
NESC - National Electrical Safety Code
NIST - National Institute of Standards and Technology
NPDES - National Pollutant Discharge Elimination System
NPS - Nominal Pipe Size (dimensionless)
OAR - Oregon Administrative Rules
ODA - Oregon Department of Agriculture
ODOT - Oregon Department of Transportation
ORS - Oregon Revised Statutes
OR-OSHA - Oregon Occupational Safety and Health Division of the Department of Consumer and Business Services
OSHA - Occupational Safety and Health Administration, U.S. Department of Labor
PCA - Portland Cement Association
~~PCC - Portland Cement Concrete~~
PCI - Precast/Prestressed Concrete Institute
PCP - Pollution Control Plan
PF - Pay Factor of a constituent
PLS - Professional Land Surveyor
PMBB - Plant Mixed Bituminous Base
PTI - Post-Tensioning Institute
PUC - Public Utility Commission, State of Oregon
QA - Quality Assurance
QC - Quality Control
QCT - Quality Control Technician
QL - Quality Level
QPL - Qualified Products List
RAP - Reclaimed Asphalt ~~Concrete~~ Pavement
REA - Rural Electrification Administration, U.S. Department of Agriculture
RMA - Radio Manufacturers Association or Rubber Manufacturers Association
SAE - Society of Automotive Engineers
SI - International System of Units (Système Internationale)
SRCM - Soil and Rock Classification Manual (ODOT)
SSPC - Society for Protective Coatings
T - Tolerances, AASHTO Test Method
TM - Test Method (ODOT)

TV	-	Target Value
UBC	-	Uniform Building Code (as adopted by the State of Oregon)
UL	-	Underwriters Laboratory, Inc.
UPC	-	Uniform Plumbing Code (as adopted by the State of Oregon)
USC	-	United States Code
WAQTC	-	Western Alliance for Quality Transportation Construction
WCLIB	-	West Coast Lumber Inspection Bureau
WWPA	-	Western Wood Products Association

Definitions

00110.20 Definitions - Following are definitions of words and phrases used in the Standard Specifications, ~~the Supplemental Specifications,~~ in the Special Provisions, on the Plans, and in other Contract Documents. Other definitions may be in the individual Sections of the Standard Specifications to which they apply, in the ~~Supplemental Specifications, in the~~ Special Provisions, and in OAR 731-005 and OAR 731-007.

Act of God or Nature - A natural phenomenon of such catastrophic proportions or intensity as would reasonably prevent performance.

Addendum - A written or graphic modification, issued before the opening of Bids, which revises, adds to, or deletes information in the Solicitation Documents or previously issued Addenda.

Additional Work - Increased quantities of any Pay Item, within the scope of the Contract, for which a unit price has been established.

Advertisement - The public announcement (Notice to Contractors) inviting Bids for Work to be performed or Materials to be furnished.

Agency - The city, county, or State agency or special district or political subdivision, as applicable, which has entered into a Contract with the Contractor.

Agency-Controlled Lands - Lands owned by the Agency, or controlled by the Agency under lease or agreement, or under the jurisdiction and control of the Agency for the purposes of the Contract.

Aggregate - Rock of specified quality and gradation.

Attorney in Fact - An Entity appointed by another to act in its place, either for some particular purpose, or for the transaction of business in general.

Award - Written notification to the Bidder that the Bidder has been awarded a Contract.

Base - A Course of specified material of specified thickness placed below the Pavement.

Bid - A competitive offer, binding on the Bidder and submitted in response to an invitation to bid.

Bid Bond - The Surety bond for Bid guarantee.

Bid Booklet - The bound paper version included in the Solicitation Documents, or the electronic version that is available to be downloaded from the BidExpress® website, that contain the information identified in 00120.10.

Bid Closing - The date and time after which Bids, Bid modifications, and Bid withdrawals will no longer be accepted.

Bid Documents - See under Solicitation Document.

Bid Opening - The date and time Bids are opened.

Bid Schedule - The list of Pay Items, their units of measurement, and estimated quantities. (When a Contract is awarded, the Bid Schedule becomes the Schedule of Items.)

Bid Section - The portion of the Bid Booklet containing all pages after the Bidder's checklist and before the appendix.

Bidder - An Entity that submits a Bid in response to an invitation to bid.

Bike Lane - A lane in the Traveled Way, designated by striping and Pavement markings for the preferential or exclusive use of bicyclists.

Borrow - Material lying outside of planned or required Roadbed excavation used to complete Project earthwork.

Boulders - Particles of rock that will not pass a 12 inch square opening.

Bridge - A single or multiple span Structure, including supports, that carries motorized and non-motorized vehicles, pedestrians, or utilities on a Roadway, walk, or track over a watercourse, highway, railroad, or other feature.

Buttress - A rock fill placed at the toe of a landslide or potential landslide in order to resist slide movement.

Calendar Day - Any day shown on the calendar, beginning and ending at midnight.

Camber - A slight arch in a surface or Structure to compensate for loading.

Change Order - A written order issued by the Engineer to the Contractor modifying Work required by the Contract, or adding Work within the scope of the Contract, and, if applicable, establishing the basis of payment for the modified Work.

Changed Work - Work included in a Pay Item and within the scope of the Contract that is different from that reflected in the ~~Plans and Specifications.~~Contract Documents. (see 00140.30)

Class of Project - A designation based on a Project's funding source, i.e., State or Federal-Aid.

Class of Work - A designation referring to the type of Work in which Bidders must be pre-qualified. Classes of Work are limited to those listed in ODOT's Contractor's Prequalification Application.

Clay - Soil passing a No. 200 sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents.

Clear Zone - Roadside border area, starting at the edge of the Traveled Way, that is available for safe use by errant vehicles. Establishing a minimum width Clear Zone implies that rigid objects and certain other hazards within the Clear Zone should be relocated outside the Clear Zone, or shielded, or remodeled to make them break away on impact or be safely traversable.

Close Conformance - Where working tolerances are given on the Plans or in the Specifications, Close Conformance means compliance with those tolerances. Where working tolerances are not given, Close Conformance means compliance, in the Engineer's judgment, with reasonable and customary manufacturing and construction tolerances.

Coarse Aggregate - Crushed Rock or crushed Gravel retained on a 1/4 inch sieve, with allowable undersize.

Cobbles - Particles of Rock, rounded or not, that will pass a 12 inch square opening and be retained on a 3 inch sieve.

Commercial Grade Concrete - Concrete furnished according to Contractor proportioning, placed in minor Structures and finished as specified.

Contract - The written agreement between the Agency and the Contractor, including without limitation all Contract Documents, describing the Work to be completed and defining the rights and obligations of the Agency and the Contractor.

Contract Administration Engineer - The Agency representative presiding over Agency-level claims review under 00199.40.

Contract Amount - Sum of the Pay Item amounts computed by multiplying the Pay Item quantities by the unit prices in the Schedule of Items.

Contract Documents - Solicitation Documents, Specifications, Plans, Contract booklet, Change Orders, Force Account Work orders, pay documents issued by the Agency, Materials certifications, Project Work schedules, final estimate, written orders and authorizations issued by the Agency, ~~approved Plans,~~ Material source development and reclamation plans, and permits, orders and authorizations obtained by the Contractor or Agency applicable to the Project, as well as all documents incorporated by reference therein.

Contract Time - The amount of time allowed to complete the Work under the Contract.

Contractor - The Entity awarded the Contract according to the solicitation.

Course - A specified Surfacing Material placed in one or more Lifts to a specified thickness.

Coverage - One Pass by a piece of Equipment over an entire designated area.

Cross Section - The exact image formed by a plane cutting through an object, usually at right angles to a central axis, to determine area.

Day - A Calendar Day including weekdays, weekends, and holidays, unless otherwise specified.

Durable Rock - Rock that has a slake durability index of at least 90% based on a two-cycle slake durability test, according to ASTM D 4644. In the absence of test results, the Engineer may evaluate the durability visually.

Emulsified Asphalt - Emulsified asphalt cement.

Emulsified Asphalt Concrete - A mixture of Emulsified Asphalt and graded Aggregate.

Engineer - The Chief Engineer of the Agency acting either directly or through authorized representatives. If the Agency has not designated a Chief Engineer, this term denotes the person responsible for administering its public works program.

Entity - A natural person capable of being legally bound, sole proprietorship, limited liability company, corporation, partnership, limited liability partnership, limited partnership, profit or nonprofit unincorporated association, business trust, two or more persons having a joint or common economic interest, or any other person with legal capacity to contract, or a government or governmental subdivision.

Equipment - All machinery, tools, manufactured products, and fabricated items needed to complete the Contract or specified for incorporation into the Work.

Establishment Period - The time specified to assure satisfactory establishment and growth of planted Materials.

Existing Surfacing - Pavements, slabs, curbs, gutters, walks, driveways, and similar constructions of bricks, blocks, portland cement concrete, bituminous treated materials, and granular surfacing materials on existing Highways.

Extra Work - Work not included in the Contract, but deemed by the Engineer to be necessary to complete the Project.

Final Acceptance - Written confirmation by the Agency that the Project has been completed according to the Contract, with the exception of latent defects and Warranty obligations, if any, and has been accepted.

Final Inspection - The inspection conducted by the Engineer to determine that the Project has been completed according to the Contract.

Fine Aggregate - Crushed Rock, crushed Gravel, or Sand that passes a 1/4 inch sieve, with allowable oversize.

First Notification - Written acknowledgment by the Engineer of the date on which workers employed by the Contractor or a Subcontractor have begun performance of the Contract, including Aggregate source development or erection of a plant, but not including installation of covered temporary signs according to Section 00225.

Force Account Work - Items of Extra Work ordered by the Engineer that are to be paid according to Section 00197.

Granular Material - Graded and selected free-draining material composed of particles of Rock, Sand, and Gravel.

Gravel - Particles of Rock, rounded or not, that will pass a 3 inch sieve and be retained on a No. 4 sieve.

Highway - Every road, street, thoroughfare and place, including bridges, viaducts and other structures within the boundaries of the State, open, used or intended for use by vehicular traffic.

Incidental - A term identifying those acts, services, transactions, property, Equipment, labor, Materials, or other items for which the Agency will make no separate or additional payment.

Inspector - The representative of the Engineer authorized to inspect and report on Contract performance.

Leveling - Placing a variable-thickness Course of Materials to restore horizontal and vertical uniformity to existing Pavements, normally continuous throughout the Project.

Lift - The compacted thickness of material placed by Equipment in a single Pass.

Mandatory Source - A material source provided by the Agency from which the Contractor is required to obtain Materials. (see 00160.00(b) and 00160.40)

Materials - Any natural or manmade substance specified for use in the construction of the Project or for incorporation into the Work.

Median - The portion of a divided Highway separating traffic traveling in opposite directions.

Multiple Course Construction - Two or more Courses, exclusive of Patching or Leveling, placed over the entire Roadway width.

Multi-Use Path - That portion of the Highway Right-of-Way or a separate Right-of-Way, physically separated from motor vehicle traffic and designated for use by pedestrians, bicyclists and other non-motorized users.

Neat Line - Theoretical lines specified or indicated on the Plans for measurement of quantities.

Nondurable Rock - Rock that has a slake durability index of less than 90% based on a two-cycle slake durability test, as tested by ASTM D 4644, or Rock that is observed to readily degrade by air, water, and mechanical influence.

Notice to Contractors - The public announcement inviting Bids for Work to be performed or Materials to be provided.

Notice to Proceed - Written notice authorizing the Contractor to begin performance of the Work.

On-Site Work - Any Work taking place on the Project Site, including designated staging areas adjacent to the Project Site, except for installation of covered temporary signs according to Section 00225.

Organic Soil - A Soil with sufficient organic content to influence the Soil properties.

Panel - The width of specified Material being placed by Equipment in a single Pass.

Pass - One movement of a piece of Equipment over a particular location.

Patching - Placing a variable-thickness Course of Materials to correct sags, dips, and/or bumps to the existing grade and Cross Section, normally intermittent throughout the Project.

Pavement - Asphalt concrete or portland cement concrete placed for the use of motor vehicles, bicycles, or pedestrians on Roadways, Shoulders, Multi-Use Paths and parking areas.

Pay Item (Contract Item) - A specific unit of Work for which a price is provided in the Contract.

Payment Bond - The approved security furnished by the Contractor's Surety as a guaranty of the Contractor's performance of its obligation to pay promptly in full all sums due for Materials, Equipment, and labor furnished to complete the Work.

Peat - A Soil composed primarily of vegetative matter in various stages of decomposition, usually with an organic odor, dark brown to black color, and a spongy consistency.

Performance Bond - The approved security furnished by the Contractor's Surety as a guaranty of the Contractor's performance of the Contract.

Plans - Standard and Supplemental Drawings, and approved unstamped and reviewed stamped Working Drawings. (see 00150.10 and 00150.35)

Project - The sum of all Work to be performed under the Contract.

Project Manager - The Engineer's representative who directly supervises the engineering and administration of a Contract.

Project Site - The geographical dimensions of the real property on which the Work is to be performed, including designated contiguous staging areas.

Prospective Source - A Material source provided by the Agency, from which the Contractor has the option of obtaining Materials. (see 00160.00(a) and 00160.40)

Publicly-Owned Equipment - Equipment acquired by a state, county, municipality or political subdivision primarily for use in its own operations.

Public Traffic - Vehicular or pedestrian movement, not associated with the Contract Work, on a public way.

Railroad - Publicly or privately owned rail carriers, including passenger, freight, and commuter rail carriers, their tenants, and licensees. Also, Utilities that jointly own or use such facilities.

Right-of-Way - Land, property, or property interest, usually in a strip, acquired for or devoted to transportation or other public works purposes.

Roadbed - Completed excavations and embankments for the Subgrade, including ditches, side slopes, and slope rounding, if any.

Roadside - The area between the outside edges of the Shoulders and the Right-of-Way boundaries. Unpaved median areas between inside Shoulders of divided Highways and infield areas of interchanges are included.

Roadway - That portion of a Highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or Shoulder. If a Highway includes two or more separate Roadways, the term "Roadway" refers to any such Roadway separately, but not to all such Roadways collectively. (see Traveled Way)

Rock - Natural deposit of solid material composed of one or more minerals occurring in large masses or fragments.

Sand - Particles of Rock that will pass a No. 4 sieve and be retained on a No. 200 sieve.

Schedule of Items - The list of Pay Items, their units of measurement, estimated quantities, and prices.

Schedule of Values - The breakdown of the values of the component elements comprising a lump sum Pay Item.

Second Notification - Written acknowledgment by the Engineer of the end of Contract Time according to 00180.50(g).

Shoulder - The part of a Roadbed contiguous to the Traveled Way or Roadway, whether paved or unpaved, for accommodating stopped vehicles, for emergency use and for lateral support of Base and surface Courses.

Silt - Soil passing a No. 200 sieve that is nonplastic or exhibits very low plasticity.

Single Course Construction - A wearing Course only, not including patching or leveling Courses or partial width Base Course.

Slope - Vertical distance to horizontal distance, unless otherwise specified.

Soil - Accumulations of particles produced by the disintegration of Rock, which sometimes contains organic matter. Particles may vary in size from Clay to Boulders.

Solicitation Document - Documents which define the procurement of a public improvement Project, including, but not limited to, the Bid Booklet, Agency-provided Plans, Standard Specifications, ~~Supplemental Specifications,~~ Special Provisions, Addenda, and which includes all documents incorporated by reference. May also be called Bid Documents.

Special Provisions - The special directions, provisions, and requirements specific to a Project that supplement or modify the Standard Specifications~~ and the Supplemental Specifications.~~. Permits and orders governing the Project that are issued directly to the Agency by a governmental or regulatory authority are considered to be part of the Special Provisions, to the extent and under the conditions stipulated in the Special Provisions. This includes any amended or supplemental permits or orders issued during the course of performing the Work under a Contract.

Special Services - ~~Force Account~~ Work services that the Contractor and Engineer agree cannot be satisfactorily performed by the Contractor's and Subcontractors' forces, e.g., fabrication and machining work that is most effectively performed away from the Project Site, or rental of operated Equipment as defined in 00180.20(c).

Specifications - The Standard Specifications~~, the Supplemental Specifications,~~ and Special Provisions, together with all provisions of other documents incorporated therein by reference.

Standard Drawings - The Agency-prepared detailed drawings for Work or methods of construction that normally do not change from project to project.

Standard Specifications - "Oregon Standard Specifications for Construction~~", Volume 1, Part 00100, "General Conditions", and "Oregon Standard Specifications for Construction", Volume 2, Parts 00200 through 03000, "Technical Specifications~~", current edition, published by the Oregon Department of Transportation.

State - The State of Oregon.

Structures - Bridges, retaining walls, endwalls, cribbing, buildings, culverts, manholes, catch basins, drop inlets, sewers, service pipes, underdrains, foundation drains, and other similar features which may be encountered in the Work.

Subbase - A Course of specified material of specified thickness between the Subgrade and a Base.

Subcontractor - An Entity having a direct contract with the Contractor or another Subcontractor, to perform a portion of the Work.

Subgrade - The top surface of completed earthwork on which Subbase, Base, Surfacing, Pavement, or a Course of other Material is to be placed.

Substructure - Those parts of a Structure which support the Superstructure, including bents, piers, abutments, and integrally built wingwalls, up to the surfaces on which bearing devices rest. Substructure also includes portions above bearing surfaces when those portions are built integrally with a Substructure unit (e.g., backwalls of abutments). When Substructure and Superstructure elements are built integrally, the division between Substructure and Superstructure is considered to be at the bottom soffit of the longitudinal or transverse beam, whichever is lower. Culverts and rigid frames are considered to be entirely Substructure.

Superstructure - Those parts of a Structure above the Substructure, including bearing devices.

Supplemental Drawings - The Agency-prepared detailed drawings for Work or methods of construction that are Project specific, and are denoted by title in the Project title block.

~~**Supplemental Specifications** - "Supplemental Oregon Standard Specifications for Construction". Supplemental Specifications are applicable to the particular Contract, and supplement and modify the Standard Specifications with regard to the Work to be done under that Contract.~~

Supplier - The Entity that furnishes goods to be incorporated into the Work.

Surety - The Entity that issues the bond.

Surfacing - The Course or Courses of material on the Traveled Way, auxiliary lanes, Shoulders, or parking areas for vehicle use.

Third Notification - Written acknowledgment by the Engineer, subject to Final Acceptance, that as of the date of the notification the Contractor has completed the Project according to the Contract, including without limitation completion of all minor corrective work, Equipment and plant removal, site clean-up, and submittal of all certifications, bills, forms and documents required under the Contract.

Ton - One short ton of 2,000 pounds (Ton, ton, Tn, or T).

Topsoil - Soil ready for use in a planting bed.

Traffic Lane - That part of the Traveled Way marked for moving a single line of vehicles.

Traveled Way - That part of the Highway for moving vehicles, exclusive of ~~auxiliary lanes,~~ berms and Shoulders.

Typical Section - That Cross Section established by the Plans which represents in general the lines to which the Contractor shall work in the performance of the Contract.

Unsuitable Material - Frozen material, or material that contains organic matter, muck, humus, peat, sticks, debris, chemicals, toxic matter, or other deleterious materials not normally suitable for use in earthwork.

Utility - A line, facility, or system for producing, transmitting, or distributing communications, power, electricity, heat, gas, oil, water, steam, waste, storm water not connected with highway drainage, or any other similar commodity which directly or indirectly serves the public. The term may also mean the utility company, district, or cooperative owning and operating such facilities, including any wholly-owned or controlled subsidiary.

Warranty Bond - The approved security furnished by the Contractor's, Subcontractor's, or Supplier's Surety as a guaranty of the Contractor's performance of its warranty obligations.

Wetlands - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated Soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Work - The furnishing of all Materials, Equipment, labor, and Incidentals necessary to successfully complete any individual Pay Item or the entire Contract, and the discharge of duties and obligations imposed by the Contract.

Working Drawings - Supplemental Plans, not furnished by the Agency, that the Contractor is required to submit to the Engineer. (see 00150.35)

Section 00120 - Bidding Requirements and Procedures

00120.00 Prequalification of Bidders - The Oregon Department of Transportation (ODOT) will prequalify Bidders according to OAR 734-010 and OAR 731-005-0450. A Bidder must file for prequalification and pay a fee. Prequalification must be renewed by September 1 of each year.annually. Bidders shall make application for prequalification on standard forms furnished by ODOT's Procurement Office - Construction Contracts Unit, 455 Airport Road SE, Building K, Salem, Oregon 97301-5348 (telephone 503-986-6916-2710). Bidders shall return the completed application and fee to the ODOT Procurement Office - Construction Contracts Unit.

Contracts will only be awarded to Bidders who, at the time of Bid Opening, are prequalified in the Class or Classes of Work specified in the Special Provisions, except that a Bidder whose prequalification has been revoked or revised as provided in ORS 279C.430(4) may also be eligible for Award under that statute if the Project was advertised prior to the revocation or revision. The Agency will consider a Bid from a Bidder whose complete application for prequalification has been received by the ODOT Procurement Office - Construction Contracts Unit at least 10 Calendar Days before the opening of Bids. Bidders shall submit Bids in the same company name used on the prequalification application; provided however, if Bidder's legal name has changed since the submittal of its application for prequalification, it shall submit its Bid under its current legal name with the former name referenced by "formerly known as".

The Agency will regularly evaluate the performance of Contractors on its projects for purposes of responding to reference checks, future prequalification and determinations of responsibility.

00120.01 General Bidding Requirements - Bidders may obtain and submit Bids by paper, through the internet (electronic), or both. If both paper Bids and electronic Bids are submitted for the same invitation to bid, the paper Bids will prevail.

The standard prequalification forms furnished by the ODOT Procurement Office shall be used by the Bidder to file authorized signatures with the Agency. Signatures are of personnel authorized to submit Bids, modify Bids, or withdraw Bids. In addition, for electronic Bids, the authorized personnel shall have a digital signature and unique ID. The digital signature and unique ID are obtained from BidExpress® and approved by the Agency. For ODOT Bids, only digital signatures obtained from BidExpress® will be accepted. Bidders submitting Bids as a joint venture must also establish a digital signature and unique ID.

00120.05 RequestsRequest for Solicitation Documents - Plans, Special Provisions, and Bid Booklets:

(a) Informational Plans and Specifications (not for bidding) and copies of the Oregon Standard Specifications**Special Provisions** - Informational Project Plans and Special Provisions are available, free of charge, on the ODOT Electronic Bidding Information Distribution System (eBIDS) web site identified in the Notice to Contractors available on the ODOT Procurement Office - Construction Contracts Unit web site or may be purchased at the ODOT Procurement Office - Construction, Contractor Plans Contracts Unit, 455 Airport Road SE, Building K, Salem, Oregon 97301-5348 (telephone 503-986-6936-2710).

(a**(b) Bidding Plans, Special Provisions, and Bid Booklets** - Bidders may obtain and submit either paper Bids or electronic Bids.

(1) Paper Bids - Bidders must obtain Solicitation Documentschoosing to submit paper bids shall purchase Plans, Special Provisions, and Bid Booklets from the ODOT Procurement Office - Construction, Contractor Plans, 455 Airport Road SE, Building K, Salem, Oregon 97301-5348 (telephone 503-986-6936). Each request must include both the name of the

~~person ordering or~~ Contracts Unit or download them for free from ODOT eBIDS web site. Bidders obtaining ~~the Solicitation Documents, and the name of the Entity intending to use them. (The Agency will add the name of the Entity intending to use the Solicitation Documents to the~~Plans, Special Provisions, and Bid Booklets from these two sources must register on ODOT's list of "Holders of Bidding Plans~~.) Bidders are cautioned that~~". Bids will only ~~Solicitation Documents obtained from the ODOT Procurement Office - Construction, Contractor Plans may be used to submit Bids for the paper method for submitting Bids.~~be accepted from Bidders registered as "Holders of Bidding Plans".

(~~b~~2) Electronic Bids - Bidders ~~must obtain Solicitation Documents from the ODOT Procurement Office - Construction, Contractor Plans, 455 Airport Road SE, Building K, Salem, Oregon 97301-5348 (telephone 503-986-6936). Each request must include both the name of the person ordering or obtaining the Solicitation Documents, and the name of the Entity intending to use them. (The Agency will add the name of the Entity intending to use the Solicitation Documents to the list of Holders of Bidding Plans.) In addition, Bidders~~ choosing to submit electronic Bids ~~electronically must obtain~~shall use the computer-generated electronic Bid Booklet from the BidExpress® ~~website.~~web site. In addition, Bidders shall purchase Plans and Special Provisions from the ODOT Procurement Office - Construction Contracts Unit or download them for free from ODOT eBIDS web site. Bidders obtaining Plans and Special Provisions from these two sources must register on ODOT's list of "Holders of Bidding Plans". Bids submitted through BidExpress® will only be accepted from Bidders registered as "Holders of Bidding Plans"

00120.10 Bid Booklet - The Bid Booklet may include, but is not limited to:

- Bidder's checklist
- Bid Section
- Appendix, which includes required time-sensitive forms, DBE information, sample forms, and other informational pages

The Bid Section includes all pages after the Bidder's checklist and before the appendix. The Bid Section may include, but is not limited to:

- Description and location of the proposed Project
- Time, date, and location for opening Bids
- Project completion time
- Class of Project (i.e., Federal-Aid or State)
- Class of Work
- Identification of applicable ~~Supplemental Specifications and~~ Special Provisions
- Bid statement
- Certificate of non-collusion
- Certificate of noninvolvement in any debarment or suspension (for Federal-Aid Projects)
- Certificate regarding lobbying activities (for Federal-Aid Projects)
- Certificate of residency (for State Projects)
- Certificate of compliance with Oregon tax laws
- Bid Schedule
- Identification of Bidder(s) and Sureties
- Limiting statements (see 00120.50)
- Bid signature page

- Bid Bond form
- First-tier Subcontractor disclosure form

Depending on the Class of Project, other certificates or statements may be bound within the Bid Section. Plans, Specifications, and other documents referred to in the Bid Section will be considered part of the Bid.

00120.15 Examination of Work Site and Solicitation Documents; Consideration of Conditions to be Encountered - Before submitting a Bid, Bidders shall carefully examine the site of the proposed Work, the Bid Booklet, Plans, and Specifications. Bidders shall also contact Utility owners to verify all Utilities' anticipated involvement on the Project Site. Bidders are also encouraged to review any subsurface investigation material referenced in 00120.25 that may be available. Submission of a Bid will constitute confirmation that the Bidder has examined the Project Site and Solicitation Documents, finds the Plans and Specifications to be sufficiently detailed and accurate to enable Bidder to properly perform the Work, and understands the conditions to be encountered in performing the Work and all requirements of the Contract.

~~The Agency and its employees will not be~~The Bidder is responsible for loss or unanticipated costs suffered by the Bidder because of the Bidder's failure to fully examine the site and become fully informed about all conditions of the Work, or failure to request clarification of Plans and Specifications Bidder believes to be erroneous or incomplete.

Any clarification of Plans and Specifications needed by the Bidder shall be requested in writing through the Engineer. Requests shall be made in sufficient time for the Agency's reply to reach all Bidders before Bid Closing. Oral explanations or interpretations given before receiving Bids for a Project will not be binding. To be binding, interpretation of the Plans and Specifications by the Agency must be made by written Addendum furnished to all Holders of Bidding Plans according to 00120.30. Notification of erroneous or incomplete Plans or Specifications shall also be submitted to the Engineer. Such notification shall also be made in sufficient time for the Agency to make any necessary modifications and issue Addenda to Bidders prior to Bid Closing.

00120.16 Material, Equipment, and Method Substitutions - When the Contract specifies certain Materials, Equipment, and/or methods, the Bidder shall include those Materials, Equipment, and/or methods in the Bid unless the Engineer has issued an Addendum granting approval to substitute. The procedure for requesting approval is as follows:

(a) Written Request - If a Bidder proposes to use Materials, Equipment and/or methods other than those specified, the Bidder shall send a written request to the Engineer, at least ~~seven~~ 7 Calendar Days prior to Bid Opening, including complete descriptive and technical information on the proposed Materials, Equipment and/or methods.

(b) Functional Similarity - Materials and Equipment proposed for substitution shall be similar in design, and equal or better in quality and function to those specified.

(c) Manufacturer's Information - If manufacturers' brochures or information is needed, the Bidder shall submit three copies of each with all pertinent information clearly marked.

(d) Differences - The Bidder shall specifically note all differences between the specified Materials, Equipment and/or methods and the proposed substitutes.

(e) Cost - Where a substitute will result in alteration of the design or space requirements, or any other modifications to the Plans, the Bidder shall include in the substitution request all items of cost for the revised design and construction.

(f) Notification of Holders of Bidding Plans - If the Engineer approves any proposed substitution, such approval, and any modifications necessitated to the design and construction by the substitution, will be acknowledged by Addenda.

Unless the Engineer has approved substitutions of Materials, Equipment, and/or methods prior to opening of Bids, the Bidder shall furnish the items specified in the Contract. Substitution after Award is specified in 00180.31(b), 00180.31(c), and 00180.31(d).

00120.17 Use of Agency-Owned Land for Staging or Storage Areas - The Contractor may use Agency-owned property for staging or storage areas, subject to the following limitations:

(a) Within Normal Right-of-Way Limits - If approved by the Engineer, the Contractor may use available property within the normal Right-of-Way limits for the purpose of constructing improvements under the Contract. Where the Agency owns, or has rights to, other adjacent properties in the Project area, "normal Right-of-Way" is limited to a line drawn across that property connecting the normal Right-of-Way limits on either side of the property.

(b) Outside Normal Right-of-Way Limits - The Contractor may not use Agency-owned property outside of normal Right-of-Way limits for the Project without the approval of the Engineer.

If a Bidder obtains approval before submitting a Bid, use of the property will be at no cost to the Contractor, or at a cost stated by the Engineer upon granting approval, as confirmed by Addendum.

If approval is not obtained before submitting a Bid, and the Contractor proposes to use Agency-owned property outside the normal Right-of-Way limits, then use of the property may be approved by the Engineer, but the Contractor will be assessed fair market value, as determined by the Engineer, for use of the property.

(c) Restrictions on Use - Contractors shall comply with all applicable laws, ordinances, and regulations pertaining to use of Agency-owned property, and shall:

- Not cause unreasonable impacts on traffic and other facility users.
- Clean up all hazardous materials deposited by, or resulting from, Contractor operations.
- Be responsible for all costs associated with use of the property.

00120.20 Interpretation of Quantities in Bid Schedule - Quantities appearing in the Bid Schedule are approximate and are provided only for comparison of Bids. The Agency does not warrant that the actual individual items, amount of Work, or quantities will correspond to those shown in the Bid Schedule. Payment to the Contractor will be made only for actual quantities of Work performed and accepted or Materials furnished and accepted, as required by the Contract. Quantities of Work to be performed and Materials to be furnished may each be increased, decreased, or omitted as provided in 00120.30 and 00140.30.

00120.25 Subsurface Investigations - If the Agency or its consultant has conducted subsurface or geologic investigations of the proposed Project Site, the results of the investigations may be included in written reports. If reports have been prepared, copies will be available at the Engineer's office. If the Agency has retained subsurface samples, they will also be available for inspection. Bidders and the Contractor may make arrangements for viewing the samples through the Engineer's office.

The availability of subsurface information from the Agency is solely for the convenience of the Bidder and shall not relieve the Bidder or the Contractor of any risk, duty to make examinations and

investigations as required by 00120.15, or other responsibility under the Contract Documents. It is mutually agreed to by all parties that:

- The written report(s) are reference documents and not part of the Contract Documents.
- The subsurface investigations made by the Agency are for the purpose of obtaining data for planning and design of the Project.
- The data ~~concerning borings~~ for individual test boring logs apply only to that particular boring and is not intended to ~~represent with reasonable accuracy conditions and materials found~~be conclusive as to the character of any material between or around test borings.
- If Bidders use this information in ~~specific borings~~preparing a Bid, it is used at ~~the time the borings were made~~their own risk, and Bidders are responsible for all conclusions, deductions, and inferences drawn from this information.

00120.30 Changes to Plans, Specifications, or Quantities before Opening of Bids - The Agency reserves the right to issue Addenda making changes or corrections to the Plans, Specifications, or quantities. The Agency will provide Addenda only by publishing them on the Agency's web site. See the ODOT web site page included with the Special Provisions for the web site address where the Addenda are available.

Addenda may be downloaded from the web site. Bidders shall be responsible for checking the Agency web site for Addenda. Bidders should check the web site weekly until the week of Bid Closing and daily the week of Bid Closing.

Bidders, not the Agency, shall be responsible for failure of Bidders to check and download Addenda. Bids shall incorporate all Addenda. Bids may be rejected if opened and found by the Agency to not be based on all Addenda published on the web site before Bid Closing.

00120.40 Preparation of Bids:

(a) General:

(1) Paper Bids - For Bids submitted by paper, obtained from either the ODOT Procurement Office - Construction Contracts Unit or ODOT eBIDS, the Bidders shall not alter, in any manner, the paper documents ~~bound~~ within the Bid Section. Bid Sections ~~available electronically~~from BidExpress® shall not be substituted for paper Bid Sections. Bidders shall complete the certifications and statements included in the Bid Section of the Bid Booklet according to the instructions. Signature of the Bidder's authorized representative thereon constitutes the Bidder's confirmation of and agreement to all certifications and statements contained in the paper Bid Booklet. Entries on the paper documents in the Bid Section shall be in ink or typed. Signatures and initials shall be in ink, except for changes submitted by facsimile (FAX) transmission as provided by 00120.60 (in which case FAX signatures shall be considered originals).

The Bidder shall properly complete and bind all the paper documents in the Bid Section, as specified in 00120.10, between the front and back covers of the Bid Booklet, except that the Bid Bond is not required if another permissible type of Bid guaranty is provided. (see 00120.40(e))

(2) Electronic Bids - For Bids submitted electronically, the Bidders shall prepare Bids using the latest version of Trns·Port Expedite® Bid and submit using the BidExpress® website. Bidders shall complete the certifications and statements included in the Bid Section of the electronic Bid Booklet according to the instructions. The authorized digital signature of the Bidder constitutes the Bidder's confirmation of and agreement to all certifications and statements contained in the electronic Bid Booklet. Bidders choosing to submit Bids through

the internet shall be responsible for any additional fees associated with submitting Bids using Trns·Port Expedite® Electronic Bidding System software and the BidExpress® website.

(b) Bidding Considerations - Bidders may refer to the following Subsections for requirements that may affect bidding considerations:

- 00120.80, Preference for Oregon Resident Bidders
- 00130.80, Restrictions on Commencement of Work
- 00150.55, Coordination of Work
- 00150.75, Protection and Maintenance of Work
- 00160.20(a), Buy America
- 00160.20(b), Buy Oregon
- 00170.07, Record Requirements
- 00180.20, Subcontracting Limitations
- 00180.21, Subcontracting
- 00195.50(a-1), Incidentals
- 00195.00(a), Cost of Insurance and Bonds
- 00199.30, Claims Procedure

(c) Bid Schedule Entries:

(1) Paper Bid Schedule Entries - Using figures, Bidders shall fill in all blank spaces in the paper Bid Schedule. For each item in the paper Bid Schedule, Bidders shall enter the unit price and the product of the unit price multiplied by the quantity given. The unit price shall be greater than zero, shall contain no more than two decimal places to the right of the decimal point, and shall be expressed in U.S. dollars and cents (for example, $150.25 or $0.37). Bidders shall also enter the total amount of the Bid obtained by adding amounts for all items in the paper Bid Schedule. Corrections or changes of item entries shall be in ink, with incorrect entry lined out and correct entry entered and initialed.

(2) Electronic Bid Schedule Entries - For Bids submitted electronically, Bidders shall enter the unit price for each of the separate Bid Items listed. The unit price shall be greater than zero, shall contain no more than two decimal places to the right of the decimal point, and shall be expressed in U.S. dollars and cents (for example, $150.25 or $0.37).

(d) Bidder's Address and Signature Pages - Bidders shall include in the Bid the address to which all communications concerning the Bid and Contract should be sent. The Bid must be signed, or digitally signed, as appropriate, by a duly authorized representative of the Bidder. In addition, the electronic Bid requires the unique ID obtained from BidExpress® and approved by the Agency.

(e) Bid Guaranty - All Bids shall be accompanied by a Bid guaranty in the amount of 10% of the total amount of the Bid.

(1) Bid Guaranty with Paper Bids - For Bids submitted by paper, the Bid guaranty shall be either a Surety bond, irrevocable letter of credit issued by an insured institution as defined in ORS 706.008 or security in the form of a cashier's check or certified check made payable to the Agency. (see ORS 279C.365(4))

If a Surety bond is submitted, Bidders shall use the Agency's standard Bid Bond form included with the paper Bid Booklet. Bidders shall submit the bond with original signatures

and the Surety's seal affixed. The Bid guaranty shall be submitted by mail, delivery service, or hand delivered to the offices and addresses, and at the times given in the paper Bid Booklet

(2) Bid Guaranty with Electronic Bids - For Bids submitted electronically, the Bidder may choose to submit an electronic Bid Bond or a paper Bid guaranty prior to the time of Bid Closing, as follows:

- The electronic Bid Bond which is part of the digitally signed electronic Bid Booklet. This electronic Bid Bond shall include the approved Bond ID number issued by the Surety and shall be submitted by the Bidder prior to the time of Bid submission given in the Bid Booklet; or
- A Bid Bond form which is part of the electronic Bid Booklet may be printed and then filled out. The printed Bid Bond form, with original signatures and the Surety's seal affixed, shall be submitted by mail, delivery service, or hand delivered to the offices and addresses, and at the times given in the Bid Booklet. Alternately, if the Bidder chooses to submit a Bid guaranty in the form of an irrevocable letter of credit issued by an insured institution as defined in ORS 706.008, or a cashier's check or certified check made payable to the Agency (see ORS 279C.365(4)), it shall be submitted by mail, delivery service, or hand delivered to the offices and addresses, and at the times given in the Bid Booklet.

Acceptable Surety companies are limited to those authorized to do business in the State of Oregon.

Forfeiture of Bid guaranties is covered by 00130.60, and return of guaranties is covered by 00130.70.

(f) Disclosure of First-Tier Subcontractors - If a Bidder's Bid on a public improvement Project exceeds $100,000, the Bidder shall, within ~~two~~ 2 working hours of the time Bids are due to be submitted, submit to the Agency, on a form provided by the Agency, a disclosure identifying any first-tier Subcontractors that will furnish labor or labor and Materials, and whose contract value is equal to or greater than:

- 5% of the total Project Bid, but at least $15,000; or
- $350,000, regardless of the percentage of the total Project Bid.

For each Subcontractor listed, Bidders shall state:

- The name of the Subcontractor;
- The dollar amount of the subcontract; and
- The category of Work that the Subcontractor would be performing.

If no subcontracts subject to the above disclosure requirements are anticipated, a Bidder shall so indicate by entering "NONE" or by filling in the appropriate check box. For each Subcontractor listed, Bidders shall provide all requested information. An incomplete form will be cause for rejection of the Bid.

The Subcontractor Disclosure Form may be submitted for a paper Bid either:

- By filling out the Subcontractor Disclosure Form included in the Bid Booklet and submitting it together with the Bid at the time and place designated for receipt of Bids;

- By removing it from the paper Bid Booklet, filling it out and submitting it separately to the ODOT Procurement Office, Procurement Manager at the address or FAX number given in the Bid Booklet; or
- By e-mail, using the form and address provided on the Agency's web site named in the paper Bid Booklet.

The Subcontractor Disclosure Form may be submitted for an electronic Bid either:

- By filling out the Subcontractor Disclosure Form included as a file in the electronic Bid Booklet and submitting it together with the Bid, using the BidExpress® website, at the time designated for receipt of Bids;
- By filling out the Subcontractor Disclosure Form included as a file in the electronic Bid Booklet, printing it, and submitting it separately to the ODOT Procurement Office, Procurement Manager at the address or FAX number given in the Bid Booklet; or
- By e-mail, using the form and address provided on the Agency's web site named in the electronic Bid Booklet.

Subcontractor Disclosure Forms submitted by any method will be considered late if not received by the ODOT Procurement Office - Construction Contracts Unit within ~~two~~ 2 working hours of the time designated for receiving Bids.

E-mail submissions must be fully compatible with Word for Windows©. The Agency is not responsible for partial, failed, illegible or partially legible facsimile (FAX) transmissions or e-mail submittals, and such forms may be rejected as incomplete.

Bids not in compliance with the requirements of this Subsection will be considered non-responsive.

00120.45 Submittal of Bids:

(a) Paper Bids - Paper bids may be submitted by mail, parcel delivery service, or hand delivery to the offices and addresses, and at the times given in the Bid Booklet. Submit paper Bids in a sealed envelope provided by the Agency, or a reasonably similar envelope marked with the word "Bid", the name of the Project, and the words "To Be Opened Only by Authorized Personnel" on the outside. If a delivery or courier service is used, the Bidder shall place the sealed envelope containing the paper Bid inside the delivery or courier service's envelope. Closing time for acceptance of paper Bids is 9:00:00 a.m. local time on the day of Bid Opening.

Paper Bids submitted after the time set for receiving paper Bids will not be opened or considered. The Agency assumes no responsibility for the receipt and return of late paper Bids.

(b) Electronic Bids - Electronic Bids shall be submitted using the latest version of Trns·Port Expedite® Bid and be submitted using the BidExpress® website. Closing time for acceptance of Bids is 9:00:00 a.m. local time on the day of Bid Opening. ODOT and BidExpress® will not accept any Bids submitted after that time.

00120.50 Submitting Bids for More than One Contract - A Bidder who desires to submit either paper Bids or electronic Bids for more than one Contract at a single opening of multiple Bids may submit one of the "Limiting Statements" in the Bid as follows:

- If the volume of Work to be awarded is to be limited by the number of Contracts, fill in Limiting Statement No. 1 in the paper Bid Booklet , or check the appropriate box in the electronic Bid Booklet.

- If the volume of Work to be awarded is to be limited by the total of the Contract Amounts, fill in Limiting Statement No. 2 in the paper Bid Booklet , or check the appropriate box in the electronic Bid Booklet.

If a Bidder makes a limiting statement on any Bid, the statement will apply to all Bids submitted by the Bidder at that opening. Should limiting statements be made on more than one Bid, and the statements differ, the lower limiting number or amount shall govern.

Bidders shall make no qualifications of the Bids that attempt to reserve the right to choose, from among two or more Contracts, the Contract or Contracts that the Bidder will accept. Selection of Contracts will be made by the Agency.

00120.60 Revision or Withdrawal of Bids:

(a) Paper Bids - Information entered into the paper Bid Booklet by the Bidder may be changed after the paper Bid has been delivered to the ODOT Procurement Office - Construction Contracts Unit, provided that:

- Changes are prepared according to the instructions identified in the Bid Booklet; and
- Changes are received at the same offices, addresses, and times identified in the paper Bid Booklet for submitting Bids; and
- ~~The Bid number is included; and~~
- The changes are submitted in writing or by electronic facsimile (FAX) transmission to the FAX number(s) given in the paper Bid booklet, signed by an individual authorized to sign the Bid. FAX submittals received by the Agency shall constitute an original document.

A Bidder may withdraw its paper Bid after it has been delivered to the ODOT Procurement Office - Construction Contracts Unit, provided that:

- The written withdrawal request is submitted on the Bidder's letterhead, either in person or by FAX~~,~~; and ~~includes the Bid number;~~
- The request is signed by an individual who is authorized to sign the Bid, and proof of authorization to sign the Bid accompanies the withdrawal request; and
- The request is received at the same offices, addresses, and times identified in the paper Bid Booklet for submitting Bids.

(b) Electronic Bids - FAX submittals and submittals in writing to revise electronic Bids will not be permitted. However, the Bidder may submit multiple electronic Bids for the same Project to revise the electronic Bid. All electronic Bid submittals must meet all requirements and deadlines for submitting electronic Bids. The last electronic Bid submitted shall supersede all previous submittals.

Any request for withdrawal of a Bid submitted electronically may be completed through BidExpress® prior to the time set for closing Bids. The Bidder may also withdraw its electronic Bid by written withdrawal request according to the following:

- The written withdrawal request is submitted on the Bidder's letterhead, either in person or by FAX~~,~~; and ~~includes the Bid number;~~
- The request is signed by an individual who is authorized to sign the Bid, and proof of authorization to sign the Bid accompanies the withdrawal request; and

- The request is received at the ODOT Procurement Office - Construction~~, Contractor Plans~~ Contracts Unit, 455 Airport Road SE, Building K, Salem, Oregon 97301-5348, before 9:00:00 a.m. local time on the day of Bid Opening.

00120.65 Opening and Comparing Bids - Bids will be opened and the total price for each Bid will be read publicly at the time and place indicated in the Notice to Contractors and the Bid Booklet. Bidders and other interested parties are invited to be present.

Bids for each Project will be compared on the basis of the total amount of each Bid. The total amount of the Bid will be the total sum computed from quantities listed in the Bid Schedule and unit prices entered by the Bidder.

In case of conflict between the unit price and the corresponding extended amount, the unit price shall govern, and the Agency may make arithmetic corrections on extension amounts.

00120.70 Rejection of Nonresponsive Bids - A Bid will be considered irregular and will be rejected if the irregularity is deemed by the Agency to render the Bid non-responsive. Examples of irregularities include without limitation:

- The Bid Section documents provided are not properly used or contain unauthorized alterations.
- The Bid is incomplete or incorrectly completed.
- The Bid contains improper additions, deletions, alternate Bids, or conditions.
- The Bid or Bid modifications are not signed by a person authorized to submit Bids or modify Bids, as required by 00120.01.
- The Bid is submitted on documents not obtained directly from the ~~Contractor Plans office~~ODOT Procurement Office - Construction Contracts Unit, downloaded from ODOT eBIDS web site, or is submitted by a Bidder who ~~has not been identified by the Agency as a Holder~~is not registered on ODOT's "Holders of Bidding Plans" list, as required by 00120.05.
- A member of a joint venture and the joint venture submit Bids for the same Project. Both Bids may be rejected.
- The Bid has entries not typed or in ink, or has signatures or initials not in ink (save for changes received by FAX as provided by 00120.60).
- Each change or correction is not individually initialed.
- White-out tape or white-out liquid is used to correct item entries.
- The price per unit cannot be determined.
- The Bid guaranty is insufficient or improper.
- The original Bid Bond form is not used or is altered.
- The Oregon Construction Contractors Board registration number and expiration date are not shown on the Bid if required in the Solicitation Document. This requirement applies to State-funded Projects, with the exception of Aggregate production and landscape Projects. (not required on Federal-Aid Projects)
- A disclosure of first-tier Subcontractors, if required under 00120.40(f), is not received within ~~two~~ 2 working hours of the time Bids are due to be submitted, or the disclosure form is not complete.
- The Bidder has not complied with the DBE requirements of the solicitation.
- The Bid does not acknowledge all issued Addenda.
- The Bid contains entries that are not greater than zero.
- The Bid contains entries with more than two decimals to the right of the decimal point.

- The Bid entries are not expressed in U.S. dollars and cents.
- Electronic Bids not received for failure to comply with all requirements of BidExpress®.

00120.80 Reciprocal Preference for Oregon Resident Bidders - This Subsection applies only to Contracts for Projects financed without federal funds.

Bidders shall complete the certificate of residency provided by the Agency in the Bid Booklet. Failure to properly complete the form will be cause to reject the Bid.

As used in the certificate of residency and this Subsection, "Resident Bidder" means a Bidder who has:

- Paid unemployment taxes or income taxes in the State of Oregon during any of the 12 calendar months immediately preceding submission of the Bid;
- A business address in the State of Oregon; and
- Certified in the Bid that the Bidder qualifies as a Resident Bidder.

"Nonresident Bidder" means a Bidder who is not a Resident Bidder as defined above.

In determining the lowest Bid, the Agency will, for the purpose of awarding the Contract, add a percentage increase to the Bid of a Nonresident Bidder equal to the percentage, if any, of the preference given to that Bidder in the state in which the Bidder resides (ORS 279A.120). The percentage preference applied in each state will be published on or before January 1 of each year by the Oregon Department of Administrative Services. The Agency may rely on these percentages without incurring liability to any Bidder (ORS 279A.120).

This increase will only be applied to determine the lowest Bid, and will not cause an increase in payment to the Contractor after Award of the Contract.

00120.90 Disqualification of Bidders - The Bid(s) of a disqualified Bidder will be rejected. Any of the following reasons is sufficient to disqualify a Bidder:

- More than one Bid is submitted for the same Work by an Entity under the same or different name(s).
- Evidence of collusion among Bidders. Participants in collusion will be found not responsible, and may be subject to criminal prosecution.
- Any of the grounds for disqualification cited in ORS 279C.440.

A Bidder will be disqualified if the Bidder has:

- Not been prequalified as required by 00120.00;
- Been declared ineligible by the Commissioner of the Bureau of Labor and Industries under ORS 279C.860;
- Not been registered (licensed) by the Oregon Construction Contractors Board (CCB) or been licensed by the State Landscape Contractors Board before submitting a Bid (ORS 279C.365(1)(k), ORS 701.~~055~~021, ORS 701.026, and ORS 671.530). The Bidder's registration number and expiration date shall be shown in the Bid form, if requested. Failure to furnish the registration number, if requested, will render the Bid non-responsive and subject to rejection. (not required on Federal-Aid projects); or
- Been determined by the CCB under ORS 701.227 not to be qualified to hold or participate in a public contract for a public improvement.

00120.91 Rejection of Bid on Grounds of Nonresponsibility of Bidder - The Bid of a Bidder who is found to be nonresponsible according to the criteria listed in 00130.10 or ORS 279C.375(3) will be rejected. ~~Refer also to ORS 279C.375(2).~~

00120.95 Opportunity for Cooperative Arrangement - The Agency will offer the Contractor and its Subcontractors an opportunity to enter into a cooperative arrangement structured to take advantage of the strengths of each organization. The objective of the cooperative arrangement is the effective and efficient completion of the Work, on time and to a standard of quality that will be a source of pride to both the Agency and the Contractor. Participation in the program is voluntary and is not an evaluation factor for Award. An offer to participate should not be included in Bid or Proposal materials. An election for a cooperative arrangement will be included with the Contract Documents to be executed by the successful Bidder.

It is intended that the cooperative arrangement will result in agreements that will allow the Contract requirements to be achieved effectively and efficiently by both the Contractor and the Agency.

The Agency will make all arrangements for the orientation workshop and will bear the costs of the workshop including meals, facilitator, and workshop materials. The Agency and the Contractor will bear the salary, transportation, lodging, and other costs of their own personnel. The orientation workshop may include key Agency personnel, other stakeholders, key Contractor personnel and key Subcontractor personnel. Generally, workshops are limited to about 20 participants. Participants will not be available for other duties during this period.

Section 00130 - Award and Execution of Contract

00130.00 Consideration of Bids - After opening and reading Bids, the Agency will check them for correct extensions of unit prices and totals. (see 00120.65) The total of extensions, corrected where necessary, will be used by the Agency for Award purposes.

The Agency reserves the right to waive minor informalities and irregularities, and to reject any or all Bids for irregularities under 00120.70 or for good cause after finding that it is in the public interest to do so (ORS 279C.395). An example of good cause for rejection in the public interest is the Agency's determination that any of the unit Bid prices are significantly unbalanced to the Agency's potential detriment. The Agency may correct obvious errors, when the correct information can be determined from the face of the document, if it finds that the best interest of the Agency and the public will be served thereby.

Bids will be considered and a Contract awarded, if at all, within 30 Calendar Days from the date of Bid Opening, unless an extension beyond that time is agreed to by both parties and acknowledged in writing by the Bidder.

00130.10 Award of Contract - After the Bids are opened and a determination is made that a Contract is to be awarded, the Contract will be awarded to the lowest responsible Bidder. For the purposes of this Section, "lowest responsible Bidder" means the responsible Bidder that submitted the lowest ~~Bidder~~responsive Bid who is not on the list created by the Construction Contractors Board according to ORS 701, and who has:

- Substantially complied with all prescribed public bidding procedures and requirements.
- Available the appropriate financial, Materials, Equipment, facility and personnel resources and expertise, or ability to obtain the resources and expertise, necessary to indicate the capability of the prospective Bidder to meet all contractual responsibilities.
- A satisfactory record of performance. In evaluating a Bidder's record of performance, the Agency may consider, among other things, whether the Bidder completed previous contracts of a similar nature with a satisfactory record of performance. For purposes of evaluating a Bidder's performance on previous contracts of a similar nature, a satisfactory record of performance means that to the extent that the costs associated with and time available to perform a previous contract remained within the Bidder's control, the Bidder stayed within the time and budget allotted for the procurement and otherwise performed the contract in a satisfactory manner. Satisfactory performance of the Contract also includes compliance with the requirements for records in 00170.07 for Contracts with the Agency.
- ~~A satisfactory record of integrity.~~
- A satisfactory record of integrity. In evaluating a Bidder's record of integrity, the Agency may consider, among other things, whether the Bidder has previous criminal convictions for offenses related to obtaining or attempting to obtain a contract or subcontract or in connection with the Bidder's performance of a contract or subcontract.
- Qualified legally to contract with the Agency.
- Supplied all necessary information in connection with the inquiry concerning responsibility. If a prospective Bidder fails to promptly supply information requested by the Agency concerning responsibility, the Agency shall base the determination of responsibility upon any available information, or may find the prospective Bidder not to be responsible.
- Not been disqualified by the public contracting agency under ORS 279C.440.

If the Bidder is found not to have a satisfactory record of performance or integrity, the Agency will document the record and the reasons for the unsatisfactory finding.

The Agency will provide Notice of Intent to Award on the Agency's web site. See the ODOT web site page included with the Special Provisions for the web site address where the Notice of Intent to Award is available.

The Award will not be final until the later of the following:

- Three working days after the Notice of Intent to Award has been posted as specified in the advertised solicitation or Addendum thereto; or
- The Agency has provided a written response to each timely protest, denying the protest and affirming the Award.

If the Agency accepts a Bid and awards a Contract, the Agency will send the successful Bidder written notice of acceptance and Award.

Notice of Award and Contract booklets ready for execution will be sent within 30 Calendar Days of the opening of Bids or within the number of Calendar Days specified in the Special Provisions or a written mutual agreement.

00130.15 Right to Protest Award - Adversely affected or aggrieved Bidders, limited to the three apparent lowest Bidders and any other Bidder directly in line for Contract Award, may submit to the ODOT Procurement Office - Construction Contracts Unit a written protest of the Agency's intent to Award within ~~three~~ 3 working days following posting of the Notice of Intent to Award on the Agency's web site. The protest shall specify the grounds upon which it is based.

The Agency is not obligated to consider late protests.

00130.20 Cancellation of Award - Without liability to the Agency, the Agency may for good cause cancel Award at any time before the Contract is executed by all parties to the Contract, as provided by ORS 279C.395 for rejection of Bids, upon finding it is in the public interest to do so.

00130.30 Contract Booklet - The Contract booklet may include but is not limited to:

- ~~Supplemental Specifications, if any~~
- Special Provisions
- Addenda
- Schedule of Items
- Contract
- Performance Bond
- Payment Bond
- Certification of workers' compensation coverage

00130.40 Contract ~~Bonds, Certificates, and Registrations~~Submittals - Before the Agency will execute the Contract, the successful Bidder shall furnish the following~~ bonds, certificates, and registrations~~:

(a) Performance and Payment Bonds - When Awarded the Contract, the successful Bidder shall furnish a Performance Bond and a Payment Bond of a Surety authorized to do business in the State of Oregon.

The successful Bidder shall submit the standard bond forms, which are bound in the Contract booklet. Faxed or photocopied bond forms will not be accepted. The amount of each bond shall be equal to the Contract Amount. The Performance Bond and the Payment Bond must be

signed by the Surety's authorized Attorney-in-Fact, and the Surety's seal must be affixed to each bond. A power of attorney for the Attorney-in-Fact shall be attached to the bonds in the Contract booklet, which must include bond numbers, and the Surety's original seal must be affixed to the power of attorney. Bonds shall not be canceled without the Agency's consent, nor will the Agency normally release them, prior to Contract completion.

When a coating system warranty is required by 00594.75, the Contractor shall also furnish a supplemental warranty performance bond as and when described in 00594.75. ~~in addition to the regular Performance Bond for the Contract to the Agency, executed by a surety authorized to do business in the State of Oregon. The supplemental warranty performance bond shall be in the sum of 80% of the full Contract Amount. The bond is to secure the performance by the Contractor of correction work on any coating system defects that the Contractor may be directed by the Agency to perform. The Contractor shall use the Agency-provided form for the bond except that if the surety is a multiple surety, a copy of the form for a bond with multiple sureties shall be obtained from the Agency. The supplemental warranty performance bond shall be signed by the Surety's authorized Attorney-in-Fact, and the Surety's seal shall be affixed to the bond. A power of attorney for the Attorney-in-Fact shall be attached to the bond in the Contract booklet, which shall include bond numbers, and the Surety's original seal shall be affixed to the power of attorney. A copy of the supplemental warranty performance bond is included near the front of the Special Provisions.~~

~~Upon Third Notification, the supplemental warranty performance bond shall become effective and shall continue in full force and effect until the Agency has advised the Contractor that:~~

- ~~There are no coating system defects; or~~
- ~~If the Contractor has been notified that there are coating system defects, the defects have been repaired by the Contractor to the satisfaction of the Agency as specified under the coating system warranty and the full warranty period has expired.~~

~~Supplemental warranty performance bonds cannot be canceled nor can they be released due to possible claims.~~

(b) Certificates of Insurance - The successful Bidder shall furnish the Agency certificates of insurance applicable to the Project, according to 00170.70. The insurance coverages shall remain in force throughout the performance of the Contract and shall not be allowed to lapse without prior written approval of the Agency. Bidders may refer to 00170.70 for minimum coverage limits and other requirements.

For specified Contracts, certified copies, and in some instances the original, of insurance policies may be required by the Special Provisions.

(c) Workers' Compensation - To certify compliance with the workers' compensation insurance coverage required by 00170.61(a) and 00170.70(d), the successful Bidder shall complete and sign the "Certification of Workers' Compensation Coverage" form bound in the Contract booklet.

(d) Registration Requirements:

(1) ORS 701.~~055~~021, ORS 701.026, and ORS 671.530 require that Bidders be registered with the Oregon Construction Contractors Board or licensed by the State Landscape Contractors Board prior to submission of a Bid on a Project not involving federal funds. Registration with the Construction Contractors Board or licensing by the State Landscape Contractors Board is not a prerequisite to bidding on Federal-Aid Projects; however, the Agency will not execute a Contract until the Contractor is so registered or licensed.

(2) Bidders must be registered with the Corporation Division, Oregon Secretary of State, if bidding as a corporation, limited liability company, joint venture, or limited liability partnership, or if operating under an assumed business name and the legal name of each person carrying on the business is not included in the business name.

(3) A Contractor registered under ORS 701 may bid on a landscaping Project or perform a construction project that includes landscape contracting as a portion of the project if the landscape contracting is subcontracted to a licensed landscaping business as defined in ORS 671.520.

(4) A landscaping business may bid on a Project or perform a Contract that includes the phase of landscape contracting for which it is not licensed if it employs a landscape contractor, or subcontracts with another licensed landscaping business, licensed for that phase.

(e) Tax Identification Number - The successful Bidder shall furnish the Agency the Bidder's Federal Tax Identification Number.

00130.50 Execution of Contract and Bonds:

(a) By the Bidder - The successful Bidder shall deliver the required number of Contract booklets with the properly executed Contract, Performance Bond, Payment Bond, certification of workers' compensation coverage, and the required certificates of insurance, to the ODOT Procurement Office - Construction Contracts Unit within 15 Calendar Days after the date on which the Contract booklets are sent or otherwise conveyed to the Bidder under 00130.10. The Bidder shall return the originals of all documents received from the Agency and named in this Subsection, with original signatures. Certificates of insurance shall also be originals. Certificates of insurance for coverages that are permitted by the Agency under 00170.70(a) to be obtained by appropriate subcontractors shall be delivered by the Contractor to the Agency together with the Contractor's request under 00180.21 for approval of the subcontract with that subcontractor. No copies of these documents will be accepted by the Agency.

Proper execution requires that:

- If the Contractor is a partnership, limited liability partnership, joint venture, or limited liability company, an authorized representative of each Entity comprising it shall sign the Contract, Performance Bond, and Payment Bond, and an authorization to sign shall be attached.
- If the Contractor is a corporation, the President and the Secretary of that corporation shall sign the Contract, Performance Bond, and Payment Bond. However, if other corporate officers are authorized to execute contracts and bonds, the successful Bidder shall furnish with those documents a certified, true and correct copy of the corporate bylaws or minutes stating that authority. If only one officer is signing, then the bylaws or minutes must include the authority to sign without the signature of others. The successful Bidder shall also include the title(s) or corporate office(s) held by the signer(s).

(b) By the Agency - Within ~~seven~~ 7 Calendar Days after the Agency has received and verified the properly executed documents specified in 00130.50(a), and received legal sufficiency approval from the Attorney General (if required), the Agency will execute the Contract. The Agency will then send a fully-executed original Contract booklet to the successful Bidder, who then officially becomes the Contractor.

00130.60 Failure to Execute Contract and Bonds - Failure of the successful Bidder to execute the Contract and provide the required certificates, certifications, and bonds may be cause for cancellation of the Award, and may be cause for forfeiture of the Bid guaranty under ORS 279C.385.

Award may then be made to the next lowest responsible Bidder, the Project may be re-advertised, or the Work may be performed otherwise as the Agency decides.

The forfeited Bid guaranty will become the Agency's property, not as a penalty but as liquidation of damages resulting from the Bidder's failure to execute the Contract and provide the certificates, certifications, and bonds as required by these Specifications.

00130.70 Release of Bid Guaranties - Bid guaranties will be released and checks returned ~~seven~~ 7 Calendar Days after Bids are opened, except for those of the three apparent lowest Bidders on each Project. The guaranties of the three apparent lowest Bidders will be released and checks returned to unsuccessful Bidders within ~~seven~~ 7 days of the Agency's execution of the Contract.

00130.80 Project Site Restriction - Until the Agency sends the Contractor written Notice to Proceed with the Work, and the Contractor has filed the public works bonds required in 00170.20,the Contractor shall not go onto the Project Site on which the Work is to be done, nor move Materials, Equipment, or workers onto that Project Site.

The Contractor will not automatically be entitled to extra compensation because the commencement of Work is delayed by failure of the Agency to send the Contract for execution. However, if more than 30 Calendar Days elapse between the date the Bid is opened and the date the Agency sends the Contract to be executed, the Agency will consider granting an adjustment of time for completion of the Work to offset any actual delay to Contract completion resulting directly from delay in commencement.

00130.90 Notice to Proceed - Notice to Proceed will be issued within ~~five~~ 5 Calendar Days after the Contract is executed by the Agency.

Should the Agency fail to issue the Notice to Proceed within ~~five~~ 5 Calendar Days of Contract execution, the Contractor may apply for an adjustment of Contract Time according to 00180.80(c).

The Engineer will issue a First Notification recording the date the performance of the Contract has begun.

Section 00140 - Scope of Work

00140.00 Purpose of Contract - The purpose of the Contract is to set forth the rights and obligations of the parties and the terms and conditions governing completion of the Work. The Contractor's obligations shall include without limitation the following:

- The Contractor shall furnish all Materials, Equipment, labor, transportation, and Incidentals required to complete the Work according to Plans, Specifications, and terms of the Contract.
- The Contractor shall perform the Work according to the lines, grades, Typical Sections, dimensions, and other details shown on the Plans, as modified by written order, or as directed by the Engineer.
- The Contractor shall perform all Work determined by the Engineer to be necessary to complete the Project.
- The Contractor shall contact the Engineer for any necessary clarification or interpretation of the Contract.

00140.10 Typical Sections - The Typical Sections are intended to apply in general. At other locations where the Typical Section is not appropriate, the Contractor shall perform construction to the identified alignment as directed by the Engineer.

00140.20 Thickness - The thickness of Courses of Materials shown on the Plans, given in the Specifications, or established by the Engineer is considered to be the compacted thickness. Minor variations are acceptable when within tolerances specified in the Specifications or Plans, or when approved by the Engineer.

00140.30 Agency-Required Changes in the Work - Changes to the Plans, quantities, or details of construction are inherent in the nature of construction and may be necessary or desirable during the course of Project construction.

Without impairing the Contract, the Agency reserves the right to require changes it deems necessary or desirable within the scope, which in the Specifications means general scope, of the Project. These changes may modify, without limitation:

- Specifications and design
- Grade and alignment
- Cross Sections and thicknesses of Courses of Materials
- Method or manner of performance of Work
- Project Limits

or may result in:

- Increases and decreases in quantities
- Additional Work
- Elimination of any Contract item of Work
- Acceleration or delay in performance of Work

Upon receipt of a Change Order, the Contractor shall perform the Work as modified by the Change Order. If the Change Order increases the Contract Amount, the Contractor shall notify its Surety of the increase and shall provide the Agency with a copy of any resulting modification to bond documents. The Contractor's performance of Work according to Change Orders shall neither

invalidate the Contract nor release the Surety. Payment for changes in the Work will be made according to 00195.20. Contract Time adjustments, if any, will be made according to 00180.80.

00140.40 Differing Site Conditions - The following constitute differing Project Site conditions provided such conditions are discovered at the Project Site after commencement of the Work:

- **Type 1** - Subsurface or latent physical conditions that differ materially from those indicated in the Contract Documents; or
- **Type 2** - Unknown physical conditions of unusual nature that differ materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract.

The party discovering such a condition shall promptly notify the other party, in writing, of the specific differing conditions before they are disturbed and before the affected Work is performed. The Contractor shall not continue Work in the affected area until the Engineer has inspected such condition according to 00195.30 to determine whether an adjustment to Contract Amount or Contract Time is required.

Payment adjustments due to differing Project Site conditions, if any, will be made according to 00195.30. Contract Time adjustments, if any, will be made according to 00180.80.

00140.50 Environmental Pollution Changes - ORS 279C.525 will apply to any increases in the scope of the Work required as a result of environmental or natural resources laws enacted or amended after the submission of Bids for the Contract. The Contractor shall comply with the applicable notice and other requirements of ORS 279C.525. The applicable rights and remedies of that statute will also apply.

In addition to ORS 279C.525, the Agency has compiled a list at 00170.01 of those federal, State, and local agencies, of which the Agency has knowledge, that have enacted ordinances, rules, or regulations dealing with the prevention of environmental pollution and the preservation of natural resources that may affect the performance of Agency contracts.

00140.60 Extra Work - If directed by the Engineer's written order, the Contractor shall perform work not included in the Contract. The Contractor shall perform this work according to:

- Standard Specifications
- ~~Supplemental Specifications, if any~~
- Other Plans and Specifications issued by the Engineer

Payment for Extra Work will be made according to Section 00196. Contract Time adjustments, if any, will be made according to 00180.80.

00140.65 Disputed Work - The Contractor may dispute any part of a Change Order, written order, or an oral order from the Engineer by the procedures specified in Section 00199.

00140.70 Cost Reduction Proposals - The Contractor may submit written proposals to the Engineer that modify Plans, Specifications, or other Contract Documents for the sole purpose of reducing the total cost of construction. Unless otherwise agreed to in writing by the Agency, a proposal that is solely or primarily a proposal to reduce estimated quantities or delete Work, as determined by the Engineer, is not eligible for consideration as a cost reduction proposal and will instead be addressed under 00140.30, whether proposed or suggested by the Agency or the Contractor.

(a) Proposal Requirements - The Agency will not adopt a cost reduction proposal that impairs essential functions or characteristics of the Project including but not limited to service life, economy of operation, ease of maintenance, designed appearance, or design and safety standards.

To conserve time and funds, the Contractor may first submit a written request for a feasibility review by the Engineer. The request should contain a description of the proposal together with a rough estimate of anticipated dollar and time savings. The Engineer will, within a reasonable time, advise the Contractor in writing whether or not the proposal would be considered by the Agency, should the Contractor elect to submit a detailed cost reduction proposal.

A detailed cost reduction proposal shall include without limitation the following information:

- A description of existing Contract requirements for performing the Work and the proposed change;
- The Contract items of Work affected by the proposed change, including any quantity variation caused by the proposed change;
- Pay Items affected by the proposed change including any quantity variations;
- A detailed cost estimate for performing the Work under the existing Contract and under the proposed change. Cost estimates shall be ~~based on a force account payment basis.~~made according to Section 00197. Costs of re~~-~~-design, which are incurred after the Agency has accepted the proposal, will be included in the cost of proposed work; and
- A date by which the Engineer must accept the proposal in order to accept the proposed change without impacting the Contract Time or cost reduction amount.

(b) Continuing to Perform Work - The Contractor shall continue to perform the Work according to Contract requirements until the Engineer issues a Change Order incorporating the cost reduction proposal. If the Engineer fails to issue a Change Order by the date specified in the proposal, the proposal shall be deemed rejected.

(c) Consideration of Proposal - The Engineer is not obligated to consider any cost reduction proposal. The Agency will not be liable to the Contractor for failure to accept or act upon any cost reduction proposal submitted.

The Engineer will determine in its sole discretion whether to accept a cost reduction proposal as well as the estimated net savings in construction costs from the adoption of all or any part of the proposal. In determining the estimated net savings, the Engineer may disregard the Schedule of Items. The Engineer will establish prices that represent a fair measure of the value of Work to be performed or to be deleted as a result of the cost reduction proposal.

(d) Sharing Investigation Costs - As a condition for considering a Contractor's cost reduction proposal, the Agency reserves the right to require the Contractor to share in the Agency's costs of investigating the proposal. If the Agency exercises this right, the Contractor shall provide written acceptance of the condition to the Engineer. Such acceptance will authorize the Agency to deduct its share of investigation costs from payments due or that may become due to the Contractor under the Contract.

(e) Acceptance of Proposal Requirements - If the Contractor's cost reduction proposal is accepted in whole or in part, acceptance will be made by a Change Order that will include without limitation the following:

- Statement that the Change Order is made according to 00140.70;

- Revised ~~Plans and Specifications~~Contract Documents that reflect all modifications necessary to implement the approved cost reduction measures;
- Any conditions upon which the Agency's approval is subject;
- Estimated net savings in construction costs attributable to the approved cost reduction measures; and
- A payment provision according to which the Contractor will be paid 50% of the estimated net savings amount as full and adequate consideration for performance of the Work of the Change Order.

The Contractor's cost of preparing the cost reduction proposal and the Agency's costs of investigating the proposal, including any portion paid by the Contractor, will be excluded from determination of the estimated net savings in construction costs. Costs of re-design, which are incurred after the Agency has accepted the proposal, will be included in the cost of the Work attributable to cost reduction measures.

If the Agency accepts the cost reduction proposal, the Change Order that authorizes the cost reduction measures will also address any Contract Time adjustment.

(f) Right to General Use - Once submitted, the cost reduction proposal becomes the property of the Agency. The Agency reserves the right to adopt the cost reduction proposal for general use without additional compensation to the Contractor when it determines that a proposal is suitable for application to other contracts.

00140.80 Use of Publicly Owned Equipment - The Contractor is prohibited from using publicly-owned Equipment except in the case of emergency. In an emergency, the Contractor may rent publicly-owned Equipment provided that:

- The Engineer provides written approval that states that such rental is in the public interest; and
- Rental does not increase the Project cost.

00140.90 Final Trimming and Cleanup - Before Final Inspection as described in 00150.90, the Contractor shall neatly trim and finish the Project and remove all remaining unincorporated Materials and debris. Final trimming and cleanup shall include without limitation the following:

- The Contractor shall retrim and reshape earthwork, and shall repair deteriorated portions of the Project Site.
- Where the Work has impacted existing facilities or devices, the Contractor shall restore or replace those facilities to their pre-existing condition.
- The Contractor shall clean all drainage facilities and sanitary sewers of excess Materials or debris resulting from the Work.
- The Contractor shall clean up and leave in a neat, orderly condition, Rights-of-Way, Materials sites, and other property occupied in connection with performance of the Work.
- The Contractor shall remove temporary buildings, construction plants, forms, falsework and scaffolding, surplus and discarded Materials, and rubbish.
- The Contractor shall dispose of Materials and debris including without limitation forms, falsework, scaffolding, and rubbish resulting from clearing, grubbing, trimming, clean-up, removal, and other Work. These Materials and debris become the property of the Contractor. The Contractor shall dispose of these Materials and debris immediately.

Unless the Contract specifically provides for payment for this item, the Agency will make no separate or additional payment for final trimming and cleanup.

Section 00150 - Control of Work

00150.00 Authority of the Engineer - The Engineer has full authority over the Work and its suspension. (see Section 00180) The Contractor shall perform all Work to the complete satisfaction of the Engineer. The Engineer's determination shall be final on all matters, including but not limited to the following:

- Quality and acceptability of Materials and workmanship
- Measurement of unit price Work
- Timely and proper prosecution of the Work
- Interpretation of ~~Plans and Specifications~~Contract Documents
- Payments due under the Contract

The Engineer's decision is final and, except as provided in 00180.80 for adjustments of Contract Time and Section 00199 for claims for additional compensation, may be challenged only through litigation.

Work performed under the Contract will not be considered complete until it has passed Final Inspection by the Engineer and has been accepted by the Agency.

Interim approvals issued by the Engineer, including but not limited to Third Notification, will not discharge the Contractor from responsibility for errors in prosecution of the Work, for improper fabrication, for failure to comply with Contract requirements, or for other deficiencies, the nature of which are within the Contractor's control.

00150.01 Project Manager's Authority and Duties - The Engineer may designate a Project Manager as its representative on the Project with authority to enforce the provisions of the Contract.

When the Engineer has designated a Project Manager, the Contractor should direct all requests for clarification or interpretation of the Contract, in writing, to the Project Manager. The Project Manager will respond within a reasonable time. Contract clarification or interpretation obtained from persons other than the Project Manager will not be binding on the Agency.

The Project Manager shall have the authority to appoint Inspectors and other personnel as required to assist in the administration of the Contract.

00150.02 Inspector's Authority and Duties - To the extent delegated under 00150.01, Inspectors are authorized to represent the Engineer and Project Manager to perform the following:

- Inspect Work performed and Materials furnished, including without limitation, the preparation, fabrication, or manufacture of Materials to be used;
- Orally reject defective Materials and to confirm such rejection in writing;
- By oral order, temporarily suspend the Work for improper prosecution pending the Engineer's decision; and
- Exercise additional delegated authority.

Inspectors are not authorized to:

- Accept Work or Materials.
- Alter or waive provisions of the Contract.
- Give instructions or advice inconsistent with the Contract Documents.

00150.05 Cooperative Arrangements - The Contractor may enter into a voluntary cooperative arrangement with the Agency for the Work covered by this Contract. Some elements of this arrangement are described in 00120.95. The Contractor may exercise the election to enter into a cooperative arrangement by signing and returning the form provided with the Notice of Award. This form must be returned no later than the time that the Contractor returns the signed Contract to the Agency.

If the cooperative arrangement alternative is selected:

- Within ~~five calendar days~~5 Calendar Days of receipt of the signed form by the Agency, the Contractor and the Engineer will identify the key personnel who will participate in the orientation workshop. Key personnel should include key Subcontractors and other stakeholders. The Agency will arrange the workshop time and location.
- It is intended that the cooperative arrangement will result in agreements that establish an environment of cooperation between parties and will allow the Contract requirements to be achieved effectively and efficiently by both the Contractor and the Agency.
- A definitive working arrangement for the Contractor and the Agency will be developed and, if agreed at the workshop, committed to writing.
- Either the Contractor or the Agency may withdraw from the cooperative arrangement upon written notice to the other. However, no claim or dispute settled or change approved during the existence of the cooperative arrangement shall be revived.
- The sole remedy for nonperformance of the cooperative arrangement shall be the ability to withdraw from the cooperative arrangement as stated in the paragraph immediately above.

00150.10 Coordination of ~~Specifications and Plans~~Contract Documents - The Contract Documents, including but not limited to Contract Change Orders, the Special Provisions, the Plans, ~~Supplemental Specifications,~~ and the Standard Specifications are intended to collectively describe all of the items of Work necessary to complete the Project.

(a) Order of Precedence - The Engineer will resolve any discrepancies between these documents in the following order of precedence:

- Contract Change Orders;
- Special Provisions;
- Agency-prepared drawings specifically applicable to the Project and bearing the Project title;
- Reviewed and accepted, stamped Working Drawings;
- Standard Drawings;
- Approved Unstamped Working Drawings;
- ~~Supplemental Specifications;~~
- Standard Specifications; and
- All other ~~contract documents~~Contract Documents not listed above.

Notes on a drawing shall take precedence over drawing details.

Dimensions shown on the drawings, or that can be computed, shall take precedence over scaled dimensions.

(b) Immaterial Discrepancies - The ~~Specifications and Plans~~Contract Documents specify details for the construction and completion of the Work. If ~~Specifications or Plans~~Contract

Documents describe portions of the Work in sufficient detail but are silent in some minor respect, the Contractor may proceed utilizing the current best industry practices.

(c) Material Discrepancies - If the Contractor identifies a discrepancy, error, or omission in the ~~Specifications or Plans~~Contract Documents that cannot be resolved by the approach specified in (b) above, the Contractor shall immediately request clarification from the Engineer.

00150.15 Construction Stakes, Lines, and Grades:

(a) General - The Contractor shall perform no Work until the Engineer establishes field controls. Work performed without field controls will be subject to removal at the Contractor's expense.

(b) Agency Responsibilities - The Engineer will:

- Lay out and set construction stakes and marks to establish the lines, grades, Slopes, Cross Sections, and curve super-elevations for roadwork;
- Provide one set of construction stakes for line and grade for each additional phase of the Work;
- Set bench marks and stakes for centerline of Bridges and bents;
- Calculate and provide finish deck grades; and
- Deduct from payments due the Contractor all costs incurred to replace stakes and marks negligently or intentionally damaged, removed, or destroyed by the Contractor.

(c) Contractor Responsibilities - The Contractor shall:

- Inform the Engineer of staking requirements at least ~~five~~ 5 Calendar Days before the staking needs to begin;
- Coordinate construction to provide sufficient area for the Engineer to perform surveying work efficiently and safely;
- Accurately measure detailed dimensions, elevations, and Slopes from the Engineer's stakes and marks;
- Perform the Work in such a manner as to preserve stakes and marks; and
- Set any reference lines for automatic control from the control stakes provided by the Engineer.

00150.20 Inspection:

(a) Inspection by the Engineer - The Engineer may test Materials furnished and inspect Work performed by the Contractor to ensure Contract compliance.

If the Contractor performs Work without the Engineer's inspection or uses Materials that the Engineer has not approved, the Engineer may order affected portions of the Work removed at the Contractor's expense. The foregoing sentence shall not apply if the Engineer fails to inspect the Work within a specific period of time required in the Contract, or in the absence of a specific period of time, within a reasonable period of time after receiving the Contractor's timely written request for inspection or testing.

At the Engineer's direction, any time before the Work is accepted, the Contractor shall uncover portions of the completed Work for inspection. After inspection, the Contractor shall restore these portions of Work to the standard required by the Contract. If the Engineer rejects Work due to Materials or workmanship, or if the Contractor performed such Work without providing

sufficient advance request for inspection to the Engineer, the Contractor shall bear all costs of uncovering and restoring the Work. If the Engineer accepts the uncovered Work, and the Contractor performed the Work only after providing the Engineer with sufficient advance notice, the costs of uncovering and restoring the Work will be paid for by the Agency ~~as Extra Work~~according to 00195.20.

(b) Inspection Facilities - The Contractor shall furnish walkways, railings, ladders, shoring, tunnels, platforms, and other facilities necessary to permit the Engineer to have safe access to the Work to be inspected. The Contractor shall require producers and fabricators to provide safe inspection access as requested by the Engineer.

(c) Sampling - The Contractor shall furnish the Engineer with samples of Materials that the Engineer will test. All of the Contractor's costs related to this required sampling are Incidental.

(d) Inspection by Third Parties - Where third parties have the right to inspect the Work, the Contractor shall coordinate with the Engineer and shall provide safe inspection access.

(e) Contractor's Duty to Make Corrections - The Contractor shall perform all Work according to the ~~Specifications and Plans.~~Contract Documents. The Contractor shall correct Work that does not comply with the ~~Specifications and Plans~~Contract Documents at its own expense. Inspection of the Work by the Engineer does not relieve the Contractor of responsibility for improper prosecution of the Work.

00150.25 Acceptability of Materials and Work - The Contractor shall furnish Materials and shall perform Work in Close Conformance to the ~~Plans and Specifications.~~Contract Documents. If the Engineer determines that the Materials furnished or the Work performed are not in Close Conformance with the ~~Plans and Specifications~~Contract Documents, the Engineer may:

- Reject the Materials or Work and order the Contractor, at the Contractor's expense, to remove, replace, or otherwise correct any non-conformity; or
- Accept the Materials or Work as suitable for the intended purpose, adjust the amount paid for applicable Pay Items to account for diminished cost to the Contractor or diminished value to the Agency, document the adjustment, and provide written documentation to the Contractor regarding the basis of the adjustment.

The Engineer's decisions concerning acceptability of Materials or Work will be final.

00150.30 Delivery of Notices - Written notices to the Contractor~~,~~ by the Engineer~~,~~ or the Agency ~~shall~~will be delivered~~ via first class mail, or in person to the current office address as shown in the records of the Agency. Notices delivered via first class mail shall be deemed delivered five business days following the postmarked date.~~:

- In person;
- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested), to the current office address as shown in the records of the Agency; or
- By overnight delivery service of a private industry courier, to the current office address as shown in the records of the Agency.

Notices shall be considered as having been received by the Contractor:

- At the time of actual receipt when delivered in person;
- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or

- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

Written notices to the Engineer or the Agency by the Contractor shall be delivered to the Agency address shown in the Special Provisions, unless a different address is agreed to by the Engineer, and shall be delivered:

- In person;
- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested); or
- By overnight delivery service of a private industry courier.

Notices will be considered as having been received by the Agency:

- At the time of actual receipt when delivered in person;
- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or
- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

00150.35 Plans and Working Drawings:

(a) Plans - The Plans will show details of lines, grades, and Typical Section of the Roadway, and locations and design details of Structures.

(b) Working Drawings - The Contractor shall supplement the Agency-prepared Plans with stamped or unstamped Working Drawings that show all information necessary to complete the Work. The applicable Section or Subsection of the Standard Specifications will indicate the supplemental information required and whether the drawings are to be stamped or unstamped. Stamped and unstamped Working Drawings are defined as follows:

(1) Stamped Working Drawings - Working Drawings, calculations, and other data which are prepared by or under the direction of a Professional Engineer licensed in the State of Oregon, and which bear the engineer's signature, seal, and expiration date.

(2) Unstamped Working Drawings - Working Drawings, calculations, and other data that do not bear an engineering seal.

(c) Number and Size of Drawings - The Contractor shall submit Working Drawings according to one of the following methods:

(1) Paper Submittal - For paper submissions, submit seven copies of Working Drawings for steel Structures and six copies of Working Drawings for other Structures to the Engineer. The submitted copies shall be clear and readable. Drawing dimensions shall be 8 1/2 inches by 11 inches, 11 inches by 17 inches, or 22 inches by 36 inches in size. One copy of the submitted Working Drawings will be returned to the Contractor after processing. The Contractor shall submit such additional number of copies to the Engineer for processing that the Contractor would like to have returned.

(2) Electronic Submittal - For electronic submissions, submit Working Drawings according to the "Guide to Electronic Shop Drawing Submittal" which is available from the Engineer.

(d) Processing Working Drawings - The Engineer will process Working Drawings and include all comments on them as follows:

(1) Stamped Working Drawings - Stamped Working Drawings will be designated as "reviewed ~~and accepted~~" or "reviewed with comments" by the Engineer.

(2) Unstamped Working Drawings - Unstamped Working Drawings will be designated on the face of the Drawing, as "approved", "approved as noted", or "returned for correction~~", or "rejected~~" by the Engineer.

The Contractor shall not fabricate or construct any structural components until the stamped or unstamped Working Drawings are returned by the Engineer with written notation of approval or review, as applicable, of the Working Drawings.

The Engineer's processing of the Working Drawings does not amend any contractual obligations of the parties.

The Engineer will process and return Working Drawings within 21 Calendar Days (65 Calendar Days if Railroad approval is required) after receipt by the Engineer. If the Engineer fails to return such drawings within this period of time, the Engineer will consider granting a Contract Time extension according to 00180.80.

00150.37 Equipment Lists and Other Submittals - The Contractor shall submit Equipment lists, and other required submittals for approval by the Engineer. The Engineer will respond to requests for approval within time frames specified in each Section of the Specifications that requires such approval.

00150.40 Cooperation and Superintendence by the Contractor~~:~~ -

~~**(a) General** - The Contractor shall:~~

~~Keep~~The Contractor is responsible for full management of all aspects of the Work, including superintendence of all Work by Subcontractors, Suppliers, and other providers. The Contractor shall appoint a single Superintendent and may also appoint alternate Superintendents as necessary to control the Work. The form of appointment of the alternate shall state, in writing, the alternate's name, duration of appointment in the absence of the Superintendent, and scope of authority. The Contractor shall:

- Provide for the cooperation and superintendence on the Project by:
  - Furnishing the Engineer all data necessary to determine the actual cost of all or any part of the Work, added Work, or changed Work.
  - Allowing the Engineer reasonable access to the Contractor's books and records at all times. To the extent permitted by public records laws, the Engineer will make reasonable efforts to honor the Contractor's request for protection of confidential information.
  - Keeping one complete set of Contract Documents ~~available~~ on the Project Site at all times, available for use by all the Contractor's own organization, and by the Engineer if necessary.
- Appoint a single Superintendent and any alternate Superintendent who shall meet the following qualifications:
  - Appointees shall be competent to manage all aspects of the Work.
  - Appointees shall be from the Contractor's own organization.

- Appointees shall have performed similar duties on at least one previous project of the size, scope and complexity as the current Contract.
- Appointees shall be experienced in the types of Work being performed.
- Appointees shall be capable of reading and thoroughly understanding the Contract Documents.

- The appointed single Superintendent, or any alternate Superintendent shall:
  - Be present for all On-Site Work, regardless of the amount to be performed by the Contractor, Subcontractors, Suppliers, or other providers, unless the Engineer provides prior approval of the Superintendent's or alternate Superintendent's absence.
  - Be equipped with a two way radio or cell phone capable of communicating throughout the project during all the hours of Work on the Project Site and be available for communication with the Engineer.
  - Have full authority and responsibility to promptly execute orders or directions of the Engineer.
  - Have full authority and responsibility to promptly supply the Materials, Equipment, labor, and Incidentals required for performance of the Work.
  - Coordinate and control all Work performed under the Contract, including without limitation the Work performed by Subcontractors, Suppliers, and Owner Operators.
  - Diligently pursue progress of the Work according to the schedule requirements of Section 00180.
  - Cooperate in good faith with the Engineer, Inspectors, and other contractors in performance of the Work.
  - ~~Designate, from the Contractor's organization, a competent single representative responsible for the Project, experienced in the type of Work being performed, and capable of reading and thoroughly understanding the Plans and Specifications.~~
  - Provide all assistance reasonably required by the Engineer to obtain information regarding the nature, quantity, and quality of any part of the Work.
  - Provide access, facilities and assistance to the Engineer in establishing such lines, grades and points as the Engineer requires.
  - Carefully protect and preserve the Engineer's marks and stakes.

~~Provide all assistance reasonably required by the~~

Any Superintendent or alternate Superintendent who repeatedly fails to follow the Engineer's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project.

- ~~Engineer to obtain information regarding the nature, quantity, and quality of any part of the Work.~~
- ~~Allow the Engineer reasonable access to the Contractor's books and records at all times. To the extent permitted by public records laws, the Engineer will make reasonable efforts to honor the Contractor's request for protection of confidential information.~~
- ~~Furnish the Engineer all data necessary to determine the actual cost of all, or any part, of the Work.~~
- ~~Diligently pursue progress of the Work according to the schedule requirements of Section 00180.~~
- ~~Coordinate and control all Work performed under the Contract, including without limitation the Work performed by Subcontractors.~~

~~**(b) Superintendence** - The Contractor shall appoint a single designated representative responsible for the Project described under 00150.40(a), in writing. The single designated representative responsible for the Project shall:~~

- ~~Have full authority and responsibility to promptly execute orders or directions of the Engineer;~~
- ~~Have full authority and responsibility to promptly supply the Materials, Equipment, labor, and Incidentals required for performance of the Work;~~
- ~~Be available during the hours of work on the Project Site for communication with the Engineer; and~~
- ~~Be present for all On-Site Work except as provided in the Contract Documents, or approved by the Agency.~~

~~For short periods of time during the performance of minor or Incidental portions of the Work, the Contractor may designate a person to act on behalf of the single designated representative responsible for the Project. The Contractor shall submit the designation in writing to the Engineer. The form of designation shall state the designee's name, duration of appointment, and scope of authority. The single designated representative responsible for the Project shall be available to the Engineer at all times for contact by telephone or radio. The Engineer expressly reserves the right to require the single designated representative responsible for the Project to be on the Project Site by giving 48 hours advance verbal or written notice thereof to the Contractor.~~

If the Contractor fails or neglects to provide a Superintendent, or an alternate Superintendent, and no prior approval has been granted, the Engineer has the authority to suspend the Work according to 00180.70. Any continued Work by the Contractor, Subcontractors, Suppliers, or other providers may be subject to rejection and removal. The Contractor's repeated failure or neglect to provide the superintendence required by these provisions constitutes a material breach of the Contract, and the Engineer may impose any remedies available under the Contract, including but not limited to Contract termination ~~or suspension of Contract performance~~.

00150.50 Cooperation with Utilities:

(a) General - Unless otherwise specified ~~in any Supplemental Specifications,~~ in the Special Provisions~~,~~ or on the Plans, existing Utilities requiring adjustment may be adjusted by the Utility before, during, or after Project construction. "Adjustment of Utilities" shall mean the alteration, improvement, connection, disconnection, relocation, or removal of existing Utility lines, facilities, or systems in temporary or permanent manner.

(b) Agency Responsibilities - Before Bids are received, the Agency will make preliminary arrangements for planned Adjustment of Utilities. The Agency will list in the Special Provisions the estimated completion dates or times for adjustment work by the Utility owner, and will include a general statement describing any relocation. The Plans will not normally show the anticipated new location of Utilities that have been or will be adjusted.

(c) Contractor's Responsibilities - The Contractor shall:

- Follow applicable rules adopted by the Oregon Utility Notification Center;
- Contact Utility owners during Bid preparation and after the Contract is awarded to verify all Utilities' involvement on the Project Site;
- Coordinate Project construction with the Utilities' planned adjustments, take all precautions necessary to prevent disruption of Utility service, and perform its Work in the manner that results in the least inconvenience to the Utility owners;

- Include all Utility adjustment work, whether to be performed by the Contractor or the Utilities, on the Contractor's Project Work schedule submitted under 00180.41;
- Protect from damage or disturbance any Utility that remains within the area in which Work is being performed;
- Not disturb an existing Utility if it requires an unanticipated adjustment, but shall protect it from damage or disturbance and promptly notify the Engineer; and
- Report to the Engineer any Utility owner who fails to cooperate or fails to follow the planned Utility adjustment.

Subject to the Engineer's approval, the Contractor may adjust the Utilities by asking the Utility owners to move, remove, or alter their facilities in ways other than as shown on the Plans~~, in any Supplemental Specifications,~~ or in the Special Provisions. The Contractor shall conduct all negotiations, make all arrangements, and assume all costs that arise from such changes.

(d) Delays - If the Contractor complies with Subsection (c) above, and if Utility adjustments are completed later than the date specified in the Special Provisions, thus causing Project completion to be delayed (provide notification under 00180.60), additional Contract Time will be considered under 00180.80, and additional compensation, if applicable, will be considered under 00195.40.

(e) Notification - If the Project is located within the area served by the Oregon Utility Notification Center, the Contractor shall notify owners of Utilities prior to the performance of Work in the vicinity of their facilities. The Utilities notification system telephone number is 1-800-332-2344.

The Contractor shall comply with the rules of the Oregon Utility Notification Center, OAR 952-001-0010 through OAR 952-001-0090, and ORS 757.993. The Contractor may contact the Oregon Utility Notification Center at 503-232-1987 about these rules.

00150.55 Cooperation with Other Contractors - The Agency reserves the right to perform other work on or near the Project Site, including without limitation any Materials site, with forces other than those of the Contractor.

If such work takes place ~~within~~on or ~~next to~~near the Project Site, the Contractor shall have the following obligations:

- The Contractor shall coordinate Work with other contractors or forces.
- The Contractor shall cooperate in good faith with all other contractors or forces.
- The Contractor shall perform the Work specified in the Contract in a way that will minimize interference and delay for all forces involved.
- The Contractor shall place and dispose of the Materials being used so as not to interfere with the operations of other forces.
- The Contractor shall join the Work with that of other forces in a manner acceptable to the Engineer or the Agency, and shall perform it in the accepted sequence with the work of the other force.

The Engineer will resolve any disagreements under this Subsection that may arise among the Contractor and other work forces, or between the Contractor and the Agency. The Engineer's decision in these matters is final, as provided in 00150.00.

When the schedules for Work of the Contractor and the work of other forces overlap, each contractor involved shall submit a current, realistic progress schedule to the Engineer. Before the

Engineer accepts the schedule, each party shall have the opportunity to review all schedules. After this review and any necessary consultations, the Engineer will determine acceptable schedules.

The Contractor waives any right it may have to make claims against the Agency for any damages or claims that may arise because of inconvenience, delay, or loss due solely to the presence of other contractors working on or near the Project Site.

If the Contract gives notice of work to be performed by other forces that may affect the Contractor's Work under the Contract, the Contractor shall include any costs associated with coordination of the Work in the appropriate Pay Item or as a portion of a Pay Item.

In an emergency, the contractor most immediately able to respond may repair a facility or Utility of another contractor in order to prevent further damage to the facility, Utility, or other Structure as a result of the emergency.

00150.60 Construction Equipment Restrictions:

(a) Load and Speed Restrictions for Construction Vehicles and Equipment - The Contractor shall comply with legal weight and speed restrictions when moving Materials or Equipment beyond the limits of the Project Site.

The Contractor shall control vehicle and Equipment loads and speeds within the Project Site according to the following restrictions, unless the Special Provisions provide otherwise:

- The Contractor shall restrict loads and speeds as necessary to avoid displacement or loss of Materials on Subgrades and Aggregate Bases.
- The Contractor shall restrict weights to legal loads, and shall travel at speeds of no more than 45 mph or the posted construction speed, whichever is less, on treated Bases, Pavement, or wearing Courses.
- The Contractor shall not cross Bridges or other Structures with Equipment or vehicles exceeding the legal load limit without prior written permission of the Engineer. The Contractor shall make any such request in writing, describing the loading details and the arrangement, movement, and position of the Equipment on the Structure. The Contractor shall comply with any restrictions or conditions included in the Engineer's written permission.

(b) Protection of Buried Items - The Contractor shall use temporary fill or other methods to avoid overload of pipes, box culverts, and other items that are covered, or to be covered, by fill or backfill.

(c) Responsibility for Damages - The Contractor shall assume responsibility for damages caused by excessive Equipment speed or loads while performing the Work, both inside and outside the Project Site. The Engineer's permission to cross Bridges and other Structures, according to 00150.60(a) will not relieve the Contractor from responsibility for load-caused damages.

00150.70 Detrimental Operations - The Contractor shall avoid operations whose methods, conditions, or timing may injure people or damage property or the Work. Damage may include without limitation, staining surfaces with mud or asphalt. (also see 00150.60, 00150.75, and Section 00170)

When any such damage occurs, the Engineer will determine if it is to be corrected by repair, replacement, or compensatory payment by the Contractor. If compensatory payment is required,

the Engineer will determine the amount. Compensatory payment may be deducted from monies due or to become due to the Contractor under the Contract.

00150.75 Protection and Maintenance of Work During Construction - The Contractor shall protect and maintain the Work during construction and until Third Notification has been issued, unless otherwise provided in the Contract. For the purposes of this Subsection, "maintenance" shall include measures to prevent deterioration of Roadway and Structures at the Project Site, and to keep them in good condition at all times during the prosecution of the Work. The Contractor shall continuously allocate sufficient Equipment and workers to achieve such maintenance.

If the Contract requires the placement of a Course upon a previously constructed Course or Subgrade, the Contractor shall maintain the previous Course or Subgrade during all construction operations.

The Contractor shall include costs of protecting and maintaining the Work during construction in the unit prices bid for the various Pay Items. The Contractor will not be paid an additional amount for this Work, unless otherwise specified.

The Engineer will ~~immediately~~ notify the Contractor of Contractor's noncompliance with this Subsection. If the Contractor fails to remedy unsatisfactory protection or maintenance within 24 hours after receipt of such notice, the Engineer may proceed ~~immediately~~ to remedy the deficiency, and deduct the entire cost from monies due or to become due the Contractor under the Contract.

00150.80 Removal of Unacceptable and Unauthorized Work - The Contractor shall correct or remove unacceptable Work and remove unauthorized work, as directed by the Engineer in writing. The Contractor shall replace such work with Work and Materials conforming to the requirements of the Contract.

For the purposes of this Subsection, "unauthorized work" shall include without limitation the following:

- Work that extends beyond lines shown on the Plans or otherwise established by the Engineer;
- Work that is contrary to the Engineer's instructions; and
- Work that is conducted without the Engineer's written authorization.

The Agency will not pay the Contractor for unacceptable Work or unauthorized ~~or unacceptable~~ work. The Engineer may issue a written order for the correction or removal of such work at the Contractor's expense.

If, when ordered by the Engineer, the Contractor fails to correct or remove unacceptable Work or unauthorized work, the Engineer may have the correction, or removal and replacement, done by others and deduct the entire cost from monies due or to become due the Contractor under the Contract.

00150.90 Final Inspection:

(a) On-site Construction Work - The Engineer will inspect the Project at a time close to the completion of On-Site Work ~~to ensure the Contractor's compliance with the Plans and Specifications~~.

When all On-Site Work on the Project is completed, including but not limited to Change Order Work and Extra Work, the Engineer will issue Second Notification as specified in 00180.50(g).

Within 15 Calendar Days after the Engineer receives the Contractor's written notification that all punch list items, final trimming and cleanup according to 00140.90 have been completed, the Engineer will review the Project and notify the Contractor that all Work is complete, or will give the Contractor written instruction regarding incomplete or unsatisfactory Work.

(b) All Contract Work - The Engineer will issue the Third Notification when the Contractor has satisfactorily accomplished all of the following:

- The Contractor has completed all On-Site Work required under the Contract, including the punch list items from (a) above;
- The Contractor has removed all Equipment; and
- The Contractor has submitted all required certifications, bills, forms, warranties and other documents.

00150.91 Post-Construction Review - The Contractor or the Engineer may request a Post-Construction Review meeting, to be held at a time prior to issuance of Third Notification but not earlier than 15 Days following the date of Second Notification. The meeting may be held if agreed to by both parties. The party making the request will conduct the meeting, and will announce the time and place of the meeting at least 15 Days prior to the meeting date. The purpose of this meeting is to examine the Project for possible process improvements that may benefit future projects.

00150.95 Final Acceptance - After the Engineer completes Final Inspection of all Work and sends Third Notification to the Contractor, the Agency will acknowledge Final Acceptance. The Agency will notify the Contractor in writing of the date of Final Acceptance within ~~seven~~ 7 Calendar Days after Final Acceptance, or as soon thereafter as is practicable.

00150.96 Maintenance Warranties and Guarantees - Prior to Third Notification, the Contractor shall transfer to the Agency all unexpired manufacturers' warranties and guarantees for Materials and Equipment installed on the Project. Such warranties and guarantees shall recite that they are enforceable by the Agency.

00150.97 Responsibility for Materials and Workmanship:

(a) The Contractor shall perform the Work according to the terms, conditions, and requirements~~, Plans, and Specifications set out in~~ of the Contract.

(b) Whether before or after the Agency's acceptance of the Work, the Contractor shall be responsible for:

- Correcting or repairing any defects in, or damage to, the Work which results from the use of improper or defective materials or workmanship; or
- Replacing, in its entirety, the Work affected by the use of improper or defective materials or workmanship to the extent provided by law; and
- Correcting or repairing any Work, Materials, Structures, Existing Surfacings, Pavement, Utilities, or sites, including without limitation Wetlands, damaged or disturbed in that correction, repair, or replacement. (see 00170.80 to 00170.85)

Section 00160 - Source of Materials

00160.00 Definitions - The following definitions apply to Section 00160:

(a) Prospective Source - Agency-furnished Materials source, use of which by the Contractor is optional. The Agency makes no guarantee or representation, by implication or otherwise, of the land use status, quantity, quality, or acceptability of Materials available from it, except as may be stated in the Special Provisions.

(b) Mandatory Source - Agency-furnished Materials source, use of which by the Contractor is required.

00160.01 Notification of Source of Supply and Materials:

(a) All Materials - The Contractor shall notify the Engineer in writing of all proposed Materials sources of supply, including without limitation any steel or other fabricators within the following time frames:

- At least 15 Calendar Days before using or fabricating Materials, if source is within the State; or
- At least 45 Calendar Days before using or fabricating Materials, if source is outside the State

(b) Prospective Source Materials - When given an option to use Prospective Sources of Materials to be incorporated into the Work, the Contractor shall notify the Engineer in writing of the option selected within 15 Calendar Days from date of Notice to Proceed. Otherwise, such Materials sources may become unavailable.

(c) Approval Required - Before allowing production or delivery of Materials to begin from any source, the Contractor must obtain the Engineer's approval. Approval to use any source does not imply that Materials from that source will be accepted. If approved sources do not provide Materials that meet Specifications, the Materials will be rejected. The Contractor will then be responsible for locating other sources and obtaining the Engineer's approval.

(d) Terms Required - The Contractor shall comply with 00170.07.

00160.05 Qualified Products List (QPL) - The QPL is a listing of manufactured products available on the market (shelf items) that ODOT has evaluated and found suitable for a specified use in highway construction. The QPL is published twice a year and is available from ODOT's Construction Section; 800 Airport Road SE; Salem, OR 97301-4798; phone 503-986-3000. It may also be viewed on ODOT's web site.

The current version of the QPL at the time of Award is the version in effect for the Project. The Engineer may approve for use a conditionally qualified product, or a product qualified for inclusion in a later edition of the QPL, if the Engineer finds the product acceptable for use on the Project.

Use of listed products shall be restricted to the category of use for which they are listed. The Contractor shall install all products as recommended by the manufacturer. The Contractor shall replace qualified products not conforming to Specifications or not properly handled or installed at the Contractor's expense.

00160.10 Ordering, Producing, and Furnishing Materials - The Contractor shall not place orders for or produce full quantities of Materials anticipated to be required to complete the Work until the Work has advanced to a stage that allows the quantities to be determined with reasonable

accuracy. Upon request, the Engineer will notify the Contractor in writing of the quantities required. Quantity estimates by the Engineer before this notification are only approximate.

(a) Contractor's Duties - In purchasing, producing, or delivering Materials, the Contractor shall take into account the following:

- Kind of work involved;
- Amount of work involved;
- Time required to obtain Materials; and
- Other relevant factors.

(b) Approval of Quantity of Materials Ordered - Materials quantities shown on the Plans, or indicated by quantities and Pay Items, are subject to change or elimination. Therefore, the Contractor is cautioned to order or produce Materials only after having received the approval of the Engineer. The Contractor is responsible for payment for excess Materials delivered to the Project Site or storage sites without advance authorization from the Engineer. Unless otherwise specified in the Contract, the Agency will not be responsible for:

- Materials the Contractor may deliver or produce in excess of Contract requirements;
- Extra expense the Contractor may incur because Materials were not ordered or produced earlier; or
- The Contractor's expenses related to Materials ordered by the Contractor that are not subsequently approved for use.

Excess Materials, ordered or produced by the Contractor, without approval of the Engineer, may be purchased by the Agency at the sole discretion of the Agency. (see 00195.80)

00160.20 Preferences for Materials:

(a) Buy America - If federal highway funds are involved on the Project, the Contractor shall limit the quantity of foreign Materials incorporated into the Work as follows. Section 635.410 of Title 23, Code of Federal Regulations, and the Intermodal Surface Transportation Efficiency Act require that all iron or steel manufacturing processes, including without limitation the casting of ingots, for iron or steel Materials permanently incorporated into the Project shall occur in the United States, unless the cost of foreign-origin iron or steel Materials does not exceed one-tenth of one percent (0.1%) of the Contract Amount or $2,500, whichever is greater. The Contractor shall not incorporate foreign-origin iron or steel Materials in excess of this amount into the Project. All foreign-origin iron or steel Materials incorporated in the Project in excess of the amount indicated above shall be removed and replaced with domestic iron or steel Materials at the Contractor's expense. For purposes of this Specification, the cost of foreign-origin iron or steel Materials shall be the value of the iron or steel products as of the date they are delivered to the Project Site.

Manufacturing processes include without limitation the application of coatings to finished iron or steel products or components. Coatings include epoxy coating, galvanizing, painting, and any other coating that protects or enhances the value of the steel or iron product or component.

The Contractor shall provide the Engineer with a Certificate of Materials Origin, on a form furnished by the Engineer, before incorporating any iron or steel products into the Project. Unless a Certificate of Materials Origin has been provided to the Engineer, the Materials shall be considered of foreign origin.

The Contractor shall retain manufacturers' certificates verifying the origin of all domestic iron or steel Materials for ~~three~~ 3 years after the date of final payment for the Project, and shall furnish copies to the Engineer upon request.

(b) Buy Oregon - According to ORS 279A.120, the Contractor shall give preference to goods or services produced in Oregon if price, fitness, availability, and quality are equal. This provision does not apply to Contracts financed wholly or in part by federal funds.

(c) Recycled Materials - According to ORS 279A.010, ORS 279A.125, ORS 279A.145, ORS 279A.150, and ORS 279A.155, and subject to the approval of the Engineer, the Contractor shall use recycled products to the maximum extent economically feasible.

00160.30 Agency-Furnished Materials - Unless otherwise specified in the Special Provisions, Materials listed as Agency-furnished will be available to the Contractor free of charge.

The Contractor shall be responsible for all Materials furnished by the Agency and shall pay all demurrage and storage charges. The Contractor shall replace at its expense Agency-furnished Materials lost or damaged due to any cause.

The locations at which Agency-furnished Materials are available will be specified in the Special Provisions. If the locations are not listed in the Special Provisions, the Agency-furnished Materials will be furnished to the Contractor at the Project Site. In either case, all costs of handling, hauling, unloading, and placing Agency-furnished Material shall be considered included in the price paid for the Pay Item involving such Material.

All Agency-furnished Materials not incorporated into the Work remains the property of the Agency. The Contractor shall deliver such Materials as directed by the Engineer.

00160.40 Agency-Furnished Sources - The Agency may list in the Special Provisions, or show on the Plans, Borrow pits or Aggregate sources from which the Contractor may, or shall, obtain Materials. These sources will be identified and referred to as Prospective or Mandatory Sources. A development plan will be included in Section 00235 of the Special Provisions when such sources are shown on the Plans.

(a) Working in a Different Area of the Materials Source - If the Contractor desires to work in a different area of the Materials source than that shown on the development plan, the Contractor must submit a written request stating the reasons for the requested change. If a new land use permit, development plan, or reclamation plan is needed, the Contractor must submit it and obtain approval from the Engineer before starting work in any area other than that shown on the Plans. Approval for work in a different area will not entitle the Contractor to any added compensation or adjustment of Contract Time.

The Agency will not be responsible for the availability of sources other than as stated in the Special Provisions. If the Contractor has given notice of intent to use, but does not use the source(s) on the Project, the Contractor shall reimburse the Agency for any costs the Agency incurs in making such source(s) available.

(b) Cost of Sources - Unless otherwise specified in the Special Provisions, any Prospective or Mandatory Source will be provided by the Agency for use without payment of royalty or other charge. (see 00160.50)

(c) Exhaustion of Sources - If the Engineer determines that the quantities of specified Materials that can be produced from a Mandatory Source are insufficient for the Work, and it becomes necessary to move to another source, the Agency will pay for the reasonable cost of moving the plant to, and erecting it at, a new approved source from which specified Materials

can be produced. Adjustment in hauling costs, other costs, and Contract Time will be determined as provided in 00140.30.

No allowance, reimbursement, compensation, or adjustment will be made for changes in the use of sources, or for moving from one source to another, except as provided above.

00160.50 Agency-Controlled Land; Limitations and Requirements:

(a) General - The Contractor shall have no property rights in, or right of occupancy on, Agency-Controlled Land. Nor shall the Contractor have the right to sell, use, remove, or otherwise dispose of any material from Agency-Controlled Land, areas, or property, except as specified in the Special Provisions or by the written authorization of the Engineer.

Unless authorized in the Contract, the Contractor shall not disturb any material within Rights-of-Way without written authorization from the Engineer.

Unless otherwise specified in the Contract, the ownership of all materials originating on Agency-Controlled Lands will at all times vest in, and remain within the control of, the Agency.

(b) Waste, Excess, and By-Product Materials - All waste, excess, and by-product materials, collectively referred to in this Subsection as "By-Products", from the manufacture or production of Materials from Agency-Controlled Lands shall remain Agency property. Unless otherwise ordered by the Engineer in writing, By-Products shall be placed as required by the development plan:

- In stockpiles at designated locations;
- At locations and in shapes that are readily accessible; and
- In such a manner as to avoid fouling areas containing useable materials, or interfering with future plant setups to use materials from the property.

The Agency will not compensate the Contractor for handling and stockpiling By-Products according to the development plan requirements. If by written order the Engineer directs the Contractor to stockpile or place designated By-Products at alternate sites, the By-Products designated shall be loaded, hauled, and placed as directed, and this work will be paid for ~~as Extra Work~~according to 00195.20.

00160.60 Contractor-Furnished Materials and Sources:

(a) General - The Contractor shall furnish, at its own expense, all products and Materials required for the Project from sources of its own choosing, unless such sources have been specified in the Special Provisions or Plans as Prospective or Mandatory Sources.

(b) Acquisition of Sources - The Contractor shall acquire, at its own expense, the rights of access to, and the use of, all sources the Contractor chooses which are not Agency-controlled and made available by the Agency to the Contractor.

(c) Additional Requirements - Except for continuously-operated commercial sources, Work shall not begin, nor will any Materials be accepted by the Engineer, until the Contractor has:

(1) Given to the Engineer a copy of permits from, or proof that permits are not required from:

- The Department of Geology and Mineral Industries, as required under ORS 517.790;
- The ~~Division~~Department of State Lands, as required under ORS 196.815 (when removing material from the bed or banks of any waters or from any Wetland); and

- Local governmental authorities having jurisdiction over land use at the source location.

(2) Furnished to the Engineer written approval of the property owner, if other than the Contractor, for the Contractor's proposed plans of operation in, and reclamation of, the source. The Contractor shall include in the document containing the property owner's written approval a summary of the requirements of the permits described above, which shall be subject to the Engineer's approval.

00160.70 Requirements for Plant Operations - Before operating mixing plants, Rock crushers, or other Equipment, the Contractor shall provide the Engineer copies of all applicable discharge permits for noise, air contaminants, and water pollutants from DEQ or applicable local jurisdictions, or a letter from DEQ or the local jurisdiction stating that no permits are required for the use of the Equipment and sites.

00160.80 Requirements for Sources of Borrow and Aggregate - The Contractor shall conduct operations according to all applicable federal, State, and local laws (including without limitation ORS 517 and OAR 632-030) when developing, using, and reclaiming all sources of Borrow material and Aggregate. The Contractor shall provide erosion control at Borrow sources that are not within the Project Site. The Contractor shall not operate in Wetlands except as allowed by permit. The Contractor shall comply with all requirements for pollution and sediment control, including without limitation the National Pollutant Discharge Elimination System where applicable.

Except for continuously-operated commercial sources, the Contractor shall also conform to the following:

(a) If a natural growth of trees or shrubs is present, preserve a border of such to conceal land scars.

(b) Excavate Borrow sources and Aggregate sources, except for those in streams and rivers, to provide:

- Reasonably uniform depths and widths;
- Natural drainage so no water stands or collects in excavated areas, when practicable;
- Slopes trimmed to blend with the adjacent terrain upon completion of operations;
- Slopes covered with native soil, or acceptable plant rejects to support plant growth, if required by Specifications, Plans, or permits; and
- A vegetative cover that blends with the adjacent natural growth.

(c) Excavate in quarries so that:

- Faces will not be steeper than vertical (no overhang);
- Vertical faces conform to Oregon OSHA standards, Division 3, and as shown on an approved development plan;
- Floors or benches are excavated to a uniform Slope free of depressions and will drain and not interfere with the downland owner's property; and
- Upon completion, the quarry is left appearing neat and compatible with surrounding terrain.

(d) Obliterate haul roads specifically built for access to sources, and restore the areas disturbed by these roads as nearly as practicable to the conditions that existed before the roads were built, unless otherwise directed by the landowner or regulatory body.

Section 00165 - Quality of Materials

Description

00165.00 General - The Contractor shall incorporate into the Work only Materials conforming to the Specifications and approved by the Engineer. The Contractor shall incorporate into the Work only manufactured products made of new materials unless otherwise specified in the Contract. The Agency may require additional testing or retesting to determine whether the Materials or manufactured products meet Specifications.

Materials or manufactured products not meeting the Specifications at the time they are to be used are unacceptable and must be removed immediately from the Project Site, unless otherwise directed by the Engineer.

00165.01 Rejected Materials - The Engineer may reject any Materials that appear to be defective (00150.25) or that contain asbestos. The Contractor shall not incorporate any rejected Materials into the Work. Rejected Materials whose defects have been corrected may not be incorporated into the Work until the Engineer has approved their use. The Engineer may order the removal and replacement by the Contractor, at Contractor's expense, of any defective Materials. (refer also to 00150.20)

00165.02 Materials Conformance and Quality Compliance Documents - For purposes of this Section, "Materials Conformance Documents" means the Contractor's quality-control, the Agency's verification, and the independent assurance test results, and the identity of the testing facility~~.~~, as specified in the ODOT Manual of Field Test Procedures (MFTP), unless otherwise specified in the Contract.

For purposes of this Section, "Quality Compliance Documents" means those documents specified in ODOT's Nonfield-Tested Materials Acceptance Guide, unless otherwise specified in the Contract.

00165.03 Testing by Agency - When testing Materials, the Agency will conduct the tests in its central laboratory, field laboratories, or other laboratories designated by the Engineer, even though certain AASHTO, ASTM, and other Materials specifications may require testing at the place of manufacture. Results of the Agency's tests will be made available to the Contractor.

00165.04 Costs of Testing - When the Contract requires that the Agency performs the testing, the testing will be at the Agency's expense. The Agency will pay the cost of Contractor-requested source-review tests on unprocessed Aggregates from no more than two sources for each Project, and on no more than three unprocessed samples from each source. Additional source-review tests performed at the Contractor's request shall be at the Contractor's expense.

Unless otherwise provided in the Contract, all testing required to be performed by the Contractor will be at the Contractor's expense.

Provisions and Requirements

00165.10 Materials Acceptance Guides - Unless otherwise specified elsewhere in the Contract, Materials will be accepted according to the following guides:

(a) Field-Tested Materials - Field-tested Materials will be accepted according to the ODOT Manual of Field Test Procedures (MFTP). The MFTP is published once per year and is available ~~at~~from the ODOT ~~Procurement Office -~~Construction~~, Contractor Plans, 455~~ Section; 800 Airport Road SE~~, Building K,~~; Salem, ~~Oregon~~OR 97301-~~5348 (telephone~~4798; phone 503-986~~ 6936).~~ 3000. The MFTP is also available on the ODOT Construction Section web site.

(b) Nonfield-Tested Materials - Nonfield-tested Materials will be accepted according to the ODOT Nonfield Tested Materials Acceptance Guide (NTMAG), unless otherwise specified in the Contract. The NTMAG is available ~~at~~on the ODOT ~~Procurement Office -~~ Construction~~, Contractor Plans~~ Section web site.

00165.20 Materials Specifications and Test Method References - References to Materials specifications and test methods of ODOT, WAQTC, AASHTO, ASTM, other governmental agencies, or other recognized organizations mean those officially adopted and in current use by the agency or organization on the date of Advertisement.

If there are conflicting references, or if no reference is made to Materials specifications or test method, Materials must meet the Materials specifications or test methods required by the first applicable of the following agencies and organizations:

- Field-Tested Materials:
  - Special Provisions;
  - MFTP; and
  - ~~Supplemental Specifications; and~~
  - Standard Specifications.
- Nonfield Tested Materials:
  - ODOT;
  - WAQTC;
  - AASHTO;
  - ASTM;
  - Other recognized national organizations, such as ANSI, AWPA, IMSA, and UL; and
  - Industry standards in the location where the Work is being performed.

If there are conflicting references in the Contract or the Quality Assurance program, to required sampling and testing frequencies, the Contractor shall sample and test the Materials according to the first applicable of the following:

- Special Provisions;
- MFTP; and
- ~~Supplemental Specifications; and~~
- Standard Specifications.

00165.30 Field-Tested Materials:

(a) Contractor's Duties - The Contractor shall:

- Furnish Materials of the quality specified in the Contract;
- Provide and administer a quality control program as described in the Quality Assurance Manual portion of the MFTP. Upon request, the Contractor shall provide to the Engineer the names, telephone numbers, and copies of certifications for all personnel performing field testing; and
- Perform other testing as required by the Contract.

(b) Types of Tests - The types of tests and testing methods generally required by ODOT are described in the MFTP.

(c) Acceptance of Field-Tested Materials - The Contractor's test results for field-tested Materials will be verified by the Agency according to the Quality Assurance program outlined in the MFTP. If the Agency's QA test results verify the Contractor's results, the Materials will be analyzed for acceptance according to one of the following methods before the Engineer will accept them for incorporation into the Work:

- Statistically, according to 00165.40, to determine "Pay Factors" for produced Aggregate;
- Statistically, according to 00165.40, to determine "Composite Pay Factors" for mixtures; or
- Other methods determined by the Engineer.

If the Agency's verification testing reveals that the Contractor's data is incorrect, the Agency may require additional testing to determine whether the Materials meet Specifications. The Contractor shall perform additional quality control testing or provide split samples to the Agency for additional testing as directed. If the Materials do not meet Specifications, the Contractor shall reimburse the Agency for the cost of the additional testing, which may be deducted from monies due or to become due the Contractor under the Contract. Incorporated Materials that do not meet Specifications will be evaluated according to 00165.01 and 00150.25. If the Materials meet Specifications the Agency will pay the cost for the additional testing.

00165.35 Nonfield-Tested Materials - The Contractor shall furnish Materials meeting Specifications, along with all Materials Conformance and Quality Compliance Documents.

(a) Test Results Certificate - The Certificate shall:

- Be from the manufacturer verifying that the Material furnished has been sampled and tested and the test results meet the Specifications.
- Include, or be accompanied by, a copy of the specified test results (ODOT, AASHTO, ASTM, UL or other).
- Identify the testing agency and the representative responsible for the test results.
- Permit positive determination that Material delivered to the Project is the same Material covered by the test results.
- Be delivered to the Engineer with the shipment of the material.

(b) Quality Compliance Certificate - The Certificate from the manufacturer shall:

- Verify that the Material meets the Specifications, and identify by number the specified test methods used, (ODOT, AASHTO, ASTM, UL, or other)
- Permit positive determination that Material delivered to the Project is the same Material covered by the certificate,
- Be delivered to the Engineer with the shipment of the Material, or be an identification plate or mark, decal, sticker, label, or tag attached to the container or Material,

(c) Equipment List and Drawings - These consist of lists of proposed Equipment and Materials, such as:

- Shop drawings
- Material lists
- Equipment lists

- Catalog description sheets
- Manufacturer's brochures

Submit these lists to the Engineer for review of conformance with the Specifications.

(d) Certificate of Origin of Steel Materials - When specified, complete this document (ODOT Form 734-2126) as required by 00160.20 for Federal-aid projects.

Materials will be subject to acceptance testing if the Engineer so elects. The Engineer may reject damaged or non-Specification Materials regardless of the Materials Conformance Documents furnished.

00165.40 Statistical Analysis - When 00165.30(c) or 00165.50 applies, the Contractor shall divide the Materials into lots and sublots, randomly sample and test them as required, and analyze the results statistically to determine whether the Materials conform to the Specifications.

All acceptance test results of lots and sublots will be analyzed collectively using the Quality Level Analysis procedure set out in this Subsection. This procedure shall not be used for a lot with less than three sublots. Sampling of Material for a lot that contains two or fewer sublots shall be increased to obtain at least three sublots. The Engineer has discretion to either accept or reject lots originating with two or fewer sublots, even after sampling is increased.

(a) Lot - A lot is the quantity of Materials produced by a single process or JMF that is sampled, tested, and statistically evaluated, as specified in this Subsection.

(b) Sublot - A sublot is a portion of a lot, for which a sample test value may be normally obtained.

(c) Quality Level Analysis - Quality Level Analysis is a statistical procedure to determine, for each lot:

- The percentage of each constituent of the Materials meeting Specifications;
- The Pay Factor for each constituent; and
- The Composite Pay Factor, when specified.

(d) Pay Factor and Composite Pay Factor Computation - Procedures for determining the percent meeting Specifications, Pay Factors, and Composite Pay Factor for a lot of Materials are as follows:

(1) Compute lot arithmetic mean ($\overline{X}$) for each constituent:

$$\overline{X} = \frac{\sum X}{n}$$

Where ΣX = summation of sample test values
n = total number of samples

(2) Compute standard deviation (sd) for each constituent:

$$sd = \sqrt{\frac{\sum X^2 - n\overline{X}^2}{n-1}}$$

Where $\sum X^2$ = summation of the squares of each sample test value

$\overline{X}^2$ = square of the lot arithmetic mean

(3) Compute the upper quality index (Q_U) for each constituent:

$$Q_U = \frac{USL - \overline{X}}{sd}$$

Where USL (upper specification limit) is the target value plus allowable tolerance

(4) Compute the lower quality index (Q_L) for each constituent:

$$Q_L = \frac{\overline{X} - LSL}{sd}$$

Where LSL (lower specification limit) is the target value minus allowable tolerance

(5) From Table 00165-1, for each constituent, determine the percent within the upper specification limit (P_U) which corresponds to a given Q_U. If USL is 100% or is not specified, P_U will be 100.

(6) From Table 00165-1, for each constituent, determine the percent within the lower specification limit (P_L) which corresponds to a given Q_L. If LSL is 0 or not specified, P_L will be 100.

(7) Compute the quality level, or total percent within specification limits (P_T), for each constituent:

$$P_T = (P_U + P_L) - 100$$

(8) Using the P_T from Step 7, determine the Pay Factor (PF) from Table 00165-2 for each constituent tested. A minimum PF of 1.00 will be used when all sublot test values are within the upper and lower specification limits, regardless of the calculated PF.

(9) Compute the Weighted Pay Factor (WPF) for each constituent:

$$WPF = (PF) \times (f_i)$$

Where f_i = weighting factor listed in the specifications for each constituent tested.

(10) Compute the Composite Pay Factor (CPF) for the lot and report the results to three decimal places.

$$CPF = \frac{\sum WPF}{\sum f_i}$$

Where $\sum WPF$ = sum of the weighted pay factors for each constituent

$\sum f_i$ = sum of the weighting factors listed in the specifications

Table 00165-1

QUALITY LEVEL ANALYSIS BY THE STANDARD DEVIATION METHOD								
P_U or P_L PERCENT WITHIN LIMITS FOR POSITIVE VALUES OF Q_U or Q_L	UPPER QUALITY INDEX Q_U OR LOWER QUALITY INDEX Q_L							
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10 to n = 11
100	1.16	1.50	1.79	2.03	2.23	2.39	2.53	2.65
99	-	1.47	1.67	1.80	1.89	1.95	2.00	2.04
98	1.15	1.44	1.60	1.70	1.76	1.81	1.84	1.86
97	-	1.41	1.54	1.62	1.67	1.70	1.72	1.74
96	1.14	1.38	1.49	1.55	1.59	1.61	1.63	1.65
95	-	1.35	1.44	1.49	1.52	1.54	1.55	1.56
94	1.13	1.32	1.39	1.43	1.46	1.47	1.48	1.49
93	-	1.29	1.35	1.38	1.40	1.41	1.42	1.43
92	1.12	1.26	1.31	1.33	1.35	1.36	1.36	1.37
91	1.11	1.23	1.27	1.29	1.30	1.30	1.31	1.31
90	1.10	1.20	1.23	1.24	1.25	1.25	1.26	1.26
89	1.09	1.17	1.19	1.20	1.20	1.21	1.21	1.21
88	1.07	1.14	1.15	1.16	1.16	1.16	1.16	1.17
87	1.06	1.11	1.12	1.12	1.12	1.12	1.12	1.12
86	1.04	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.01	1.02	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96
82	0.97	0.96	0.95	0.94	0.93	0.93	0.93	0.92
81	0.96	0.93	0.91	0.90	0.90	0.89	0.89	0.89
80	0.93	0.90	0.88	0.87	0.86	0.86	0.86	0.85
79	0.91	0.87	0.85	0.84	0.83	0.82	0.82	0.82
78	0.89	0.84	0.82	0.80	0.80	0.79	0.79	0.79
77	0.87	0.81	0.78	0.77	0.76	0.76	0.76	0.75
76	0.84	0.78	0.75	0.74	0.73	0.73	0.72	0.72
75	0.82	0.75	0.72	0.71	0.70	0.70	0.69	0.69
74	0.79	0.72	0.69	0.68	0.67	0.66	0.66	0.66
73	0.76	0.69	0.66	0.65	0.64	0.63	0.63	0.62
72	0.74	0.66	0.63	0.62	0.61	0.60	0.60	0.59
71	0.71	0.63	0.60	0.59	0.58	0.57	0.57	0.57
70	0.68	0.60	0.57	0.56	0.55	0.55	0.54	0.54
69	0.65	0.57	0.54	0.53	0.52	0.52	0.51	0.51
68	0.62	0.54	0.51	0.50	0.49	0.49	0.48	0.48
67	0.59	0.51	0.47	0.47	0.46	0.46	0.46	0.45
66	0.56	0.48	0.45	0.44	0.44	0.43	0.43	0.43
65	0.52	0.45	0.43	0.41	0.41	0.40	0.40	0.40
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34
62	0.43	0.36	0.34	0.33	0.32	0.32	0.32	0.32
61	0.39	0.33	0.31	0.30	0.30	0.29	0.29	0.29
60	0.36	0.30	0.28	0.27	0.27	0.27	0.26	0.26
59	0.32	0.27	0.25	0.25	0.25	0.24	0.24	0.24
58	0.29	0.24	0.23	0.22	0.21	0.21	0.21	0.21
57	0.25	0.21	0.20	0.19	0.19	0.19	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.16	0.16	0.16
55	0.18	0.15	0.14	0.14	0.13	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.11	0.11	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05
51	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NOTE: For negative values of Q_U or Q_L, P_U or P_L is equal to 100 minus the table value for P_U or P_L. If the value of Q_U or Q_L does not correspond exactly to a figure in the table, use the next higher figure.

Table 00165-1

QUALITY LEVEL ANALYSIS BY THE STANDARD DEVIATION METHOD							
P_U or P_L PERCENT WITHIN LIMITS FOR POSITIVE VALUES OF Q_U OR Q_L	UPPER QUALITY INDEX Q_U OR LOWER QUALITY INDEX Q_L						
	n = 12 to n = 14	n = 15 To n = 18	n = 19 to n = 25	n = 26 to n = 37	n = 38 to n = 69	n = 70 to n = 200	n = 201 to n = ∞
100	2.83	3.03	3.20	3.38	3.54	3.70	3.83
99	2.09	2.14	2.18	2.22	2.26	2.29	2.31
98	1.91	1.93	1.96	1.99	2.01	2.03	2.05
97	1.77	1.79	1.81	1.83	1.85	1.86	1.87
96	1.67	1.68	1.70	1.71	1.73	1.74	1.75
95	1.58	1.59	1.61	1.62	1.63	1.63	1.64
94	1.50	1.51	1.52	1.53	1.54	1.55	1.55
93	1.44	1.44	1.45	1.46	1.46	1.47	1.47
92	1.37	1.38	1.39	1.39	1.40	1.40	1.40
91	1.32	1.32	1.33	1.33	1.33	1.34	1.34
90	1.26	1.27	1.27	1.27	1.28	1.28	1.28
89	1.21	1.22	1.22	1.22	1.22	1.22	1.23
88	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.12	1.12	1.12	1.12	1.12	1.13	1.13
86	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.04	1.04	1.04	1.04	1.04	1.04	1.04
84	1.00	1.00	1.00	1.00	0.99	0.99	0.99
83	0.96	0.96	0.96	0.96	0.95	0.95	0.95
82	0.92	0.92	0.92	0.92	0.92	0.92	0.92
81	0.88	0.88	0.88	0.88	0.88	0.88	0.88
80	0.85	0.85	0.85	0.84	0.84	0.84	0.84
79	0.81	0.81	0.81	0.81	0.81	0.81	0.81
78	0.78	0.78	0.78	0.78	0.77	0.77	0.77
77	0.75	0.75	0.75	0.74	0.74	0.74	0.74
76	0.71	0.71	0.71	0.71	0.71	0.71	0.71
75	0.68	0.68	0.68	0.68	0.68	0.68	0.67
74	0.65	0.65	0.65	0.65	0.65	0.64	0.64
73	0.62	0.62	0.62	0.62	0.62	0.61	0.61
72	0.59	0.59	0.59	0.59	0.59	0.58	0.58
71	0.56	0.56	0.56	0.56	0.56	0.55	0.55
70	0.53	0.53	0.53	0.53	0.53	0.53	0.52
69	0.50	0.50	0.50	0.50	0.50	0.50	0.50
68	0.48	0.48	0.47	0.47	0.47	0.47	0.47
67	0.45	0.45	0.45	0.44	0.44	0.44	0.44
66	0.42	0.42	0.42	0.42	0.41	0.41	0.41
65	0.39	0.39	0.39	0.39	0.39	0.39	0.39
64	0.37	0.37	0.36	0.36	0.36	0.36	0.36
63	0.34	0.34	0.34	0.34	0.33	0.33	0.33
62	0.31	0.31	0.31	0.31	0.31	0.31	0.31
61	0.29	0.29	0.28	0.28	0.28	0.28	0.28
60	0.26	0.26	0.26	0.26	0.26	0.25	0.25
59	0.23	0.23	0.23	0.23	0.23	0.23	0.23
58	0.21	0.21	0.20	0.20	0.20	0.20	0.20
57	0.18	0.18	0.18	0.18	0.18	0.18	0.18
56	0.15	0.15	0.15	0.15	0.15	0.15	0.15
55	0.13	0.13	0.13	0.13	0.13	0.13	0.13
54	0.10	0.10	0.10	0.10	0.10	0.10	0.10
53	0.08	0.08	0.08	0.08	0.08	0.08	0.08
52	0.05	0.05	0.05	0.05	0.05	0.05	0.05
51	0.03	0.03	0.03	0.03	0.03	0.03	0.02
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NOTE: For negative values of Q_U or Q_L, P_U or P_L is equal to 100 minus the table value for P_U or P_L. If the value of Q_U or Q_L does not correspond exactly to a figure in the table, use the next higher figure.

Table 00165-2

PAY FACTOR	REQUIRED QUALITY LEVEL FOR A GIVEN SAMPLE SIZE (n) AND A GIVEN PAY FACTOR							
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10 to n = 11
1.05	100	100	100	100	100	100	100	100
1.04	90	91	92	93	93	93	94	94
1.03	80	85	87	88	89	90	91	91
1.02	75	80	83	85	86	87	88	88
1.01	71	77	80	82	84	85	85	86
1.00	68	74	78	80	81	82	83	84
0.99	66	72	75	77	79	80	81	82
0.98	64	70	73	75	77	78	79	80
0.97	62	68	71	74	75	77	78	78
0.96	60	66	69	72	73	75	76	77
0.95	59	64	68	70	72	73	74	75
0.94	57	63	66	68	70	72	73	74
0.93	56	61	65	67	69	70	71	72
0.92	55	60	63	65	67	69	70	71
0.91	53	58	62	64	66	67	68	69
0.90	52	57	60	63	64	66	67	68
0.89	51	55	59	61	63	64	66	67
0.88	50	54	57	60	62	63	64	65
0.87	48	53	56	58	60	62	63	64
0.86	47	51	55	57	59	60	62	63
0.85	46	50	53	56	58	59	60	61
0.84	45	49	52	55	56	58	59	60
0.83	44	48	51	53	55	57	58	59
0.82	42	46	50	52	54	55	57	58
0.81	41	45	48	51	53	54	56	57
0.80	40	44	47	50	52	53	54	55
0.79	38	43	46	48	50	52	53	54
0.78	37	41	45	47	49	51	52	53
0.77	36	40	43	46	48	50	51	52
0.76	34	39	42	45	47	48	50	51
0.75	33	38	41	44	46	47	49	50
REJECT	QUALITY LEVELS LESS THAN THOSE SPECIFIED FOR A 0.75							

NOTE: If the computed QUALITY LEVEL does not correspond exactly to a figure in the table, use the next lower value.

Table 00165-2

	REQUIRED QUALITY LEVEL FOR A GIVEN SAMPLE SIZE (n) AND A GIVEN PAY FACTOR						
PAY FACTOR	n = 12 to n = 14	n = 15 to n = 18	n = 19 to n = 25	n = 26 to n = 37	n = 38 to n = 69	n = 70 to n = 200	n = 201 to n = ∞
1.05	100	100	100	100	100	100	100
1.04	95	95	96	96	97	97	99
1.03	92	93	93	94	95	95	97
1.02	89	90	91	92	93	94	95
1.01	87	88	89	90	91	93	94
1.00	85	86	87	89	90	91	93
0.99	83	85	86	87	88	90	92
0.98	81	83	84	85	87	88	90
0.97	80	81	83	84	85	87	89
0.96	78	80	81	83	84	86	88
0.95	77	78	80	81	83	85	87
0.94	75	77	78	80	81	83	86
0.93	74	75	77	78	80	82	84
0.92	72	74	75	77	79	81	83
0.91	71	73	74	76	78	80	82
0.90	70	71	73	75	76	79	81
0.89	68	70	72	73	75	77	80
0.88	67	69	70	72	74	76	79
0.87	66	67	69	71	73	75	78
0.86	64	66	68	70	72	74	77
0.85	63	65	67	69	71	73	76
0.84	62	64	65	67	69	72	75
0.83	61	63	64	66	68	71	74
0.82	60	61	63	65	67	70	72
0.81	58	60	62	64	66	69	71
0.80	57	59	61	63	65	67	70
0.79	56	58	60	62	64	66	69
0.78	55	57	59	61	63	65	68
0.77	52	56	57	60	62	64	67
0.76	51	55	56	58	61	63	66
0.75	51	53	55	57	59	62	65
REJECT	QUALITY LEVELS LESS THAN THOSE SPECIFIED FOR A 0.75						

NOTE: If the computed QUALITY LEVEL does not correspond exactly to a figure in the table, use the next lower value.

00165.50 Statistical Acceptance Sampling and Testing - The Contractor shall sample and test Materials for acceptance, as required by the Contract. The Contractor may statistically evaluate test results for purposes of quality control or to predict a Pay Factor or Composite Pay Factor. The following apply:

(a) Statistical Acceptance - The Engineer will perform statistical analysis according to 00165.40 for acceptance and to determine a Pay Factor (PF) or Composite Pay Factor (CPF). The Engineer's determination of the PF or CPF shall be controlling.

(b) Pay Adjustments - As an incentive to produce quality Materials, the Engineer's acceptance will be based upon the following:

(1) Specification Materials - Any constituent with a PF of 1.00 or greater, or any Materials with a CPF of 1.0000 or greater, will be considered Specification Materials. A constituent with a PF greater than 1.00 or Materials with a CPF greater than 1.0000 will be considered of superior quality and, when specified, may earn a PF adjustment greater than 1.00, up to a maximum of 1.05.

(2) Nonspecification Materials - Any constituent with a PF less than 1.00, or any Materials with a CPF less than 1.0000 will be considered nonspecification Materials. When specified, a lot containing nonspecification Materials may be accepted at a reduced price as described in (c) below.

(c) Nonspecification Materials:

(1) Isolation of a Partial Sublot - The Engineer may isolate from a sublot or adjoining sublots any Material that is suspected of being nonspecification. The Contractor shall perform additional testing or provide split samples to the Agency as directed. Such isolated Material will not include an original test location.

(2) Isolation of an Entire Sublot - The Engineer may isolate a sublot or a series of sublots in which tests show the Material to be nonspecification. The Contractor shall perform additional testing or provide split samples to the Agency as directed. Isolated Material will be statistically evaluated as a separate lot.

(3) A Lot-in-Progress - The Contractor shall shut down production when any of the following occurs:

- The CPF for a lot-in-progress drops below 1.0000, and the Contractor is taking no corrective action;
- The CPF is less than 0.7500; or
- Any constituent test is continually out of specification limits, regardless of whether or not the CPF is below 0.7500.

The Contractor shall not resume production until the Engineer has determined that Specification Materials can be produced, and has given approval to resume.

(4) An Entire Lot - The Engineer may reject an entire lot of Materials with a CPF between 0.7500 and 1.0000, or may take action according to 00150.25.

For a lot of Material with a CPF below 0.7500, the Engineer will take one or more of the following actions:

a. Remain in Place - Allow Materials to remain in place with an appropriate price reduction that may range from 25% to 100% (no payment);

b. Corrective Work - Require corrective work, at the Contractor's expense, with an appropriate price reduction that may range from zero (full payment) to 100% (no payment); ~~or~~

or

c. Remove and Replace - Require complete removal and replacement with Specification Materials. No payment will be made for the rejected Materials, the cost of removal, or for the costs of sampling and testing.

00165.70 Use of Materials without Acceptable Materials Conformance Documents:

(a) General - The Contractor shall not incorporate Materials into the Project prior to submittal of Materials Conformance Documents acceptable to the Engineer. The Engineer may waive this requirement temporarily if Materials are necessary for immediate traffic safety.

(b) Materials Incorporated for Immediate Traffic Safety - If Materials are incorporated into the Project for immediate traffic safety before acceptable Materials Conformance Documents are available, no payment will be made for the value of the Materials, or the costs of incorporating them, until Materials Conformance Documents have been submitted to and approved by the Engineer, or the Materials are otherwise found through testing to comply with Specifications.

(c) Contractor's Request for Testing Assistance - If acceptable Materials Conformance Documents are not available, the Contractor may either have the necessary tests performed at a private laboratory or request in writing that the Engineer:

- Determine if the Agency or its agents can sample and test;
- Estimate the cost to the Contractor for the testing service; and
- Estimate the time required to obtain the test results.

The Engineer will provide this information to the Contractor in writing. If the Contractor requests the Engineer, in writing, to proceed, the Engineer will arrange for the sampling and testing, at the Contractor's expense. If these tests determine the Material complies with the Specifications, the Materials may be incorporated into the Project, or for Materials previously incorporated according to (b) above, payment will be authorized.

00165.75 Storage and Handling of Materials - The Contractor shall store and handle Materials so as to preserve their quality and fitness for incorporation into the Work. The Contractor shall restore all storage sites to their original condition according to 00140.90, or to comply with any applicable permits, orders, or agreements, at the Contractor's expense.

Stored Materials:

- Shall be readily accessible for inspection;
- May be stored on approved parts of the Right-of-Way; and
- May be stored on private property if written permission of the owner or lessor is obtained.

Measurement

00165.80 Measurement - No separate measurement will be made of Work performed under this Section.

Payment

00165.90 Incidental Basis - No separate or additional payment will be made for sampling, testing, certification, or other associated Work performed under this Section, whether performed by the Contractor, manufacturer, producer or supplier. No payment will be made for providing quality control personnel.

00165.91 Fabrication Inspection Expense - Fabrication of certain items outside of the State creates additional shop and plant inspection expense to the Agency. It is impractical, and extremely difficult, to determine the actual additional expenses incurred. Therefore, each time that inspection by Agency personnel is necessary, payment to the Contractor will be reduced by an amount computed at the following rates:

Zone	Place of Fabrication	Reduction in Payment
1	All of State of Oregon, and those portions of adjacent states within 50 airline miles of the Oregon border	$0
2	Outside of Zone 1, and up to 300 airline miles from the Oregon border	$100 per Calendar Day
3	Outside of Zone 2, up to 3,000 airline miles from the Oregon border, and within the continental United States.	Round trip coach airfare from Portland, Oregon plus $100 per Calendar Day
4	Outside of Zone 3, or outside of the continental United States.	Round trip coach airfare from Portland, Oregon plus $150 per Calendar Day

Calendar Day charges begin on the first day the Agency's inspector begins travel to begin work at the fabrication site, and continue without interruption through the final day of travel back to the State. The Contractor will be notified in writing of the dates of beginning and ending of Calendar Days used in computing payment reduction.

This Subsection applies to all fabricated items or manufactured Materials that are inspected by Agency personnel ~~when fabricated or manufactured in the State. They~~, which include, but are not limited to:

- Structural steel fabrication;
- Prestressed concrete members;
- Precast concrete;
- Signs;
- Preservative treatment of wood products;
- Epoxy coating of reinforcing steel; and
- Other items specifically identified in the Specifications as requiring fabrication site or in-plant inspection by the Agency.

Section 00170 - Legal Relations and Responsibilities

Description

00170.00 General - The Contractor shall comply with all laws, ordinances, codes, regulations and rules, (collectively referred to as "Laws" in this Section), that relate to the Work or to those engaged in the Work. Where the provisions of the Contract are inconsistent or in conflict, the Contractor shall comply with the more stringent standard.

The Contractor shall indemnify, defend, and hold harmless the Agency and its representatives from liability arising from or related to the violation of Laws by those engaged in any phase of the Work. This provision does not apply to Work performed by Agency employees.

In any litigation, the entire text of any order or permit issued by a governmental or regulatory authority, as well as any documents referenced or incorporated therein by reference, shall be admissible for the purpose of Contract interpretation.

The Contract shall not be construed against either party regardless of which party drafted it. Other than as modified by the Contract, the applicable rules of contract construction and evidence shall apply. This Contract shall be governed by and construed according to the laws of the State of Oregon without regard to principles of conflict of laws.

Any dispute between the Agency and the Contractor that arises from or relates to this Contract and that is not resolved under the provisions of Section 00199 shall be brought and conducted solely and exclusively within the Circuit Court for the State of Oregon in the county where the Agency's main office is located; provided, however, if a dispute must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this Subsection be construed as a waiver by the State of Oregon on any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR BY EXECUTION OF THE CONTRACT HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.

Provisions and Requirements

00170.01 Other Agencies Affecting Agency Contracts - Representatives of regulatory bodies or units of government whose Laws may apply to the Work shall have access to the Work according to 00150.20(d). These may include but are not limited to those in the following (a), (b), (c), and (d).

(a) Federal Agencies:

Agriculture, Department of
- Forest Service
- Natural Resource Conservation Service

Army, Department of the
- Corps of Engineers

Commerce, Department of
- National Marine Fisheries Service

Defense, Department of

Energy, Department of

Environmental Protection Agency (EPA)

Federal Energy Regulatory Commission

Geology Survey

Health and Human Services, Department of

Homeland Security, Department of
- U.S. Coast Guard (USCG)

Housing and Urban Development, Department of

Interior, Department of
- Heritage, Conservation, and Recreation Service
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Mines
- Bureau of Reclamation
- Geological Survey
- Minerals Management Service
- Office of Surface Mining, Reclamation, and Enforcement

Minerals Management Service

Solar Energy and Energy Conservation Bank

U.S. Fish and Wildlife Service

Labor, Department of
- Mine Safety and Health Administration
- Occupational Safety and Health Administration (OSHA)

Transportation, Department of
- Federal Highway Administration

Water Resources Council

(b) State of Oregon Agencies:

Administrative Services, Department of

Agriculture, Department of
- Natural Resources Division
- Soil and Water Conservation District

Columbia River Gorge Commission

Consumer and Business Services, Department of
- Insurance Division
- Oregon Occupational Safety and Health Division (OR-OSHA)

Energy, Office of

Environmental Quality, Department of (DEQ)

Fish and Wildlife, Department of

Forestry, Department of

Geology and Mineral Industries, Department of

Human Resources, Department of

Labor and Industries, Bureau of

Land Conservation and Development Department

Parks and Recreation, Department of

State Lands, ~~Division~~Department of

Water Resources Department

(c) Local Agencies:

City Councils

County Courts

County Commissioners, Boards of

Design Commissions

Historical Preservation Commissions

Lane Regional Air Pollution Authority (LRAPA)

Planning Commissions

Port Districts

Special Districts

(d) Oregon Federally Recognized Tribal Governments:

Burns Paiute Tribe

Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians

Confederated Tribes of Grand Ronde

Confederated Tribes of Siletz

Confederated Tribes of Umatilla Indian Reservation

Confederated Tribes of Warm Springs

Coquille Tribe

Cow Creek Band of Umpqua Indians

Klamath Tribe

00170.02 Permits, Licenses, and Taxes - As required to accomplish the Work, the Contractor shall do the following:

- Obtain all necessary permits and licenses, except for those noted in 00170.03;
- Pay all applicable charges, fees and taxes, except for those noted in 00170.03;
- Give all notices required by applicable Laws, or under the terms of the Contract;
- Comply with ORS 274.530 relating to lease of stream beds by Oregon Division of State Lands;
- License, in the State of Oregon, all vehicles subject to licensing;
- Comply with ORS 477.625 and ORS 527.670 relating to clearing and fire hazards on forest lands; and
- Comply with all orders and permits issued by a governmental authority, whether local, State, or federal.

00170.03 Furnishing Right-of-Way and Permits - Unless required to be obtained in the name of the Contractor, the Agency will obtain and pay for the following when they are required by the applicable Laws or by Plans or Specifications:

- All necessary Rights-of-Way;

- Permits required for crossing or encroaching upon navigable streams;
- Permits required for removing materials from or depositing materials in waterways;
- Permits required for operating in Agency-controlled source of Materials or disposal area;
- System development fees charged by local units of government;
- Building construction permits, not including specialty work such as heating, ventilation, air conditioning, or electrical;
- Cost of referencing and replacing endangered survey monuments; and
- Environmental permits, including erosion control permits.

00170.04 Patents, Copyrights, and Trademarks - Prior to use of designs, devices, materials, or processes protected by patent, copyright, or trademark, the Contractor shall obtain from the Entity entitled to enforce the patent, copyright, or trademark all necessary evidence of legal right.

The Contractor shall indemnify, defend and hold harmless the Agency and all third parties and political subdivisions having a possessory or ownership interest or regulatory authority over the Project or Project Site from claims of patent, copyright or trademark infringement, and from costs, expenses and damages the Contractor or Agency may be obligated to pay as a result of such infringement during or after completing the Work.

00170.05 Assignment of Antitrust Rights - The Contractor irrevocably assigns to the Agency any claim for relief or cause of action the Contractor acquires during the term of the Contract, or which may accrue thereafter, by reason of any violation of:

- Title 15 (Commerce and Trade), United States Code;
- ORS 646.725; and
- ORS 646.730.

In connection with this assignment, it is an express obligation of the Contractor to take no action that would in any way impair or diminish the value of the rights assigned to the Agency according to the provisions of this Subsection. Further, it is the express obligation of the Contractor to take all action necessary to preserve the rights assigned. It is an express obligation of the Contractor to advise the Agency's legal counsel:

- In advance, of its intention to commence any action involving such claims for relief or causes of action;
- Immediately upon becoming aware of the fact that an action involving such claims for relief or causes of action has been commenced by some other person or persons;
- The date on which it notified the obligor(s) of any such claims for relief or causes of action of the fact of the Contractor's assignment to the Agency according to the provisions of this Subsection; and
- Immediately upon the discovery of any such antitrust claim for relief or cause of action.

In the event any payment is made to the Contractor under any such claims for relief, the Contractor shall promptly pay the full sum over to the Agency. In the event the Contractor fails to make such payment, the Agency may deduct the amount from monies due or to become due the Contractor under the Contract.

00170.07 Record Requirements - For purposes of this Subsection the term "Contractor" includes the Contractor, all subcontractors, Material Suppliers, and providers of rented operated Equipment (except non-DBE truck drivers), at all tiers, for all subcontracts with first-tier Subcontractors, all subcontracts between the first-tier Subcontractors and their subcontractors and any other lower tier

subcontracts, and "Related Entities" as that term is defined in OAR 731-005-0780. The Material Suppliers included in this definition are those for Aggregates, Asphalt Cement Concrete, Portland Cement Concrete and the supply and fabrication of structural steel items or Material Suppliers that provide quotes.

(a) Records Required - The Contractor shall maintain all records, whether created before or after execution of the Contract, or during Contract performance, or after Contract completion, to clearly document:

- The Contractor's performance of the Contract or a subcontract;
- The Contractor's ability to continue performance of the Contract or a subcontract; and
- All claims arising from or relating to performance under the Contract or a subcontract.

These records shall include all records, including fiscal records, regardless of when created for the Contractor's business. The records for the Contractor's business include without limitation the:

- Bidding estimates and records, worksheets, tabulations or similar documents.
- Job cost detail reports, including monthly totals.
- Payroll records (including without limitation the ledger or register, and tax forms) and all documents which establish the periods, individuals involved, the hours for the individuals, and the rates for the individuals.
- Records that identify the Equipment used by the Contractor and subcontractors in the performance of the Contract or subcontracts, including without limitation, Equipment lists, rental contracts and any records used in setting rental rates.
- Invoices from vendors, rental agencies, and subcontractors.
- Material quotes, invoices, purchase orders and requisitions.
- Contracts with subcontractors and contracts with Material Suppliers, Suppliers and providers of rented equipment.
- Contracts or documents of other arrangements with any Related Entity as defined in OAR 731-005-0780.
- General ledger.
- Trial Balance.
- Financial statements (including without limitation the balance sheet, income statement, statement of cash flows, and financial statement notes).
- Income tax returns.
- All worksheets used to prepare bids or claims, or to establish the cost components for the Pay Items, including without limitation, the labor, benefits and insurance, Materials, Equipment, and subcontractors.

The following are examples, but not an exhaustive list, of records that would be included, if generated by the Contractor. If the Contractor generates such records, or equivalent records, they are included among the records subject to 00170.07.

- Daily time sheets and supervisor's daily reports.
- Collective bargaining agreements.
- Earnings records.
- Journal entries and supporting schedules.

- Insurance, welfare, and benefits records.
- Material cost distribution worksheet.
- Subcontractors' and lower tier subcontractors' payment certificates.
- Payroll and vendor's cancelled checks.
- Cash disbursements journal.
- All documents related to each and every claim together with all documents that support the amount of damages as to each claim.
- Additional financial statements (including without limitation the balance sheet, income statement, statement of cash flows, and financial notes) preceding the execution of the Contract and following final payment of the Contract.
- Depreciation records on all business Equipment maintained by the business involved, its accountant, or other Entity. (If a source other than depreciation records is used to develop cost for the Contractor's internal purposes in establishing the actual cost of owning and operating Equipment, all such other source documents.)

The Contractor shall maintain all fiscal records in material compliance with generally accepted accounting principles, or other accounting principles that are accepted accounting principles and practices for the subject industry and adequate for the nature of the Contractor's business, and in such a manner that providing a complete copy is neither unreasonably time consuming nor unreasonably burdensome for the Contractor or the Agency. Failure to maintain the records in this manner shall not be an excuse for not providing the records.

The Contractor shall include in its subcontracts, purchase orders, and all other written agreements, a provision requiring all subcontractors, Material Suppliers and providers of rented operated Equipment, (except non-DBE truck drivers), at all tiers to comply with 00170.07. The Contractor shall also require all subcontractors, Material Suppliers, and providers of rented operated Equipment, (except non-DBE truck drivers), at all tiers and Related Entities to include in their contracts, purchase orders, and all other written agreements, a provision requiring all lower tier subcontractors, Material Suppliers and providers of rented operated Equipment (except non-DBE truck drivers) to comply with 00170.07. The Material Suppliers to which this applies are those for Aggregates, Asphalt Cement Concrete, Portland Cement Concrete and the supply and fabrication of structural steel items or Material Suppliers that provide Material quotes and Related Entities as defined in OAR 731-005-0780.

(b) Access to Records - The Contractor shall provide the Engineer access to or a copy of all Contractor records upon request. A Project Manager's authority to request or access records is subject to OAR 731-005-0780(9). During the record retention period the Engineer, employees of the Agency, representatives of the Agency, or representatives of regulatory bodies or units of government may:

- Inspect, examine and copy or be provided a copy of all Contractor records;
- Audit the records, a Contract or the performance of a Contract;
- Inspect, examine and audit the records when, in the Agency's sole discretion, the records may be helpful in the resolution of any claim, litigation, administrative proceeding or controversy arising out of or related to a Contract.

Reasons for access to audit, inspect, examine and copy records include without limitation, general auditing, reviewing claims, checking for collusive bidding, reviewing or checking payment of required wages, performance and contract compliance, workplace safety compliance, evaluating related Entities, environmental compliance, and qualifications for performance of the Contract, including the ability to perform and the integrity of the Contractor.

Where such records are stored in a computer or in other digital media, the Engineer may request, and the Contractor shall provide, a copy of the data files and such other information or access to software to allow the Engineer review of the records.

Nothing in 00170.07 is intended to operate as a waiver of the confidentiality of any communications privileged under the Oregon Evidence Code. Nothing in 00170.07 limits the records or documents that can be obtained by legal process.

(c) Record Retention Period - The Contractor shall maintain the records and keep the records accessible and available at reasonable times and places for at least 3 years from the date of final payment under the Contract, or until the conclusion of all audits, litigation, administrative proceedings, disputes and claims arising out of or related to the Contract, whichever date is later.

(d) Public Records Requests - If records provided under this section contain any information that may be considered exempt from disclosure as a trade secret under either ORS 192.501(2) or ORS 646.461(4), or under other grounds specified in Oregon Public Records Law, ORS 192.410 through ORS 192.505, the Contractor shall clearly designate on or with the records the portions which the Contractor claims are exempt from disclosure, along with a justification and citation to the authority relied upon. Entire records or documents should not be designated as a trade secret or otherwise exempt from disclosure. Only specific information within a record or document should be so designated.

To the extent allowed by the Oregon Public Records Law or other applicable law related to the disclosure of public records, Agency will not disclose records or portions of records the Contractor has designated as trade secrets to a third party, who is not a representative of the Agency, to the extent the records are exempt from disclosure as trade secrets under the Oregon Public Records Law or other applicable law, except to the extent Agency is ordered to disclose in accordance with the Oregon Public Records Law or by a court of competent jurisdiction. Application of the Oregon Public Records Law or other applicable law shall determine whether any record, document or information is actually exempt from disclosure.

In addition, in response to a public records request, the Agency will not produce or disclose records so identified as exempt by the Contractor to any person other than representatives of the Agency, and others with authorized access under 00170.07(b), without providing the Contractor a copy of the public records request, unless:

- The Contractor consents to such disclosure; or
- Agency is prohibited by applicable law or court order from providing a copy of the public records request to the Contractor.

00170.10 Required Payments by Contractors - The Contractor shall comply with ORS 279C.505 and ORS 279C.515 during the term of the Contract.

(a) Prompt Payment by Contractor for Labor and Materials - As required by ORS 279C.505, the Contractor shall:

- Make payment promptly, as due, to all Entities supplying labor or Materials under the Contract;
- Pay all contributions or amounts due the Industrial Accident Fund, whether from the Contractor or a ~~Subcontractor~~subcontractor, incurred in the performance of the Contract;
- Not permit any lien or claim to be filed against the State or any political subdivision thereof, on account of any labor or Material furnished in performance of the Contract; and

- Pay to the Department of Revenue all sums withheld from employees according to ORS 316.167.

(b) Prompt Payment by Contractor to First-Tier Subcontractor(s) - According to ORS 279C.580(3)(a), after the Contractor has determined and certified to the Agency that one or more of its Subcontractors has satisfactorily performed subcontracted Work, the Contractor may request payment from the Agency for the Work, and shall pay the Subcontractor(s) within ~~ten~~ 10 Calendar Days out of such amounts as the Agency has paid to the Contractor for the subcontracted Work.

(c) Interest on Unpaid Amount - If the Contractor or a first~~-~~-tier Subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract within 30~~ days~~ Days after the Contractor's receipt of payment, the Contractor or first~~-~~-tier Subcontractor shall owe the Entity the amount due plus interest charges ~~commencing on~~that begin at the ~~date~~end of the 10 day period within which payment ~~was~~is due under ORS 279C.580(3) and ~~ending~~that end upon final payment, unless payment is subject to a good-faith dispute as defined in ORS 279C.580(5)(b). As required by ORS 279C.515(2), the rate of interest on the amount due shall be 9 percent per annum. The amount of interest shall not be waived.

~~As required by ORS 279C.515(2), the rate of interest charged to the Contractor or first-tier Subcontractor on the amount due shall equal three times the discount rate on 90-day commercial paper in effect at the Federal Reserve Bank in the Federal Reserve district that includes Oregon on the date that is 30 days after the date when the payment was received from the Agency or from the Contractor. The amount of interest due may not be waived, but the rate of interest shall not exceed 30 percent.~~

(d) Agency's Payment of the Contractor's Prompt Payment Obligations - If the Contractor fails, neglects or refuses to make prompt payment of any invoice or other demand for payment for labor or services furnished to the Contractor or a Subcontractor by any Entity in connection with the Contract as such payment becomes due, the Agency may pay the Entity furnishing the labor or services and charge the amount of the payment against monies due or to become due the Contractor under the Contract. (The Agency has no obligation to pay these Entities, and ODOT will not normally do so, but will refer them to the Contractor and the Contractor's Surety.)

The payment of a claim by the Agency in the manner authorized in this Subsection shall not relieve the Contractor or the Contractor's Surety from obligations with respect to any such claims.

(e) Right to Complain to the Construction Contractors Board - If the Contractor or a ~~Subcontractor~~subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract, the Entity may file a complaint with the Construction Contractors Board, unless payment is subject to a good-faith dispute as defined in ORS 279C.580(5)(b).

(f) Notice of Claim Against Bond - An Entity (which by definition includes a natural person) claiming not to have been paid in full for labor or Materials supplied for the prosecution of the Work may have a right of action on the Contractor's Payment Bond as provided in ORS 279C.600 and ORS 279C.605.

The Commissioner of the Bureau of Labor and Industries (BOLI) may have a right of action on the Contractor's and Subcontractors' public works bonds and Payment Bonds for workers who have not been paid in full, as provided in ORS 279C.600 and ORS 279C.605.

00170.20 Public Works Bond - Before starting Work, the Contractor and subcontractors shall each file with the Construction Contractors Board, and maintain in full force and effect, a separate public works bond, in the amount of $30,000 unless otherwise exempt, as required by ORS 279C.830(3) and ORS 279C.836. The Contractor shall verify subcontractors have filed a public works bond before the subcontractor begins Work.

00170.32 Protection of Navigable Waters - The Contractor shall comply with all applicable Laws, including without limitation the Federal River and Harbor Act of March 3, 1899 and its amendments.

The Contractor shall not interfere with waterway navigation or impair navigable depths or clearances, except as U.S. Coast Guard or Corps of Engineer permits allow.

00170.60 Safety, Health, and Sanitation Provisions - The Contractor shall comply with all Laws concerning safety, health, and sanitation standards. The Contractor shall not require workers to perform Work under conditions that are hazardous, dangerous, or unsanitary.

Workers exposed to traffic shall wear upper body garments or safety vests that are highly visible and meet the requirements of 00225.~~27~~25.

Workers exposed to falling or flying objects or electrical shock shall wear hard hats.

Upon their presentation of proper credentials, the Contractor shall allow inspectors of the U.S. Occupational Safety and Health Administration (OSHA) and the Oregon Occupational Safety and Health Division (OR-OSHA) to inspect the Work and Project Site without delay and without an inspection warrant.

According to ORS 468A.715 and ORS 468A.720, the Contractor or a Subcontractor who performs Project Work involving asbestos abatement shall possess a valid DEQ asbestos abatement license.

00170.61 Industrial Accident Protection:

(a) Workers' Compensation - The Contractor shall provide workers' compensation coverage for on-the-job injuries as required by 00170.70(d).

(b) Longshoremen's and Harbor Workers' Compensation - If Work to be performed is over or adjacent to navigable waters, the Longshoremen's and Harbor Workers' Compensation Act, (Chapter 18, Title 33 of the USC) may apply, and the Contractor shall be responsible for complying with its provisions (which may include the provision of additional workers' compensation benefits to employees).

00170.62 Labor Nondiscrimination - The Contractor shall comply with all Laws concerning equal employment opportunity, including without limitation those prohibiting discrimination because of race, religion, color, sex, disability, or national origin.

00170.63 Payment for Medical Care - According to ORS 279C.530, the Contractor shall promptly, as due, make payment to any person, copartnership, association or corporation furnishing medical, surgical and hospital care services or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums that the Contractor agrees to pay for the services and all moneys and sums that the Contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

00170.65 Minimum Wage and Overtime Rates for Public Works Projects:

(a) General - The Contractor ~~shall be~~is responsible for investigating local labor conditions. The Agency does not imply that labor can be obtained at the minimum hourly wage rates specified in State or federal wage rate publications, and no increase in the Contract Amount will be made if wage rates paid are more than those listed.

~~For work performed on Indian Reservations, tribally-owned businesses and businesses owned by tribally-enrolled Native Americans are not subject to the Oregon Bureau of Labor and Industries overtime requirements. These businesses are subject to the Federal Contract Work Hours and Safety Standards Act, which states that employees must be paid time and one-half for all hours worked in excess of forty hours per week.~~

(b) State Prevailing Wage Requirements - The Contractor shall comply ~~fully~~ with the prevailing wage provisions of ORS 279C.800 through ORS 279C.870. ~~Documents establishing those conditions, as determined by the Commissioner of the~~

(1) Minimum Wage Rates - The Bureau of Labor and Industries (BOLI~~), are included~~) determines and publishes the existing State prevailing wage rates in the publication "Prevailing Wage Rates for Public Works Contracts in ~~the Contract~~ Oregon". The Contractor shall pay workers ~~at no~~not less than the specified minimum hourly wage rate ~~of wage~~, according to ORS 279C.838 and ORS 279C.840 and shall include ~~that~~this requirement in all subcontracts ~~according to 00170.65(b) and 00170.65(c).~~. ~~As required in ORS 279C.845 the Agency will retain~~

See the Project Wage Rates page included with the Special Provisions for additional information about which wage rates apply to the project and how to access the applicable wage rates.

The applicable BOLI wage rates will be included in the Contract.

(2) Payroll and Certified Statements - As required in ORS 279C.845, the Contractor and every subcontractor shall submit written certified statements to the Engineer on the form prescribed by the Commissioner of BOLI in OAR 839-025-0010 certifying compliance with wage payment requirements and accurately setting out the Contractor's or subcontractor's weekly payroll records for each worker employed upon the project.

The Contractor and subcontractors shall preserve the certified statements for a period of 6 years from the date of completion of the Contract.

(3) Additional Retainage:

a. Agency - As required in ORS 279C.845(7) the Agency will retain 25% of any amount earned by the Contractor on the project until the Contractor has filed the certified statements required in ORS 279C.845 ~~or~~and in FHWA Form 1273~~.~~, if applicable. The Agency will pay to the Contractor the amount retained within 14 ~~days~~ Days after the Contractor files the required certified statements, regardless of whether a subcontractor has failed to file certified statements.

b. Contractor - As required in ORS 279C.845(8) the Contractor shall retain 25% of any amount earned by a first tier subcontractor on the project until the first tier subcontractor has filed with the Agency the certified statements required in ORS 279C.845 ~~or~~and in FHWA Form 1273, if applicable. Before paying any amount retained, the Contractor shall verify that the first tier subcontractor has filed the certified statement. Within 14 ~~days~~ Days after the first tier subcontractor files the required certified statement the Contractor shall pay the first tier subcontractor any amount retained.

(4) Owner/Operator Data - The Contractor shall furnish data to the Engineer for each owner/operator providing trucking services. Furnish the data before the time the services are performed and include without limitation for each owner/operator:

- Drivers name;
- Copy of driver's license;
- Vehicle identification number;
- Copy of vehicle registration;
- Motor vehicle license plate number;
- Motor Carrier Plate Number;
- Copy of ODOT Motor Carrier 1A Permit; and
- Name of owner/operator from the side of the truck.

(c) State Overtime Requirements - As a condition of the Contract, the Contractor shall comply with the pertinent provisions of ORS ~~279C.520 and ORS~~ 279C.540.

(1) Maximum Hours of Labor and Overtime Pay - According to ORS 279C.~~520~~540, no person shall be employed to perform Work under this Contract for more than 10 hours in any ~~one~~ 1 Day, or 40 hours in any ~~one~~ 1 week, except in cases of necessity, emergency, or where public policy absolutely requires it. In such instances, the Contractor shall pay the employee at least time and a half pay:

- For all overtime in excess of ~~eight~~ 8 hours a ~~Day~~day or 40 hours in any ~~one~~ 1 week when the work week is ~~five Days~~5 consecutive days, Monday through Friday; or
- For all overtime in excess of 10 hours a ~~Day~~day or 40 hours in any ~~one~~ 1 week when the work week is ~~four Days~~4 consecutive days, Monday through Friday; and
- For all Work performed on Saturday and on any legal holiday specified in ORS 279C.540.

~~The above~~For additional information on requirements for overtime and establishing a work schedule see OAR 839-025-0050 and OAR 839-025-0034.

(2) Notice of Hours of Labor - The Contractor shall give written notice to employees of the number of hours per day and days per week the employees may be required to work. Provide the notice either at the time of hire or before commencement of work on this Contract, or by posting a notice in a location frequented by employees.

(3) Exception - The maximum hours of labor and overtime requirements under ORS 279C.540 will not apply to the Contractor's Work under this Contract if the Contractor is ~~currently~~ a party to a collective bargaining agreement in effect with any labor organization. For a collective bargaining agreement to be in effect it shall be enforceable within the geographic area of the project, and its terms shall extend to workers who are working on the project (see OAR 839-025-0054).

~~According to ORS 279C.845, the Contractor and every subcontractor shall submit written certified statements to the Engineer on the form prescribed by the Commissioner of the Bureau of Labor and Industries, certifying the hourly rate of wage paid each worker which the Contractor or the subcontractor has employed on the Project and further certifying that no worker employed on the Project has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the Contract, which certificate and statement shall be verified by the oath of the Contractor or subcontractor that the Contractor or subcontractor has read such statement and certificate and knows the contents thereof and that the same is true to the~~

~~Contractor or subcontractor's best knowledge and belief. The certified statements shall set out accurately and completely the payroll records for the prior week including the name and address of each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made and actual wages paid. Certified statements for each week during which the Contractor or subcontractor has employed a worker on the Project shall be submitted once a month, by the fifth Calendar Day of the following month.~~

~~The Contractor and subcontractors shall preserve the certified statements for a period of six years from the date of completion of the Contract.~~

~~**(b) When Federal Funds Are Involved** - The Contractor shall pay the wage rate and fringe benefits listed in the publication "General Wage Determinations Issued Under the Davis-Bacon and Related Acts" from the U.S. Secretary of Labor, unless a higher wage rate and fringe benefits are required according to ORS 279C.838, as provided in the Oregon Bureau of Labor and Industries (BOLI) publication titled "Prevailing Wage Rates for Public Works Contracts in Oregon subject to BOTH the State PWR and federal Davis-Bacon Act", which are incorporated herein by reference. See the Project Wage Rates page included with the Special Provisions for the web site address where these publications are available.~~

~~For Federal-Aid projects, the Contractor shall comply with the provisions of FHWA Form 1273, "Required Contract Provisions Federal-Aid Construction Contracts", and ORS 279C.520 (see (a) of this Subsection) and ORS 279C.540.~~

~~With regard to overtime pay, the Contractor shall comply with the provision affording the greatest compensation.~~

~~**(c) When No Federal Funds Are Involved** - The Contractor shall pay the wage rate and fringe benefits listed in the BOLI publication titled "Prevailing Wage Rates for Public Works Contracts in Oregon" which is incorporated by reference. See the Prevailing Wage Rates page included with the Special Provisions for the web site address where this publication is available.~~

~~Except for businesses subject to the Federal Contract Work Hours and Safety Standards Act as described in 00170.65(a), the Contractor shall comply with the overtime requirements of ORS 279C.520, ORS 279C.540 (see (a) and (b) of this Subsection), and ORS 279C.845.~~.

(d) State Time Limitation on Claim for Overtime - According to ORS 279C.545, ~~the Contractor shall:~~any worker employed by the Contractor is foreclosed from the right to collect any overtime provided in ORS 279C.540 unless a claim for payment is filed with the Contractor within 90 Days from the completion of the contract, provided the Contractor posted and maintained a circular as specified in this provision. Accordingly, the Contractor shall:

- ~~**(1)**~~ Cause a circular, clearly printed in ~~blackface pica~~boldfaced 12-point type ~~and~~ containing a copy of ORS 279C.545, to be posted in a prominent place alongside the door of the timekeeper's office or in a similar place which is readily available and freely visible to any or all workers employed to perform Work; and

- ~~**(2)**~~ Maintain such circular continuously posted from the inception to the completion of the Contract on which workers are or have been employed.

~~**(e) Owner/Operator Data** - The Contractor shall furnish data to the Engineer for each owner/operator providing trucking services. The data must be provided before the time the services are provided and must include without limitation for each owner/operator:~~

- ~~Drivers name;~~

- ~~Copy of drivers license;~~
- ~~Vehicle identification number;~~
- ~~Copy of vehicle registration;~~
- ~~Motor vehicle license plate number;~~
- ~~Motor Carrier Plate Number;~~
- ~~Copy of ODOT Motor Carrier 1A Permit; and~~
- ~~Name of owner/operator from the side of the truck.~~

(e) Additional Requirements When Federal Funds are Involved - When federal funds are involved, the following requirements shall apply in addition to the requirements of 00170.65(a) through 00170.65(d). The Contractor shall include these provisions in all subcontracts as well as ensure that all Subcontractors include these provisions in their lower tier subcontracts.

(1) FHWA Requirements - For Federal-Aid projects, the Contractor shall comply with the provisions of FHWA Form 1273, "Required Contract Provisions Federal-Aid Construction Contracts".

(2) Minimum Wage Rates - The Contractor shall pay each worker in each trade or occupation employed to perform any work under the contract not less than the existing State (BOLI) prevailing wage rate or the applicable federal prevailing wage rate required under the Davis-Bacon Act (40 U.S.C. 3141 et seq.), whichever is higher. The Contractor shall include this provision in all subcontracts.

See the Project Wage Rates page included with the Special Provisions for additional information about which wage rates apply to the project and how to access the applicable wage rates.

The applicable Davis-Bacon and BOLI wage rates will be included in the Contract.

(3) Payroll and Certified Statements - In addition to providing the payroll information and certified statements required under ORS 279C.845 (see 00170.65(b-2)), the Contractor and every subcontractor shall submit written certified statements that also meet the requirements in Section IV of FHWA Form 1273 except the Contractor and every subcontractor shall preserve the certified statements for a period of 6 years from the date of completion of the Contract.

(4) Overtime - With regard to overtime pay, the Contractor shall comply with the overtime provision affording the greatest compensation required under FHWA Form 1273 and ORS 279C.540.

00170.70 Insurance:

(a) Insurance Coverages - The Contractor shall obtain, at its expense, and keep in effect during the term of the Contract, the insurance coverages listed below. The Contractor may however, contractually obligate an appropriate subcontractor to obtain, at the subcontractor's expense or at the Contractor's expense, and keep in effect during the term of the Contract, pollution liability coverage, asbestos liability, lead liability, or automobile liability with pollution coverages, or such other types of insurance coverage that, before execution of the Contract, the Agency approves as types of insurance coverage that may be obtained by appropriate subcontractors. If both the Contractor and an appropriate subcontractor will perform pollution related Work or other Work that would be covered by the other above-described types of insurance permitted to be obtained by an appropriate subcontractor, the insurance coverages listed below that correspond to such Work shall be obtained, at the Contractor's or

subcontractor's expense, and shall cover the liability of the Contractor and the subcontractor, either under the same or separate insurance policies.

- **Commercial General Liability** - Commercial General Liability Insurance covering bodily injury and property damage in a form and with coverages that are satisfactory to the Agency. This insurance shall include personal and advertising injury liability and products and completed operations coverage. Coverage may be written in combination with Commercial Automobile Liability Insurance with separate limits for Commercial General Liability and Commercial Automobile Liability. Coverage shall be written on an occurrence basis. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions. The annual aggregate limit shall not be less than the dollar amount indicated in the Special Provisions. The policy shall be endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

  If the Contractor's Commercial General Liability Insurance limits are less than the required limits stated above, the Contractor shall obtain Excess or Umbrella Liability Insurance with sufficient limits that when added to the Contractor's Commercial General Liability Insurance limits the total combined limits of Commercial General Liability Insurance and Excess or Umbrella Liability Insurance equal or exceed the above-stated Commercial General Liability Insurance limits required for this Project. The above-stated combined single limit per occurrence and the above-stated annual aggregate limit must each be met. Excess or Umbrella Liability Insurance coverage shall extend to the same perils, terms, and conditions as the underlying Commercial General Liability Insurance coverage.

- **Pollution Liability** - If indicated by Special Provision, Pollution Liability Insurance covering the Contractor's liability, or the liability of an appropriate subcontractor, if the coverage is obtained by the subcontractor, for bodily injury and property damage, and environmental damage resulting from sudden and accidental pollution, gradual pollution, and related clean-up costs incurred by the Contractor, or by the subcontractor if the coverage is obtained by the subcontractor, while performing Work required by the Contract. If the coverage us obtained by the Contractor, the coverage may be written in combination with the Commercial General Liability Insurance with separate limits for Pollution Liability and Commercial General Liability. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions. The annual aggregate limit shall not be less than the dollar amount indicated in the Special Provisions. The policy shall be endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

- **Asbestos Liability** - If indicated by Special Provision, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide an Asbestos Liability endorsement to the pollution liability coverage. If an endorsement cannot be obtained, The Contractor or subcontractor shall provide separate Asbestos Liability Insurance at the same combined single limit per occurrence and annual aggregate limit as the Pollution Liability Insurance with the policy endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

- **Lead Liability** - If indicated by Special Provision, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide a Lead Liability endorsement to the pollution liability coverage. If an endorsement cannot be obtained, the Contractor or subcontractor shall provide separate Lead Liability Insurance at the same combined single limit per occurrence and annual aggregate limit as the Pollution Liability Insurance with the separate policy endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

- **Commercial Automobile Liability** - Commercial Automobile Liability Insurance covering all owned, non-owned, and hired vehicles. This coverage may be written in combination with the Commercial General Liability Insurance with separate limits for Commercial Automobile Liability and Commercial General Liability. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions. If this coverage is written in combination with the Commercial General Liability, the policy shall be endorsed to state that the Commercial General Liability annual aggregate limit shall apply separately to the Contract.

- **Commercial Automobile Liability with Pollution Coverage** - If indicated by Special Provision, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide Commercial Automobile Liability Insurance with Pollution coverage covering the Contractor's liability, or the liability of an appropriate subcontractor, if the coverage is obtained by the subcontractor, for bodily injury and property damage, and environmental damage arising out of the use of all owned, non-owned, or hired vehicles while performing Work under the Contract. If the coverage is obtained by the Contractor, the coverage may be written in combination with the Commercial General Liability Insurance with separate limits for Commercial Automobile Liability with Pollution Coverage and Commercial General Liability. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions or the amount required by the U.S. Department of Transportation, whichever is greater. If this coverage is written in combination with the Commercial General Liability, the policy shall be endorsed to state that the Commercial General Liability annual aggregate limit shall apply separately to the Contract.

  Commercial Automobile Liability with Pollution Coverage is required for this Project because the Project includes pollution related Work. If the Contractor will be performing pollution related Work, this coverage covering the Contractor must be provided. If an appropriate subcontractor, but not the Contractor, will perform the pollution related Work, Commercial Automobile Liability with Pollution Coverage covering the subcontractor, but not the Contractor, must be provided, however, the Contractor shall provide Commercial Automobile Liability insurance coverage covering the Contractor as provided in the Commercial Automobile Liability bullet above. If both the Contractor and an appropriate subcontractor will be performing pollution related Work, Commercial Automobile Liability with Pollution Coverage covering both the Contractor and the subcontractor shall be provided, and the Contractor may provide the coverage covering both the Contractor and the subcontractor, or the Contractor and the subcontractor may provide their own, separate Commercial Automobile Liability with Pollution coverages.

(b) Tail Coverage - If any of the required liability insurance coverages of 00170.70(a) are on a "claims made" basis, "tail" coverage will be required at the completion of the Contract for a duration of 24 months, or the maximum time period reasonably available in the marketplace. The Contractor shall furnish certification of "tail" coverage as described, or continuous "claims made" liability coverage for 24 months following Contract completion. Continuous "claims made" coverage will be acceptable in lieu of "tail" coverage, provided its retroactive date is on or before the effective date of the Contract. If Continuous "claims made" coverage is used, the Contractor shall keep the coverage in effect for a duration of not less than 24 months from the end of the Contract. This will be a condition of Final Acceptance.

(c) Additional Insured - The liability insurance coverages of 00170.70(a) shall include the Agency, the Agency's governing body, board, or Commission and its members, and the Agency's officers and employees as Additional Insureds, but only with respect to the Contractor's activities to be performed under the Contract. Coverage shall be primary and non-contributory with any other insurance and self-insurance. The liability coverages of 00170.70(a) that are permitted by the Agency to be obtained by an appropriate subcontractor shall include all of the

foregoing as Additional Insureds and shall also include Contractor and its officers and employees as Additional Insureds.

(d) Workers' Compensation - All employers, including the Contractor and its Subcontractors, if any, that employ subject workers who are performing Work or providing labor or Materials under the Contract in the State shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. The Contractor shall ensure that each of its Subcontractors complies with these requirements.

The Contractor shall certify in the Contract that the Contractor is registered by the Oregon Workers' Compensation Division either as a carrier-insured employer, a self-insured employer, an exempt employer, or is an independent contractor who will perform the Work without the assistance of others.

The Contractor shall ensure that its insurance carrier files a guaranty contract with the Oregon Workers' Compensation Division before performing any Work.

(e) Notice of Cancellation or Change - The Contractor shall not cancel, change materially, or take any action showing intent not to renew the insurance coverage(s) without 30 days' advance written notice from the Contractor or its insurer(s) to the Agency. The Contractor shall be responsible for ensuring that insurance coverage(s) obtained by an appropriate subcontractor, as permitted by the Agency under 00170.70(a), are not cancelled, changed materially, or have any action taken by the subcontractor showing intent not to renew the insurance coverage(s) without 30 days' advance written notice from the Contractor or the insurer(s) to the Agency. Any failure to comply with the reporting provisions of this insurance shall not affect the coverage(s) provided to the Agency, County, City, or other applicable political jurisdiction or to the Agency's governing body, board, or Commission and its members, and the Agency's officers and employees.

(f) Certificate(s) of Insurance - As evidence of the insurance coverages required by this Contract, the Contractor shall furnish Certificate(s) of Insurance to the Agency at the time(s) provided in 00130.50(a). As evidence of insurance coverages required by this Contract but permitted by the Agency under 00170.70(a) to be obtained by an appropriate subcontractor, the Contractor shall furnish Certificate(s) of Insurance to the Agency for such coverages together with the Contractor's request under 00180.21 for approval of the subcontract with that subcontractor. The Certificate(s) will specify all of the parties who are Additional Insureds. The Contractor shall obtain, or ensure that the appropriate subcontractors obtain, insurance coverages required under this Contract from insurance companies or entities acceptable to the Agency and authorized to issue insurance in the State. The Contractor, or the appropriate subcontractor, but not the Agency, shall be responsible for paying all deductibles, self-insured retentions and/or self-insurance included under these provisions.

(g) Builders' Risk - If indicated by Special Provision, the Contractor shall obtain, at its expense, and keep in effect during the term of the Contract, Builders' Risk insurance on an all risks of direct physical loss basis, including, without limitation, earthquake and flood damage, for an amount equal to at least the value indicated in the Special Provisions. Any deductible shall not exceed $50,000 for each loss, except that the earthquake and flood deductible shall not exceed 5% of each loss or $50,000, whichever is greater. The policy shall include the Agency as loss payee.

00170.71 Independent Contractor Status - The service or services to be rendered under this Contract are those of an independent contractor. The Contractor is not an officer, employee, or agent of the State as those terms are used in ORS 30.265.

00170.72 Indemnity/Hold Harmless - To the fullest extent permitted by law, and except to the extent otherwise void under ORS 30.140, the Contractor shall indemnify, defend (with counsel approved by the Agency) and hold harmless the Agency, Agency's Authorized Representative, Architect/Engineer, Architect/Engineer's consultants, and their respective officers, directors, agents, employees, partners, members, stockholders and affiliated companies (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses (including reasonable attorney fees), demands and actions of any nature whatsoever which arise out of, result from or are related to the following:

- Any damage, injury, loss, expense, inconvenience or delay described in this Subsection.
- Any accident or occurrence which happens or is alleged to have happened in or about the Project Site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects.
- Any failure of the Contractor to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract.
- The negligent acts or omissions of the Contractor, a subcontractor or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder.
- Any lien filed upon the project or bond claim in connection with the Work.

Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Subsection.

In claims against any person or entity indemnified under this Subsection by an employee of the Contractor, a ~~Subcontractor~~subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Subsection shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a ~~Subcontractor~~subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

00170.74 Employee Drug Testing Program - As required by ORS 279C.505(2), the Contractor shall have in place, and maintain during the period of the Contract, an employee drug-testing program. The Agency retains the right to audit and/or monitor the program. On request by the Engineer, the Contractor shall furnish a copy of the employee drug-testing program.

00170.78 Conflict of Interest - The Contractor shall not give or offer any gift, loan, or other thing of value to any member of the Agency's governing body or employee of the Agency in connection with the award or performance of any Contract.

The Contractor shall not rent, lease, or purchase Materials, supplies, or Equipment, with or through any Agency employee or member of the Agency's governing body.

No ex-employee of the Agency who has worked for the Agency on any phase of the Project within the prior ~~two~~ 2 years may be employed by the Contractor to perform Work on the Project.

00170.79 Third Party Beneficiary - There are no third-party beneficiaries of the Contract.

00170.80 Responsibility for Damage to Work:

(a) Responsibility for Damage in General - ~~Except as otherwise provided in this Section, the~~The Contractor shall perform Work, and furnish Materials and Equipment for incorporation

into the Work, at the Contractor's own risk, until the entire Project has been completed and accepted by the Agency. The Contractor shall repair all damages to Work performed, Materials supplied, and Equipment incorporated into the Work, except as otherwise provided in this Section.

(b) Repair of Damage to Work - ~~The~~Until Final Acceptance, the Contractor shall promptly rebuild, repair, restore, and make good damages to ~~any portion~~all portions of the permanent or temporary Work, ~~regardless of whether~~except to the ~~Contractor~~extent the Agency has ~~been relieved of~~assumed responsibility according to the provisions of ~~this Subsection, unless the Engineer directs otherwise. Where the Contractor has been relieved of responsibility for the damage, Work required to repair~~ (c) below. The Contractor Shall perform all repairs of damage to ~~the Work shall be considered Extra or Changed Work. (see 00140.30 and 00140.60) The Engineer may elect to have such Extra or Changed Work performed by Agency forces or other means.~~

~~Where the Contractor has not been relieved of responsibility for the damage according to a provision of this Subsection, the Contractor shall be responsible for promptly rebuilding, repairing, restoring, and making good damages to any portion of the permanent or temporary Work occurring before issuance of Third Notification with~~Work at no additional ~~compensation~~cost to the Agency, except for repairs necessitated by damage caused by:

- Acts of God or Nature, as defined in Section 00110; or
- Actions of governmental authorities.

(c) ~~Partial Relief of~~ Responsibility for Damage to Work Caused by Public Traffic~~:~~

~~**(1) Interim Acceptance** -~~ - The Contractor may ~~request in writing interim acceptance of certain completed portions of the Work, such as drainage facilities and traffic control devices. If approved, the Engineer will issue written interim acceptance stipulating the scope and duration of the Contractor's~~ apply for relief ~~from~~of responsibility for damage to Work caused by public traffic~~. The Engineer will also include in the interim acceptance the scope and duration of Contractor's relief, if any, from responsibility for protection and maintenance under 00150.75~~ by submitting a signed Contractor's Request for Relief of Responsibility, form 734-2768, to the Engineer by mail, personal delivery or courier, by FAX, or other agreed-upon method.

~~**(2) Scope of Relief** - For the duration of interim acceptance issued by~~ The Engineer will process a maximum of two forms per month and return the forms within 7 Calendar Days indicating each item as "approved" or "denied".

The approval of the Engineer~~,~~ is limited, and is made only for the ~~Contractor will be relieved~~purposes of determining relief of responsibility for damage to ~~repair those~~completed portions of the Work caused by public traffic. The completed portions of the Work ~~upon which~~are not considered complete, and are not finally accepted for any other purposes under the Contract.

If the Contractor disagrees with the Engineer's findings, the Contractor may request a Region level review according to 00199.40(b).

(1) Request for Relief - The Agency will only accept a request for relief ~~was granted under this Subsection. The scope of potential relief applies only to~~from and will only assume responsibility for damages caused by public traffic, ~~and is limited~~ to the following completed portions of the Work:

- A segment of Roadway, drainage facilities, Slopes, lighting, traffic control devices and access facilities;

- A Bridge or other Structure within a segment of Roadway;
- Traffic signals and appurtenances at an intersection;
- Permanent, passive traffic control devices;
- Complete circuits of a highway lighting system; and
- Portions of a building open to public use.

~~**(d) Vandalism** -~~ The Agency will approve a request for the Agency to assume responsibility for damages to the completed portions of the Work caused by public traffic only under the following conditions:

- The completed portions of the Work are completed according to Contract Change Orders, the Plans or approved stage construction Plans;
- The traffic control complies with approved traffic control Plans; and
- All required Materials conformance and quality compliance documents pertaining to the completed portions of the Work are on file with the Engineer (see Section 00165).

(2) Scope of Relief - When the Agency assumes responsibility for damage to completed portions of the Work caused by public traffic any damages will be repaired by the Contractor on a Changed Work basis, or by Agency forces, or by other means as determined by the Engineer. If completed portions of the Work are damaged by public traffic before Final Inspection, and the Agency requires the Contractor to repair the damages, the Engineer will reimburse the Contractor for the Changed Work at 75% of the total amount calculated according to Section 00197.

If completed portions of the Work are damaged by public traffic after Final Inspection, and the Agency requires the Contractor to repair the damages, the Engineer will reimburse the Contractor for the Work at 100% of the total amount calculated according to Section 00197.

If any additional Work is performed by the Contractor on completed portions of the Work for which the Agency has assumed responsibility for damages caused by public traffic, and the Work is performed outside of the approved stage construction Plans or approved traffic control Plans, the Contractor shall become fully responsible and liable, and shall make good all damages caused by public traffic at no additional cost to the Agency.

(d) Vandalism and Theft - Vandalism includes damage to or destruction of Work or portions of Work that remain on the Project Site resulting from vandalism, criminal mischief, arson, or other criminal or illegal behavior.

The Contractor shall provide reasonable protection of the Work from vandalism until Third Notification. If reasonable protection has been provided, the Contractor's responsibility for damage resulting from vandalism will be limited to $5,000.00 per occurrence. Requests for reimbursement of amounts in excess of $5,000.00 shall be in writing and directed to the Engineer. Upon receipt, the Engineer will investigate, evaluate the amount of damages and their cause, determine the number of occurrences, and determine whether, and how much, the Contractor will be ~~recompensed~~compensated.

Theft includes the loss of Work or portions of Work that are lost or stolen or otherwise unaccounted for from the Project Site or from Materials or fabrication locations. The Contractor shall remain solely responsible for all losses caused by theft, including without limitation theft that occurs in conjunction with vandalism.

00170.82 Responsibility for Damage to Property and Facilities:

(a) In General - As used in this Subsection, the term "Contractor" shall include the Contractor's agents, Subcontractors, and all workers performing Work under the Contract; and the term "damage" shall include without limitation soiling or staining surfaces by tracking or splashing mud, asphalt, and other materials, as well as damage of a more serious nature.

The Contractor shall be solely responsible for damages arising from:

- The Contractor's operations;
- The Contractor's negligence, gross negligence, or intentional wrongful acts; and
- The Contractor's failure to comply with any Contract provision.

The Agency may withhold funds due the Contractor or the Contractor's Surety until all lawsuits, actions, and claims for injuries or damages are resolved, and satisfactory evidence of resolution is furnished to the Agency.

(b) Protection and Restoration of Agency Property and Facilities - The following requirements apply to highways, highway Structures and other improvements that are existing, under construction, or completed. The Contractor shall:

- Provide adequate protection to avoid damaging Agency property and facilities;
- Be responsible for damage to Agency property and facilities caused by or resulting from the Contractor's operations; and
- Clean up and restore such damage by repair, rebuilding, replacement, or compensation, as determined by the Engineer.

(c) Protection and Restoration of Non-Agency Property and Facilities - The Contractor shall determine the location of properties and facilities that could be damaged by the Contractor's operations, and shall protect them from damage. The Contractor shall protect monuments and property marks until the Engineer has referenced their location and authorized their removal. The Contractor shall restore property or facilities damaged by its operations to the condition that existed before the damage, at no additional compensation.

The Contractor shall provide temporary facilities when needed, e.g., to maintain normal service or as directed by the Engineer, until the required repair, rebuilding, or replacement is accomplished.

The Contractor shall protect specific service signs, e.g., business logos, and tourist-oriented directional signs (TODS) from damage, whether the signs are to remain in place or be placed on temporary supports. The Contractor shall repair or replace damaged signs at no cost to the Agency. Liquidated damages will be assessed against the Contractor in the amount of $200 per day for each sign out of service for more than ~~five~~ 5 Calendar Days because of the Contractor's operations.

00170.85 Responsibility for Defective Work - The Contractor shall make good any defective Work, Materials or Equipment incorporated into the Work, according to the provisions of Section 00150.

(a) Latent Defects - The Contractor shall remain liable for all latent defects resulting from causes other than fraud or gross mistakes that amount to fraud until the expiration of all applicable statutes of limitation and ultimate repose, the Performance Bond, Warranty Bond, or warranty period, whichever expires last. The Contractor shall remain liable for all latent defects resulting from fraud or gross mistakes that amount to fraud regardless of when those latent defects may be discovered, and regardless of whether such discovery occurs outside any

applicable statutes of limitation or ultimate repose or any applicable Performance Bond, Warranty Bond, or warranty period.

(b) Contractor Furnished Warranties~~:~~:

~~**(1) Warranties for ODOT Projects** - For those Contracts that are awarded by or through ODOT, this 00170.85(b-1) warranty applies.~~

(1) Contractor Warranty for Specific Items - For those Items with Specifications referencing this 00170.85(b-1) warranty, the Contractor warrants that the Work for those Items, including Changed Work, Additional Work, Incidental Work, On-Site Work, and Extra Work, and Materials and Equipment incorporated into the Work, shall meet the technical and performance Specifications required under the Contract~~, from the date and for the~~. The warranty period ~~of time~~will be identified in each applicable Specification or elsewhere in the Contract~~.~~ and will begin on the date of Second Notification. The Contractor shall be responsible for making good the Work, and for all repairs of damage to the Work and other improvements, natural and artificial structures, systems, equipment, and vegetation caused by, or resulting in whole or in part from, defects in warranted Materials, Equipment, and workmanship. The Contractor shall be responsible for all costs ~~associated with site cleanup and remediation~~ caused by, or resulting in whole or in part from, defects in warranted Materials, Equipment, or workmanship.~~ This warranty provision shall survive expiration or termination of the Contract.~~

When the Agency makes written notification of failure of an item covered by this warranty, the warranty period will stop for the effected item or the portion of the effected item that failed, as applicable, until the required repairs or replacements are made and accepted. All repaired or replaced items shall meet current specifications, unless otherwise specified in the Contract, and will be warranted for the remaining warranty period.

This warranty provision shall survive expiration or termination of the Contract.

(2) ~~Warranties~~General Warranty for Local Agency Projects - For those Contracts that are developed, advertised, awarded, and administered by Local Agencies, and do not contain federal funding, this 00170.85(b-2) warranty applies.

The Contractor shall warrant all Work and workmanship, including Changed Work, Additional Work, Incidental Work, On-Site Work, and Extra Work, and Materials and Equipment incorporated in the Work, for ~~one~~1 year from the date of ~~Third~~Second Notification, except that warranties according to 00170.85(b-1) and manufacturers' warranties and extended warranties according to 00170.85(c) shall not be abridged.

The Contractor shall be responsible for meeting the technical and performance Specifications required, making good the Work, and for all repairs of damage to the Work and other improvements, natural and artificial structures, systems, equipment, and vegetation caused by, or resulting in whole or in part from occurrences beginning during the warranty period and are the result of defects in Materials, Equipment, and workmanship. The Contractor shall be responsible for all costs associated with completing the repair of the defects and for associated Work including but not limited to permitting, mobilization, traffic control, erosion control, surface restoration, site cleanup and remediation caused by, or resulting in whole or in part from, defects in Materials, Equipment, or workmanship, and other Work determined by the Engineer to be necessary to complete the repair of the defects.

Within 10 Calendar Days of the Agency's written notice of defects, the Contractor, or the Contractor's Surety, shall vigorously and continuously correct and repair the defects and all related damage. If the Contractor or the Contractor's Surety fails to correct and repair the

defects, the Agency may have the correction and repair done by others. The Contractor or Contractor's Surety shall promptly reimburse the Agency for all expenses incurred to correct and repair the defects.

In the event of an emergency, where delay could result in serious loss or damage, the Agency may make emergency corrections and repairs, without written notice. The Contractor or Contractor's Surety shall promptly reimburse the Agency for all expenses incurred to correct and repair the defects.

Corrections, repairs, replacements or changes shall be warranted for an additional ~~one~~ 1 year period beginning on the date of the Agency's acceptance of the corrections, repairs, replacements or changes.

Without limiting the general applicability of other survival clauses under the Contract, this warranty provision shall survive expiration or termination of the Contract.

(c) Manufacturer Warranties and Guarantees:

(1) Manufacturer Warranties - For those Specification Sections referencing this 00170.85(c~~-~~1) Subsection, the Contractor shall furnish Warranties from the Manufacturer and signed by a Manufacturer's Representative.

The ~~Warranty~~warranty period will be specified in the applicable Specification Section for which it applies.

The ~~Warranty~~warranty period will ~~start~~begin on the date ~~the Engineer accepts the work and authorizes final payment unless otherwise specified in the Contract~~Second Notification.

When the Agency makes written notification to the Manufacturer of failure of an item covered by this ~~Warranty~~warranty, the ~~Warranty~~warranty period will stop for the effected item or the portion of the effected item that failed, as applicable, until the required repairs or replacements are made and accepted. All repaired or replaced items shall meet current specifications, unless otherwise specified in the Contract, and will be warranted for the remaining ~~Warranty~~warranty period.

Warranty work shall be performed when weather permits. If, in the opinion of the Engineer, temporary repairs are necessary, the temporary repairs will be made by the Agency or an independent contractor at the Manufacturer's expense. The Manufacturer shall replace all temporary repairs at no additional cost to the Agency.

The Manufacturer shall provide all required traffic control during repair or replacement of failed items at no additional cost to the Agency.

(2) Trade Practice Guarantees - For those Items installed on the Project that have customary trade practice guarantees, the Contractor shall furnish the guarantees to the Engineer at the completion of the Contract.

00170.89 Protection of Utility, Fire-control, and Railroad Property and Services; Repair; Roadway Restoration:

(a) Protection of Utility, Fire-Control, and Railroad Property and Services; Coordination ~~-~~ The Contractor shall avoid damaging the properties of Utilities, Railroads, railways, and fire-control authorities during performance of the Work. The Contractor shall cooperate with and facilitate the relocation or repair of all Utilities and Utility services, as required under 00150.50, and of Railroad and fire-control property and railways.

The Contractor shall conduct no activities of any kind around fire hydrants until the local fire-control authority has approved provisions for continued service.

The Contractor shall immediately notify any Utility, Railroad, or fire-control authority whose facilities have been damaged.

If an Entity has a valid permit from the proper authority to construct, reconstruct, or repair Utility, Railroad, or fire-control service in the Roadway, the Contractor shall allow the permit holder to perform the work.

(b) Restoration of Roadway after Repair Work - The Contractor shall restore the Roadway to a condition at least equal to that which existed before the repair work addressed under this Subsection was performed, as directed by the Engineer. Restoration will be paid as provided in the Special Provisions~~ or may be paid as Extra Work~~.

00170.92 Fencing, Protecting Stock, and Safeguarding Excavations - The Contractor shall be responsible for loss, injury, or damage that results from its failure to restrain stock and persons.

(a) At the Contractor's Expense - The Contractor shall restrain stock to lands on which they are confined using temporary fences or other adequate means. The Contractor shall provide adequate temporary fences or other protection around excavations to prevent animals and unauthorized persons from entering.

The Contractor shall repair, at Contractor's expense and to the Engineer's satisfaction, fences damaged by the Contractor's operations and the operations of the Contractor's agents, employees and Subcontractors.

(b) At the Agency's Expense - The Contractor shall construct fences, or move and reconstruct fences, as shown on the Contract Documents or as directed by the Engineer. The Contractor shall tear down and remove fencing within the Right-of-Way when no longer needed, as part of the removal Work described in and paid for according to Section 00310.

00170.93 Trespass - The Contractor shall be responsible for its own, its agents' and employees', and its Subcontractors' trespass or encroachment upon, or damage to, property during performance of the Contract.

00170.94 Use of Explosives - The Contractor shall comply with all Laws pertaining to the use of explosives. The Contractor shall notify anyone having facilities near the Contractor's operations of Contractor's intended use or storage of explosives. The Contractor shall be responsible for all damage resulting from its own, its agents' and employees', and its Subcontractors' use of explosives. (see 00330.41(e) and Section 00335)

Section 00180 - Prosecution and Progress

00180.00 Scope - This Section consists of requirements for assignment of the Contract, subcontracting, time for performance, Contract responsibility, suspensions, terminations, and related provisions.

00180.05 Assignment/Delegation of Contract - Unless the Agency gives prior written consent, the Contractor shall not assign, delegate, sell, or transfer to any Entity, or otherwise dispose of any Contract rights or obligations, including without limitation:

- The power to execute or perform the Contract; or
- Any of its right, title or interest in the Contract.

Any attempted assignment, delegation, or disposition without prior Agency consent shall be void.

Such Agency consent will not normally be given except for the assignment of funds due under the Contract, as provided in 00180.06.

If written Agency consent is given to assign, delegate, or otherwise dispose of any Contract rights or obligations, it shall not relieve the Contractor or its Surety of any part of their responsibility under the Contract.

00180.06 Assignment of Funds Due under the Contract - Assignment of funds due or to become due under the Contract to the Contractor will not be permitted unless:

- The assignment request is made on the form provided by the Agency;
- The Contractor secures the written consent of the Contractor's Surety to the assignment; and
- The Engineer approves the assignment.

00180.10 Responsibility for Contract - The Contractor shall direct and coordinate the operations of its employees, Subcontractors and agents performing Work, and see that the Engineer's orders are carried out promptly. The Contractor's failure to direct, supervise and control its employees, Subcontractors and agents performing Work will result in one or more of the following actions, as the Engineer deems appropriate:

- Suspension of the Work;
- Withholding of Contract payments, as necessary to protect the Agency;
- Ordering removal of individuals from the Project Site; or
- Termination of the Contract.

00180.15 Agency's Right to Do Work at Contractor's Expense - Except as otherwise provided in 00150.75 and 00220.60, if the Contractor neglects to prosecute the Work properly or fails to perform any provision of the Contract, the Agency may, after ~~two~~ 2 Calendar Days' written notice, correct the deficiencies at the Contractor's expense. In situations where the Engineer reasonably believes there is danger to life or property, the Agency may immediately and without notice correct the deficiencies at the Contractor's expense.

Action by the Agency under this provision will not prejudice any other remedy it may have.

00180.20 Subcontracting Limitations:

(a) General - The Contractor's own organization shall perform Work amounting to at least 30% of the original Contract Amount. The value of subcontracted Work is the full compensation to be paid to the Subcontractor(s) for all pay items in the Subcontract(s).

(b) Own Organization - The term "own organization", as used in Section 00180, includes only employees of the Contractor, Equipment owned or rented by the Contractor, Incidental rental of operated Equipment, and Materials and Equipment to be incorporated into the Work purchased or produced by the Contractor.

(c) Rental of Operated Equipment - The Agency will not allow a Disadvantaged Business Enterprise (DBE) firm to provide services without a subcontract covering all Work to be performed by the DBE firm. For non-DBE firms, the use of Equipment rented with operators will be allowed without a subcontract only when the following requirements are met:

(1) Written Request - The Contractor has submitted to the Engineer a written request describing the service to be provided, its estimated cost, and the estimated duration. The Engineer must approve the request before the service is provided.

(2) Limitations - The use of Equipment rented with operators is limited to the following services:

- Truck hauling of Materials (If the trucking is by an owner/operator, in addition to the requirements of 00170.65(e), each truck shall have the name of the owner/operator clearly displayed on the side of the truck); or
- Performing minor, Incidental, short-duration work under the direct supervision of the Contractor or Subcontractor, with Equipment not customarily owned, leased, or operated by a Contractor, or with Equipment that is temporarily unavailable to the Contractor.

(3) Submittals - The Contractor shall provide the Engineer with a copy of the rental agreement or purchase order covering the service to be provided. For owner/operator trucking, attach copies of the data required under 00170.65(e). The Contractor shall make certain that the provider of approved services submits payrolls required under Section 00170 and complies with applicable Contract provisions~~.~~, including without limitation 00170.07. The service provider will not be considered a Subcontractor under the Contract, but will be considered an agent of the Contractor in the performance of Work.

(4) Revocation of Approval - The Engineer may revoke approval for the services provided through rented, operated Equipment at any time the Engineer determines that the work is outside that authorized under 00180.20(c-2). Unless the Contractor promptly submits to the Engineer a subcontract agreement for consent under 00180.21, the service provider shall be immediately removed from the Project Site.

00180.21 Subcontracting:

(a) General - The Contractor shall not subcontract or perform any portion of the Contract by other than the Contractor's own organization without the Agency's prior written consent. A request for consent to subcontract, at any tier, solely for the furnishing of a labor force will not be considered.

A written request for consent to subcontract any portion of the Contract at any tier shall be submitted to the Engineer, and when required by the Engineer, shall be accompanied by background information showing that the organization proposed to perform the Work is experienced and equipped for such Work. The Agency will review the Contractor's submission

to verify compliance with Contract requirements, confirm the percentage of Work subcontracted, and evaluate the proposed Subcontractor's ability to perform the Work. If the Agency approves the Contractor's request to subcontract, the Agency will provide its consent to the Contractor's request as follows:

- If the subcontractor is not providing any of the insurance coverages as permitted under 00170.70(a), the Agency will respond within 7 Calendar Days after the Engineer's receipt of the request.
- If the subcontractor is providing any of the insurance coverages as permitted under 00170.70(a), the Agency will respond within 35 Calendar Days after the Engineer's receipt of the request. (28 Calendar Days for the Agency to review and approve the Certificates of Insurance required by 00170.70(f) plus 7 Calendar Days to review and approve the subcontract request.)

(b) Submittal of Requests - The Contractor must submit requests for consent to subcontract any portion of the Contract, at any tier, on the Agency's form, available from the Engineer. The Contractor shall attach a duplicate original subcontract agreement. The Contractor must also submit in writing any amendments or modifications proposed to Agency-approved subcontract agreements, at any tier, before the affected Work begins. The Agency's written consent will be required before such amendments or modifications become effective.

(c) Substitution of Disclosed Subcontractors - The Contractor may only substitute a previously undisclosed first-tier Subcontractor according to the provisions of ORS 279C.585. The Contractor shall provide the Engineer with a written notification that identifies the name of the proposed new Subcontractor and the reason for the substitution. Authorized reasons for substitution are limited to the following circumstances (see ORS 279C.585(1) through ORS 279C.585(10)):

- The disclosed Subcontractor fails or refuses to execute a written contract that is reasonably based either upon the Project Plans and Specifications, or the terms of the Subcontractor's written Bid, after having had a reasonable opportunity to do so;
- The disclosed Subcontractor becomes bankrupt or insolvent;
- The disclosed Subcontractor fails or refuses to perform the contract;
- The disclosed Subcontractor fails or refuses to meet the bond requirements of the prime Contractor that had been identified prior to the Bid submittal;
- The Contractor demonstrates to the Agency that the Subcontractor was disclosed as the result of an inadvertent clerical error;
- The disclosed Subcontractor does not hold a license from the Construction Contractors Board and is required to be licensed by the board;
- The Contractor determines that the Work performed by the disclosed Subcontractor is not in substantial compliance with the Plans and Specifications, or that the Subcontractor is substantially delaying or disrupting the progress of the Work;
- The disclosed Subcontractor is ineligible to work on a public improvement according to the applicable statutory provisions;
- The substitution is for "good cause" as defined by State Construction Contractors Board rule; or
- The substitution is reasonably based on the Contract alternates chosen by the Agency.

(d) Terms of Subcontracts - Subcontracts shall provide that work performed under the subcontract shall be conducted and performed according to the terms of the Contract. Compliance with 00170.07 is required. All subcontracts, including Contractor's with the first-tier

Subcontractors and those of the first-tier Subcontractors with their subcontractors, and any other lower tier subcontracts shall contain a clause or condition that if the Contractor or a subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract, the Entity may file a complaint with the Construction Contractors Board, unless payment is subject to a good-faith dispute as defined in ORS 279C.580. Additionally, according to the provisions of ORS 279C.580, subcontracts shall include:

(1) A payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under the subcontract within 10 Calendar Days out of amounts the Agency pays to the Contractor under the Contract.

(2) A clause that requires the Contractor to provide the first-tier Subcontractor with a standard form that the first-tier Subcontractor may use as an application for payment or as another method by which the Subcontractor may claim a payment due from the Contractor.

(3) A clause that requires the Contractor, except as otherwise provided in this subsection, to use the same form and regular administrative procedures for processing payments during the entire term of the subcontract. The Contractor may change the form or the regular administrative procedures the Contractor uses for processing payments if the Contractor:

- Notifies the Subcontractor in writing at least 45 Calendar days before the date on which the Contractor makes the change; and
- Includes with the written notice a copy of the new or changed form or a description of the new or changed procedure.

(4) An interest penalty clause that obligates the Contractor, if the Contractor does not pay the first-tier Subcontractor within 30 Calendar Days after receiving payment from the Agency, to pay the first-tier Subcontractor an interest penalty on amounts due in each payment the Contractor does not make in accordance with the payment clause included in the subcontract (under 00180.21(d-1). The Contractor or first-tier Subcontractor is not obligated to pay an interest penalty if the only reason that the Contractor or first-tier Subcontractor did not make payment when payment was due is that the Contractor or first-tier Subcontractor did not receive payment from the Agency or the Contractor when payment was due. The interest penalty applies to the period that begins on the day after the required payment date and ends on the date on which the amount due is paid; and shall be computed at the rate specified in 00170.10(c).

(5) A clause that requires the Contractor's first-tier Subcontractor to include a payment clause and an interest penalty clause that conform to the standards of ORS 279C.580 (see 00180.21(d-1) and 00180.21(d-4)) in each of the first-tier Subcontractor's subcontracts and to require each of the first-tier Subcontractor's subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or Material supplier.

These payment clauses shall require the Contractor to return all retainage withheld from the Subcontractor, whether held by the Contractor or the Agency, as specified in 00195.50(d).

As required by ORS 279C.800 through ORS 279C.870, subcontracts shall include:

- A provision requiring the subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work on the Project, unless exempt.
- A provision requiring that the workers shall be paid not less than the specified minimum hourly rate of wage.

(e) Contractor's Responsibilities - As a condition of the Agency's grant of consent to subcontract, whether or not stated in the subcontract agreement itself, the Contractor shall remain solely responsible for administration of the subcontract, including but not limited to:

- Performance of subcontracted Work;
- Progress of subcontracted Work;
- Payments for accepted subcontracted Work; and
- Disputes and claims for additional compensation regarding subcontracted Work.

The Engineer's consent to subcontract will not create a contract between the Agency and the Subcontractor, will not convey to the Subcontractor any rights against the Agency, and will not relieve the Contractor or the Contractor's Surety of any of their responsibilities under the Contract.

(f) Failure to Comply - Failure to comply with 00180.21 will be cause for the Engineer to take action reasonably necessary to obtain compliance. This action may include, but is not limited to:

- Suspension of the Work;
- Withholding of Contract payments as necessary to protect the Agency; and
- Termination of the Contract.

(g) Mentor-Protégé Agreement - If the Contractor enters into a subcontract with an Emerging Small Business (ESB) subcontractor, the Agency may offer the Contractor and its ESB subcontractor an opportunity to enter into a project specific Mentor-Protégé Agreement.

The project specific Mentor-Protégé Agreement will be paid for and specified by Change Order.

00180.22 Payments to Subcontractors and Agents of the Contractor - To the extent practicable, the Contractor shall pay in the same units and on the same basis of measurement as listed in the Schedule of Items for subcontracted Work or other Work not done by the Contractor's own organization. In making payment to Subcontractors and to its other agents performing Work and furnishing Materials and Equipment to be incorporated into the Work, the Contractor shall assume all losses resulting from overpayment.

If requested, the Engineer will make estimates of the Work quantities performed by Subcontractors or by others on the Project, and of Materials eligible for advances on Materials in the progress payments. These estimates are approximate only, and will be made in units of measure as listed in the Schedule of Items. The Agency does not guarantee the accuracy of these estimates, and an incorrect estimate will not bind the Agency in final settlement.

If requested in writing by a first-tier Subcontractor, the Contractor shall send to the Subcontractor, within ~~ten~~ 10 Calendar Days of receiving the request, a copy of that portion of any invoice or request for payment submitted to the Agency, or pay document provided by the Agency to the Contractor, specifically related to any labor, Equipment, or Materials supplied by the first-tier Subcontractor.

00180.30 Materials, Equipment, and Work Force - The Contractor shall furnish suitable and sufficient Materials, Equipment, and personnel to properly prosecute and complete the Work. The

Contractor shall use only Equipment of adequate size and condition to meet the requirements of the Work and Specifications, and to produce a satisfactory quality of Work. Upon receipt of the Engineer's written order, the Contractor shall immediately remove, and not use again on the Project without the Engineer's prior written approval, Equipment that, in the Engineer's opinion, fails to meet Specifications or produce a satisfactory product or result.

The work force shall be trained and experienced for the Work to be performed. Upon receipt of the Engineer's written order, the Contractor shall immediately remove from the Project Site, and shall not employ again on the Project without the Engineer's prior written approval, any supervisor or employee of the Contractor or ~~its Subcontractors~~any subcontractor who, in the Engineer's opinion, does not perform satisfactory Work or whose conduct interferes with the progress of the Work.

If the Contractor fails to remove Equipment or persons as ordered, or fails to furnish suitable and sufficient Materials, Equipment and personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until such orders are complied with and such deficiencies are corrected, or the Engineer may terminate the Contract under the provisions of 00180.90(a).

00180.31 Required Materials, Equipment, and Methods - The Engineer's decisions under this Section are final.

(a) General - When the Equipment and methods to be used are not specified in the Contract, any Equipment or methods that accomplish the Work as required by the Contract will be permitted.

When the Contract specifies certain Equipment or methods, the Contractor shall use the Equipment or methods specified unless otherwise authorized by the Engineer in writing.

(b) Substitution of Materials and Equipment to be Incorporated into the Work - After execution of the Contract, the Engineer ~~will~~may approve substitution of Materials and Equipment to be incorporated into the Work as follows:

(1) Reasons for Substitution - The Engineer will consider substitution only if:

- The proposed Materials or Equipment are equal to or superior to the specified items in construction, efficiency and utility; or
- Due to reasons beyond the control of the Contractor, the specified Materials or Equipment cannot be delivered to the Project in sufficient time to complete the Work in proper sequence.

(2) Submittal of Request - The Contractor shall submit requests for substitution to the Engineer, including manufacturers' brochures and other information needed to verify equality of the proposed item(s).

(c) Substitution of Equipment Specified to Perform Work - The Agency encourages development of new or improved Equipment and innovative use of Equipment. When the Specifications require Equipment of a particular size or type to be used to perform certain portions of the Work, the Contractor may submit a request to the Engineer to use Equipment of a different size or type. The request will not be considered as a cost reduction proposal under 00140.70. The request shall:

- Be in writing and include a full description of the Equipment proposed and its intended use;
- Include the reasons for requesting the substitution; and

- Include evidence, obtained at the Contractor's expense and satisfactory to the Engineer, that the proposed Equipment is capable of functioning as well as or better than the specified Equipment.

The Engineer will consider the Contractor's request and will provide a written response to the Contractor, either permitting or denying use of the proposed Equipment.

Permission may be granted on a trial basis to test the quality of Work actually produced, subject to the following:

- There will be no cost to the Agency, either in Contract Amount or in Contract Time;
- The permission may be withdrawn by the Engineer at any time if, in the Engineer's opinion, the Equipment is not performing in all respects equivalent to the Equipment specified in the Contract;
- If permission is withdrawn, the Contractor shall perform the remaining Work with the originally-specified Equipment; and
- The Contractor shall remove and replace nonspecification Work resulting from the use of the Contractor's proposed Equipment, or otherwise correct it as the Engineer directs, at no additional compensation.

(d) Substitution of Methods - The Agency encourages development of new, improved, and innovative construction methods. When the Plans or Specifications require a certain construction method for a portion of the Work, the Contractor may submit a request for a change by following the provisions of 00140.70, "Cost Reduction Proposals".

00180.32 Alternative Materials, Equipment, and Methods - Whenever the Contract authorizes certain alternative Materials, Equipment, or methods of construction for the Contractor's use to perform portions of the Work, and leaves the selection to the Contractor, the Agency does not guarantee that all listed alternative Materials, Equipment, or methods of construction can be used successfully throughout all or any part of the Work.

The Contractor shall employ only those alternatives that can be used to satisfactorily perform the Work. No additional compensation will be paid for corrective work necessitated by the Contractor's use of an inappropriate alternative.

00180.40 Limitation of Operations:

(a) In General - The Contractor shall comply with all Contract provisions and shall:

- Conduct the Work at all times so as to cause the least interference with traffic, and
- Not begin Work that may allow damage to Work already started.

(b) On-Site Work - The Contractor shall not begin On-Site Work until the Contractor has:

- Received Notice to Proceed;
- Filed with the Construction Contractors Board the public works bond as required in 00170.20;
- An approved Project Work schedule;
- An approved Traffic Control Plan;
- An approved Pollution Control Plan;
- An approved Erosion and Sediment Control Plan;

- Met with the Engineer at the required preconstruction conference; and
- Assembled all Materials, Equipment, and labor on the Project Site, or has reasonably assured that they will arrive on the Project Site, so the Work can proceed according to the Project Work schedule.

00180.41 Project Work Schedules - The Contractor shall submit a Project Work schedule meeting the requirements of this Subsection to the Engineer. The Project Work schedule is intended to identify the sequencing of activities and time required for prosecution of the Work. The schedule is used to plan, coordinate, and control the progress of construction. Therefore, the Project Work schedule shall provide for orderly, timely, and efficient prosecution of the Work, and shall contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities. Sufficient detail shall also include all required double shifts, overtime work, or combination of both necessary to complete Contract Work within the Contract Time.

Contractor's activity related to developing, furnishing, monitoring, and updating these required schedules is Incidental.

The Contractor shall submit a supplemental "look ahead" Project Work schedule each week to the Engineer. The "look ahead" Project Work schedule is supplemental to the Type A, B, or C schedule specified below. The supplemental "look ahead" Project Work schedule shall:

- Identify the sequencing of activities and time required for prosecution of the Work.
- Provide for orderly, timely, and efficient prosecution of the Work.
- Contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities.

The supplemental "look ahead" Project Work schedule shall be written in common terminology and show the planned Work activities broken down into logical, separate activities by area, stage, and size and include the following information:

- The resources the Contractor, subcontractors, or services will use.
- The locations of each activity that will be done including the limits of the work by mile posts, stations, or other indicators.
- The time frames of each activity by Calendar Days, shifts, and hours.
- All anticipated shoulder, lane, and road closures.

At a minimum, the Contractor shall prepare a bar chart that:

- Shows at least 3 weeks of activity including the week the bar chart is issued.
- Uses a largest time scale unit of 1 Calendar Day. Smaller time scale units may be used if needed.
- Is appropriate to the activities.
- Identifies each Calendar Day by month and day.

Include the Contract name, Contract number, Contractor's name, and date of issue on each page of the bar chart.

The Contractor shall submit the supplemental "look ahead" Project Work schedule starting at First Notification and continuing each week until Second Notification has been issued and all punch list items and final trimming and clean-up has been completed. The Contractor shall meet with the Engineer each week to review the supplemental "look ahead" Project Work schedule. If the

Engineer or the Contractor determines that the current supplemental "look ahead" Project Work schedule requires changes or additions, either notations can be made on the current schedule or the Engineer may require the submittal of a revised supplemental "look ahead" Project Work schedule. Review of the current and subsequent supplemental "look ahead" Project Work schedules does not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

One of the following Type "A", "B", or "C" schedules will be required under the Contract. The type of schedule will be identified in the Special Provisions.

(a) Type "A" Schedule - When a Type "A" schedule is required, the Contractor shall do the following:

(1) Schedule - 10 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer four copies of a Project Work schedule, including a time-scaled bar chart and narrative, showing:

- Expected beginning and completion dates of each activity, including all staging; and
- Elements of the Traffic Control Plan as required under 00225.05.

The schedule shall show detailed Work activities as follows:

- Construction activities;
- The time needed for completion of the utility relocation work;
- Submittal and approval of Materials samples and shop drawings;
- Fabrication, installation, and testing of special Materials and Equipment; and
- Duration of Work, including completion times of all stages and their sub phases.

For each activity, the Project Work schedule shall list the following information:

- A description in common terminology;
- The quantity of Work, where appropriate, in common units of measure;
- The activity duration in Calendar Days; and
- Scheduled start, completion, and time frame shown graphically using a time-scaled bar chart.

The schedule shall show the Work broken down into logical, separate activities by area, stage, or size. The duration of each activity shall be verifiable by manpower and Equipment allocation, in common units of measure, or by delivery dates.

The bar chart shall be prepared as follows:

- The length of bar shall represent the number of workdays scheduled.
- The time scale shall be appropriate for the duration of the Contract.
- The time scale shall be in Calendar Days.
- The smallest unit shown shall be ~~one~~ 1 Calendar Day.
- The first day and midpoint of each month shall be identified by date.
- Distinct symbols shall be used to denote multiple shift, holiday, and weekend Work.

Each page of the bar chart shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the bar chart shall be drawn on a reasonable size of paper up to a maximum of 36 inch by 36 inch, using multiple sheets when needed.

Within ~~seven~~ 7 Calendar Days after the preconstruction conference, the Engineer and the Contractor shall meet to review the Project Work schedule as submitted. The Engineer will review the schedule for compliance with all Contract Time limitations and other restraints. Review of this and subsequent schedules by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract. Within 10 Calendar Days of this meeting, the Contractor shall resubmit to the Engineer four copies of the Project Work schedule, including required revisions.

(2) Review by the Engineer - The Project Work schedule may need revision as the Work progresses. Therefore, the Contractor shall periodically review the Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the Project Work schedule.

The Contractor shall compile an updated Project Work schedule incorporating any changes to the Project completion time(s). The bar chart shall reflect the updated information. The Contractor shall submit four copies of the updated Project Work schedule to the Engineer within ~~seven~~ 7 Calendar Days after the meeting. The report shall include without limitation the following:

- Sufficient narrative to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule; and
- Proposed corrective actions.

(b) Type "B" Schedule - When a Type "B Schedule is required, the Contractor shall do the following:

(1) Initial Schedule - 10 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer four copies of a time-scaled bar chart Project Work schedule showing:

- Expected beginning and completion date of each activity, including all staging; and
- Elements of the Traffic Control Plan as required under 00225.05.

The initial schedule shall show all Work intended for the first 60 Days of the Contract to the level of detail described in (2) below, and shall show the priority and interdependence (sequencing and network logic) of all major segments of the remainder of the Work.

(2) Detailed Schedule - In addition to the above requirements, and within 30 Calendar Days after the Notice to Proceed, the Contractor shall provide the Engineer one digital copy and four paper copies of a detailed time~~-~~-scaled bar chart Project Work schedule indicating the critical course of the Work~~, including~~. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer.

Detailed work schedule activities shall include the following:

- Construction activities;
- The time needed for completion of the utility relocation work;
- Submittal and approval of Material samples and shop drawings;
- Procurement of critical Materials;
- Fabrication, installation, and testing of special Material and Equipment; and
- Duration of Work, including completion times of all stages and their sub phases.

For each activity, the Project Work schedule shall list the following information:

- A description in common terminology;
- The quantity of Work, where appropriate, in common units of measure;
- The activity duration in normal workdays; and
- Scheduled start, completion, and time frame shown graphically using a time-scaled bar chart.

The schedule shall show the Work broken down into logical, separate activities by area, stage, or size. The duration of each activity shall be verifiable by manpower and Equipment allocation, in common units of measure, or by delivery dates.

The bar chart shall be prepared as follows:

- The length of bar shall represent the number of normal workdays scheduled.
- The time scale shall be appropriate for the duration of the Contract.
- The time scale shall be in normal workdays (every day except Saturday, Sunday, and legal holidays).
- The smallest unit shown shall be ~~one~~ 1 Calendar Day.
- The first day and midpoint of each month shall be identified by date.
- Distinct symbols shall be used to denote multiple shift, holiday, and weekend Work.

The bar chart drawing(s) shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the bar chart shall be drawn on a reasonable size of paper up to a maximum of 36 inch x 36 inch, using multiple sheets when needed.

Within 10 Calendar Days after submission of the Project schedule the Engineer and the Contractor shall meet to review the Project schedule as submitted. Within 10 Days of the review meeting, the Contractor shall resubmit to the Engineer one digital and four paper copies of the Project schedule, including required revisions.

The accepted Project schedule shall represent all Work, as well as the planned sequence and time for the Work. Review of this and subsequent schedules by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(3) Review and Reporting - The Project Work schedule may require revision as the Work progresses. Therefore, the Contractor shall monitor and when necessary revise the Project Work schedule as follows:

a. Review with the Engineer - The Contractor shall perform ongoing review of the Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the Project Work schedule. After any necessary action has been agreed upon, the Contractor shall make required changes to the Project Work schedule.

The Contractor shall collect information on all activities worked on or scheduled to be worked on during the previous report period, including shop drawings, Material procurement, and Contract Change Orders that have been issued. Information shall include commencement and completion dates on activities started or completed, or if still in progress, the remaining time duration.

The Contractor shall develop detailed sub-networks to incorporate changes, Additional Work, and Extra Work into the Project Work schedule. Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. The restraints shall include those activities from the Project Work schedule that initiated the sub-network as well as those restrained by it.

The Contractor shall evaluate this information and compare it with the Contractor's project schedule. If necessary, the Contractor shall make an updated bar chart schedule to incorporate the effect changes may have on the Project completion time(s). For any activity that has started, the Contractor shall add a symbol to show the actual date the activity started and the number of normal workdays remaining until completion. For activities that are finished, a symbol shall be added to show the actual date. The Contractor shall submit one digital and four paper copies of the updated bar chart to the Engineer within ~~seven days~~7 Days after the progress meeting, along with a progress report as required by "b." below.

b. Progress Report - The Contractor shall submit a progress report to the Engineer each month. The report shall include the following:

- Sufficient narrative to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule; and
- Proposed corrective actions.

(c) Type "C" Schedule - When a Type "C" Schedule is required, the Contractor shall do the following:

(1) Initial Schedule - 10 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer one digital copy and four paper copies of a time-scaled bar chart Project Work schedule. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer. The initial schedule shall show:

- The expected beginning and completion date of each activity, including all stages and phases;
- The time needed for completion of the utility relocation work; and
- The elements of the traffic control plan as required under 00225.05.

A logic diagram and a time-scaled bar chart will be acceptable in lieu of a time-scaled logic diagram.

The initial schedule shall show all Work intended for the first 60 Days of the Contract to the level of detail described in (2) below, and shall show the priority and interdependence (sequencing and network logic) of all major segments of the remainder of the Work.

(2) Detailed Project Work Schedule - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide the Engineer one digital copy and four paper copies of a detailed time-scaled critical path method (CPM) network Project Work schedule and computer analysis printout, both clearly indicating the critical path. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer. The first submitted detailed time-scaled critical path method (CPM) network Project Work schedule shall also contain a listing of the quantity of Work for each activity, when appropriate, in common units of measure.

Detailed work schedule activities shall include the following:

- Construction activities;
- Any limitations of operation specified in 00180.40;
- The time needed for completion of the utility relocation work;
- Implementation of TCP for each stage and phase;
- Submittal and approval of Material samples, mix designs, and shop drawings;
- Agency timeframes to process and return Contractor submitted plans, working drawings, equipment lists and other submittals;
- Procurement of critical Materials;
- Fabrication, installation, and testing of special Material and Equipment;
- Duration of Work, including completion times of all stages and their sub-phases; and
- Specified cure times for all concrete elements.

The activities shall be separately identifiable by coding or use of sub-networks or both. The duration of each activity shall be verifiable and consistent with the description in the Project narrative required in (3) below.

Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. In the restraints, include those activities from any Project Work schedule that initiated the sub-network as well as those restrained by it.

The time scale used on the Contractor's detailed time-scaled critical path method (CPM) network Project Work schedule shall be appropriate for the duration of the activities and the Project duration. The time scale shall be in normal workdays, defined as every day except Saturday, Sunday and legal holidays, with calendar dates identified no less than the first and midpoint of each calendar month. The smallest unit shown shall be ~~one day~~1 Day. The network shall show the length of the activity or part scaled to accurately represent the number of normal workdays scheduled. Distinct symbols or graphics shall be used to show multiple shift, holiday, or weekend work.

The schedule network drawing(s) shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To

ensure readability the drawings shall be on a reasonable size of paper up to a maximum of 36 inch x 36 inch, using multiple sheets when needed.

The Contractor shall include a tabulation of each activity in the computer mathematical analysis of the network diagram. The following information represents the minimum required for each activity:

- Event (node) number(s) for each activity;
- Maintain event (node) numbers throughout the Project;
- Activity description;
- Original duration of activities (in normal workdays);
- Estimated remaining duration of activities (in normal workdays);
- Earliest start date and actual start date (by calendar date);
- Earliest finish date and actual finish date (by calendar date);
- Latest start date (by calendar date);
- Latest finish date (by calendar date); and
- Slack or float time (in workdays).

Computer print-outs shall consist of at least a node sort and an "early start/total-float" sort.

Within 14 Calendar Days after submission of the detailed time-scaled critical path method (CPM) network Project Work schedule, the Engineer and the Contractor shall meet to review the detailed time-scaled critical path method (CPM) network Project Work schedule as submitted. Within ~~seven~~ 7 Calendar Days of the meeting, the Contractor shall resubmit to the Engineer one digital and four paper copies of the detailed time-scaled critical path method (CPM) network Project Work schedule, including required revisions.

This first accepted detailed time-scaled critical path method (CPM) network Project Work schedule, also called the accepted Project Work schedule, shall represent all Work, as well as the planned sequence and time for the Work. Review and acceptance of any Project Work schedules and Project narratives by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(3) Project Narrative - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide to the Engineer a final written Project narrative that discusses the planning, coordinating, scheduling and resourcing of the Work. The Project narrative shall include the following written description:

- Plans for staging the project.
- All critical activities.
- All near critical activities defined as those with less than 30 ~~days~~Days of float.
- All subcontractor activities that are critical, near critical, and those that are greater than two weeks in duration.
- Labor resourcing, by stage and phase, to include the number of crews, average crew size and planned night/weekend shifts including that of subcontractors.
- Equipment allocation, by stage and phase to include mobilization, demobilization and planned activities including that of subcontractors.

- Notifications required under the Contract during each stage and phase which may include but is not limited to road closures, lanes closures, night work, cold plane pavement removal, and pile driving.
- Provide discussion on addressing reasonably predictable weather conditions and their impact on all weather sensitive activities. Also, provide discussion on other weather limitations that may affect the project schedule.
- Submittal and approval of material samples, mix designs, and shop drawings.
- Procurement of critical materials.
- Plans for dealing with "unique" construction items.
- Coordination of utilities and any immediate concerns for impacts/delays.
- Constructability issues.
- Cost Reduction Proposals and/or immediate requests for changes to the specifications.
- Concerns/issues that need to be addressed within the first 90 ~~days~~Days following First Notification.

The accepted Project narrative shall represent all critical and near critical Work, as well as the planned sequence and time for the Work.

(4) Review and Reporting - The Project Work schedule may require revision as the Work progresses. Therefore, the Contractor shall monitor and when necessary revise the Project Work schedule as follows:

a. Review with the Engineer - The Contractor shall perform ongoing review of the accepted Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the accepted Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the accepted Project Work schedule. After any necessary action has been agreed upon, the Contractor shall make required changes to the accepted Project Work schedule and associated Project narrative. Upon acceptance by the Engineer, this will become the new accepted Project Work schedule and associated Project narrative.

The Contractor shall collect information on all activities worked on or scheduled to be worked on during the previous report period, including shop drawings, Material procurement, and Contract Change Orders that have been issued. Information shall include actual start and completion dates on activities started or completed, or if still in progress, the remaining time duration.

The Contractor shall develop detailed sub-networks to incorporate changes, Additional Work, and Extra Work into the Project Work schedule. Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. The restraints shall include those activities from the Project Work schedule that initiated the sub-network as well as those restrained by it. The procedure for acceptance of the revised or updated Project Work schedule as the new accepted Project Work schedule will be as provided above.

The Contractor shall evaluate this information each month and compare it with the accepted Project Work schedule. The Contractor shall make an updated bar chart schedule to incorporate the effect changes may have on the Project completion time(s). For any activity that has started, the Contractor shall add a symbol to show the actual date the activity started and the number of normal workdays remaining until completion. For

activities that are finished, a symbol shall be added to show the actual date. The Contractor shall submit , digitally and in paper, copies of the updated bar chart to the Engineer within ~~seven days~~7 Days after the progress meeting, along with a progress report as required by "b." below.

b. Progress Report - Each month the Contractor shall submit a progress report and an update of the Project Work schedule to the Engineer. The report and updated schedule shall be submitted both digitally and in paper copy and shall include the following:

- A sufficient description, in narrative form, to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule;
- Proposed corrective actions;
- Proposals to keep the Project on schedule in the event of a delay; and
- Any changes to the logic as compared to the accepted Project Work schedule.

(d) Substitution of Schedules - When a Type "A" schedule is required, a Type "B" or Type "C" schedule may be substituted for the Type "A" schedule.

When a Type "B" schedule is required, a Type "C" schedule may be substituted for the Type "B" schedule.

(e) Specified Contract Time Not Superseded by Schedule Revisions - The completion dates in any Project Work schedule and any revised or updated Project Work schedules shall be within the Contract Time(s) specified for the Project, or within adjusted Contract Times approved according to 00180.80(c). Acceptance of any Project Work schedule or any revised or updated Project Work schedules shall not constitute approval of any completion dates that exceed such Contract Time(s). If the Contractor believes that additional Contract Time is due, the Contractor shall submit, with a revised Project Work schedule, a request for adjustment of Contract Time according to 00180.80(c). A request for an adjustment of Contract Time will be evaluated using the most recently accepted Project Work schedule.

(f) Float Time - Float time shown on the Project Work schedule, including any time between a Contractor's scheduled completion date and the specified Contract Time(s), does not exist for the exclusive use of either party to the Contract and belongs to the Project.

(g) Schedules Do Not Constitute Notice - Submittal of a Project Work schedule, with supporting Project narrative, does not constitute or substitute for any notice the Contractor is required under the terms of the Contract to give the Agency.

(h) Failure to Provide Schedule - The Project Work schedule is essential to the Agency. The Contractor's failure to provide the schedule, schedule information, progress reports, Project narratives, or schedule updates when required will be cause to suspend the Work, or to withhold Contract payments as necessary to protect the Agency, until the Contractor provides the required information to the Engineer.

00180.42 Preconstruction Conference - Unless otherwise approved in writing by the Engineer, before any Work is performed and within 30 Calendar Days of the Notice to Proceed, the Contractor shall meet with the Engineer for a preconstruction conference at a time mutually agreed upon.

00180.43 Commencement and Performance of Work - From the time of commencement of the Work to the time of Final Acceptance the Contractor shall:

- Provide adequate Materials, Equipment, labor, and supervision to perform and complete the Work;
- Perform the Work as vigorously and as continuously as conditions permit, and according to a Project Work schedule that ensures completion within the Contract Time or the adjusted Contract Time;
- Not voluntarily suspend or slow down operations without prior written approval from the Engineer; and
- Not resume suspended Work without the Engineer's written authorization.

00180.50 Contract Time to Complete Work:

(a) General - The time allowed to complete the Work or Pay Item is stipulated in the Solicitation Documents, and will be known as the "Contract Time". (see 00110.20)

(b) Kinds of Contract Time - The Contract Time will be expressed in one or more of the following ways:

(1) Fixed Date Calculation - The calendar date on which the Work or Pay Item shall be completed; or

(2) Calendar Day Calculation - The number of Calendar Days from a specified beginning point in which the Work or Pay Item shall be completed.

(c) Beginning of Contract Time - When the Contract Time is stated in Calendar Days, counting of Contract Calendar Days will begin with the fifteenth Calendar Day following the date of the Notice to Proceed.

(d) Recording Contract Time - All Contract Time will be recorded and charged to the nearest one-half Day.

On Contracts with Calendar Day counts, the Engineer will furnish the Contractor a weekly statement of Contract Time charges. The statement will show the number of Calendar Days counted for the preceding week and the number of Calendar Days remaining prior to the established completion date for that Pay Item.

For Contracts with fixed completion dates for Pay Items, the Engineer will furnish the Contractor a weekly statement of Contract Time charges only after expiration of the Contract Time. The statement will show the number of Calendar Days of liquidated damages that have been assessed, if any.

These statements will include any exclusions from, or adjustments to, Contract Time.

(e) Exclusions from Contract Time - Regardless of the way Contract Time is expressed in the Contract, certain Calendar Days will not be charged against Contract Time. These exclusions will be allowed when the Contractor is prevented from performing Work due to one of the following reasons, resulting in delay:

- Acts of God or Nature;
- Court orders enjoining prosecution of the Work;

- Strikes, labor disputes or freight embargoes that, despite the Contractor's reasonable efforts to avoid them, cause a shutdown of the entire Project or one or more major operations. "Strike" and "labor dispute" may include union action against the Contractor, a Subcontractor, a Materials supplier, or the Agency; or
- Suspension of the Work by written order of the Engineer for reasons other than the Contractor's failure or neglect.

(f) Time Calculation Protest - In the event the Contractor disputes the accuracy of the statement of Contract Time charges, it shall immediately contact the Engineer and attempt to resolve the dispute. If the dispute cannot be resolved informally, the Contractor shall submit a formal written protest to the Engineer within ~~seven~~ 7 Calendar Days of the date the Engineer mailed or delivered the statement. Failure to submit a formal written protest within the ~~seven~~ 7 Calendar Day period constitutes the Contractor's approval of the time charges, or adjusted time charges, itemized in the statement.

(g) End of Contract Time - When the Engineer determines that the On-Site Work has been completed, except for the items listed below, the Engineer will issue a Second Notification.

The Second Notification will list:

- The date the time charges stopped;
- Final trimming and cleanup tasks (see 00140.90);
- Equipment to be removed from the Project Site;
- Minor corrective work not involving additional payment to be completed; and
- Submittals, including without limitation all required certifications, bills, forms, warranties, certificate of insurance coverage (00170.70(b)), and other documents, required to be provided to the Engineer before Third Notification will issue.

The Contractor shall complete all tasks listed in the Second Notification in an expeditious manner within the time frame proposed by the Contractor and accepted by the Engineer. Unless otherwise agreed by the Agency, failure of the Contractor to complete all tasks listed in the Second Notification within the time frame accepted, will result in the Agency rescinding the Second Notification. Counting of time charges will resume upon expiration of the accepted time frame.

00180.60 Notice of Delay - The Contractor shall notify the Engineer of any delay that will likely prevent completion of the Work or a Pay Item by the date specified in the Project Work schedule. The notice shall be in writing and shall be submitted within ~~seven~~ 7 Calendar Days of when the Contractor knew or should have known of the delay. The notice shall include, to the extent available, the following:

- The reasons or causes for the delay;
- The estimated duration of the delay and the estimated resulting cumulative delay in Contract completion;
- Except for 00180.50(e) and 00180.65 delays, whether or not the Contractor expects to request an adjustment of Contract Time due to the delay;
- Whether or not the Contractor expects to accelerate due to the delay; and
- Whether or not the Contractor expects to request additional compensation due to the delay. Except for ~~00185~~00180.50(e) and 00180.65 delays, failure to include this information will constitute waiver of the Contractor's right to later make such a request.

00180.65 Right-of-Way and Access Delays - Right-of-Way and access delays will be taken into consideration in adjusting Contract Time, and in approving additional compensation if the performance of the Work is delayed because of the Agency's failure to make available to the Contractor:

- Necessary Rights-of-Way;
- Agency-owned or Agency-controlled Materials sources that are offered in the Contract for the Contractor's use; or
- Access to, or rights of occupancy of, buildings and other properties the Contractor is required to enter or to disturb according to Contract requirements.

If the ending date of an anticipated delay is stated in the Special Provisions, only the delay occurring after that date will be considered for adjusting Contract Time or providing additional compensation.

00180.70 Suspension of Work:

(a) General - The Engineer has authority to suspend the Work, or part of the Work, for any of the following causes:

- Failure of the Contractor to correct unsafe conditions;
- Failure of the Contractor to carry out any provision of the Contract;
- Failure of the Contractor to carry out orders issued by the Engineer, the Agency, or any regulatory authority;
- Existence of conditions unsuitable to proper or safe performance of the Work; or
- Any reason considered by the Agency to be in the public interest.

When Work has been suspended for any reason, the Contractor shall not resume Work without the Engineer's written authorization.

(b) Contractor's Responsibilities during and after Suspension - During periods of suspension of the Work, the Contractor shall continue to be responsible for protecting and repairing the Work according to 00170.80, and for ensuring that a single designated representative responsible for the Project remains available according to 00150.40(b).

When Work is resumed after suspension, unless otherwise specified in the Contract, the Contractor shall perform the following at no additional compensation:

- Replace or repair any Work, Materials, and Equipment to be incorporated into the Work that was lost or damaged because of the temporary use of the Project Site by the public; and
- Remove Materials, Equipment, and temporary construction necessitated by temporary maintenance during the suspension, as directed by the Engineer.

(c) Compensation and Allowances for Suspension - Compensation and allowance of additional Contract Time due to suspension of any portion of the Work will be authorized only for Agency-initiated suspensions for reasons other than the Contractor's failure or neglect. (refer to 00180.50(e), 00180.65, and 00195.40)

00180.80 Adjustment of Contract Time:

(a) General - Contract Time established for the Work will be subject to adjustment, either by increase or decrease, for causes beyond the control of the Contractor, according to the terms of this Subsection. After adjustment, the Contract Time will become, and be designated as, the "Adjusted Contract Time". Except as provided in 00180.65 and 00195.40, an adjustment of Contract Time shall be the Contractor's only remedy for any delay arising from causes beyond the control of the Contractor.

(b) Contractor's Request Not Required - The Engineer may increase or decrease the Contract Time or the Adjusted Contract Time if Change Orders or Extra Work orders issued actually increase or decrease the amount of time required to perform the Work. The Engineer may also increase Contract Time in the event of Right-of-Way and Access delays (see 00180.65), and those delays due to causes beyond the Contractor's control specified in 00180.50(e). The Engineer will promptly inform the Contractor of adjustments made to Contract Time according to this Subsection, and will include the reasons for adjustment.

If the Agency anticipates delay during performance of the Contract, and specifies its expected duration in the Special Provisions, the Engineer will only consider additional delay beyond the stipulated duration in determining whether to adjust Contract Time.

(c) Contractor's Request Required - In the event the Contractor believes that additional Contract Time is due, the Contractor shall submit to the Engineer a timely request for adjustment of Contract Time. The Engineer will not consider untimely requests. The Agency regards as timely only those requests for adjustment of Contract Time that:

- Accompany a proposed revised Project Work schedule submitted according to 00180.41, for comparison with the last revision of the Project Work schedule; or
- Are not otherwise deemed waived and are submitted within 15 Days after the date of Second Notification, if Second Notification has been issued.

The Engineer will not grant an adjustment of Contract Time for events that occurred prior to the date of the last revision of the Project Work schedule. The Engineer will not authorize, nor the Agency pay, acceleration costs incurred by the Contractor prior to its submittal of a request for adjustment of Contract Time to which the acceleration costs relate.

The Contractor's request for adjustment of Contract Time shall be submitted to the Engineer on a form provided by, or in a format acceptable to, the Engineer, and shall include a copy of the written notice required under 00180.60. The request shall include without limitation:

- Consent of the Contractor's Surety if the request totals more than 30 Calendar Days of additional Contract Time;
- Sufficient detail for the Engineer to evaluate the asserted justification for the amount of additional Contract Time requested;
- The cause of each delay for which additional Contract Time is requested, together with supporting analysis and data;
- Reference to the Contract provision allowing Contract Time adjustment for each cause of delay;
- The actual or expected duration of delay resulting from each cause of delay, expressed in Calendar Days; and
- A schedule analysis based on the current approved Project Work schedule for each cause of delay, indicating which activities are involved and their impact on Contract completion.

(d) ~~Bases~~Basis for Adjustment of Contract Time - In the adjustment of Contract Time, the Engineer will consider causes that include, but are not limited to:

- Failure of the Agency to submit the Contract and bond forms to the Contractor for execution within the time stated in 00130.50, or to submit the Notice to Proceed within the time stated in 00130.90;
- Errors, changes, or omissions in the Supplemental Drawings, quantities, or Specifications;
- Performance of Extra Work;
- Failure of the Agency or Entities acting for the Agency to act promptly in carrying out Contract duties and obligations;
- Acts or omissions of the Agency or Entities acting for the Agency that result in unreasonable delay referenced in 00195.40;
- Causes cited in 00180.50(e); and
- Right-of-way and access delays referenced in 00180.65.

The Engineer will not consider requests for adjustment of Contract Time based on any of the following:

- Contentions that insufficient Contract Time was originally specified in the Contract;
- Delays that do not affect the specified or Adjusted Contract Time;
- Delays that affect the Contractor's planned early completion, but that do not affect the specified or adjusted Contract Time;
- Shortage or inadequacy of Materials, Equipment or labor;
- Late delivery of Materials and Equipment to be incorporated into the Work, except under those conditions referenced in 00180.50(e);
- Different area of Material source in 00160.40(a);
- Substitution of Equipment in 00180.31(c);
- Reasonably predictable weather conditions; or
- Other matters within the Contractor's control or Contract responsibility.

(e) Consideration and Response by Agency - The Engineer will only consider a Contractor's request for Contract Time adjustment submitted according to the requirements of 00180.80(c). The Engineer may elect not to consider claimed delays that do not affect the specified or adjusted Contract Time required to complete the Work.

The Engineer may adjust Contract Time for causes not specifically identified by the Contractor in its request.

The Engineer will review a properly submitted request for Contract Time adjustment, and within a reasonable time will advise the Contractor of the Engineer's findings. If the Contractor disagrees with the Engineer's findings, the Contractor may request review according to the procedure specified in 00199.40.

00180.85 Failure to Complete on Time; Liquidated Damages:

(a) Time is of the Essence - Time is of the essence in the Contractor's performance of the Contract. Delays in the Contractor's performance of the Work may inconvenience the traveling public, interfere with business and commerce, and increase cost to the Agency. It is essential and in the public interest that the Contractor prosecute the Work vigorously to Contract completion.

The Agency does not waive any rights under the Contract by permitting the Contractor to continue to perform the Contract, or any part of it, after the Contract Time or adjusted Contract Time has expired.

(b) Liquidated Damages - The Agency will sustain damage if the Work is not completed within the specified Contract Time. However, in certain Agency projects it may be unduly burdensome and difficult to demonstrate the exact dollar value of such damages. The Agency will identify such projects in the Special Provisions related to them. In these projects, the Contractor agrees to pay to the Agency, not as a penalty but as liquidated damages, the amount specified in the Special Provisions for each Calendar Day the Contractor expends performing the Contract in excess of the Contract Time or adjusted Contract Time.

Payment by the Contractor of liquidated damages does not release the Contractor from its obligation to fully and timely perform the Contract according to its terms. Nor does acceptance of liquidated damages by the Agency constitute a waiver of the Agency's right to collect any additional damages it may sustain by reason of the Contractor's failure to fully perform the Contract according to its terms. The liquidated damages shall constitute payment in full only of damages incurred by the Agency due to the Contractor's failure to complete the Work on time.

If the Contract is terminated according to 00180.90(a), and if the Work has not been completed by other means on or before the expiration of Contract Time or adjusted Contract Time, liquidated damages will be assessed against the Contractor for the duration of time reasonably required to complete the Work.

00180.90 Termination of Contract and Substituted Performance:

(a) Termination for Default - Termination of the Contract for default may result if the Contractor:

- Fails to comply with the requirements for records;
- Violates any material provision of the Contract;
- Disregards applicable laws and regulations or the Engineer's instructions;
- Refuses or fails to supply enough Materials, Equipment or skilled workers for prosecution of the Work in compliance with the Contract;
- Fails to make prompt payment to Subcontractors;
- Makes an unauthorized general assignment for the benefit of the Contractor's creditors;
- Has a receiver appointed because of the Contractor's insolvency;
- Is adjudged bankrupt and the court consents to the Contract termination; or
- Otherwise fails or refuses to faithfully perform the Contract according to its terms and conditions.

If the Contract is terminated by the Agency, upon demand the Contractor and the Contractor's Surety shall provide the Engineer with immediate and peaceful possession of the Project Site, and of all Materials and Equipment to be incorporated into the Work, whether located on and off the Project Site, for which the Contractor received progress payments under 00195.50.

If the Contract is terminated for default, neither the Contractor nor its Surety shall be:

- Relieved of liability for damages or losses suffered by the Agency because of the Contractor's breach of Contract; or

- Entitled to receive any further progress payments until the Work is completed. However, progress payments for completed Work that remain due and owing at the time of Contract termination may be made according to the terms of 00195.50, except that the Engineer will be entitled to withhold sufficient funds to cover costs incurred by the Agency as a result of the termination. Final payment to the Contractor will be made according to the provisions of Section 00195.

If a termination under this provision is determined by a court of competent jurisdiction to be unjustified, the termination shall be deemed a termination for public convenience.

(b) Substituted Performance - According to the Agency's procedures, and upon the Engineer's recommendation that sufficient cause exists, the Agency, without prejudice to any of its other rights or remedies and after giving the Contractor and the Contractor's Surety 10 Calendar Days' written notice, may:

- Terminate the Contract;
- Substitute the Contractor with another Entity to complete the Contract;
- Take possession of the Project Site;
- Take possession of Materials on the Project Site;
- Take possession of Materials not on the Project Site, for which the Contractor received progress payments under 00195.50;
- Take possession of Equipment on the Project Site that is to be incorporated into the Work;
- Take possession of Equipment not on the Project Site that is to be incorporated into the Work, and for which the Contractor received progress payments under 00195.50; and
- Finish the Work by whatever method the Agency deems expedient.

If, within the 10 Calendar Day notice period provided above, the Contractor and/or its Surety corrects the basis for declaration of default to the satisfaction of the Engineer, or if the Contractor's Surety submits a proposal for correction that is acceptable to the Engineer, the Contract will not be terminated.

(c) Termination for Public Convenience - The Engineer may terminate the Contract for convenience in whole or in part whenever the Engineer determines that termination of the Contract is in the best interest of the public.

The Engineer will provide the Contractor and the Contractor's Surety ~~seven~~ 7 Calendar Days' written notice of termination for public convenience. After such notice, the Contractor and the Contractor's Surety shall provide the Engineer with immediate and peaceful possession of the Project Site, and of Materials and Equipment to be incorporated into the Work, whether located on and off the Project Site, for which the Contractor received progress payments under 00195.50.

Compensation for Work terminated by the Engineer under this provision will be determined according to the provisions of 00195.70(b).

Section 00190 - Measurement of Pay Quantities

Description

00190.00 Scope - The Engineer will measure pay quantities for accepted Work according to the United States standard measure unless otherwise provided in the Contract. Unless otherwise specified in the Contract, the Engineer will round off all quantity computations using the following convention:

- The final significant digit will not be changed when the succeeding digit is less than 5.
- The final significant digit will be increased by one when the succeeding digit is 5 or greater.

The measurement provisions contained in the Specifications for each Pay Item will supplement or modify the above convention by:

- Imposing measurement limitations
- Describing measurement or computation procedures
- Giving conversion factors or adjustment conditions
- Providing for determination of reasonably accurate and representative Pay Item quantities

Measurements required or allowed to be made by the Contractor will be subject to the Engineer's verification. The Engineer's decision about measurement is final.

00190.10 Measurement Guidelines - Measurement of quantities will be made on the following bases, unless otherwise specified in the Contract:

(a) Unit Basis - Unit will be each, unless otherwise specified in the Contract and will be determined by actual count of units in place.

(b) Length Basis - Length will be feet or mile, unless otherwise specified in the Contract and will be determined by measuring the length at least to the nearest 0.1 foot or at least to the nearest 0.1 mile, as applicable, unless otherwise specified in the Contract. Measurements will be limited to the dimensions shown or specified, or as directed by the Engineer.

(c) Area Basis - Area will be square foot, square yard, or acre, unless otherwise specified in the Contract and will be determined by measuring the width and the length (or height) at least to the nearest 0.1 foot and computed at least to the nearest 0.1 square foot, nearest 0.1 square yard, or nearest 0.1 acre, as applicable, unless otherwise specified in the Contract.

(d) Weight Basis - Weight will be pound or ton, unless otherwise specified in the Contract and will be determined as follows:

(1) Pound - Pound weight will be determined by the net weight identified on the manufacturer's packaged labels, subject to periodic check weighing. Weight by pound will be measured at least to the nearest 1.0 pound unless otherwise specified in the Contract.

Provide a certificate with each shipment together with a certified copy of the weight of each delivery. If the check weight is less than the manufacturer weight by more than 0.4%, the discrepancy will be resolved by the Engineer.

(2) Ton - Ton weight will be determined on Contractor-provided scales as required under 00190.20 unless otherwise allowed by the Specifications. Weight by ton will be measured at least to the nearest 0.01 ton unless otherwise specified in the Contract.

If bituminous materials, portland cement, lime, and similar bulk Materials are shipped by truck or rail, the supplier's shipping invoice with net scale weights, or volumes converted to weights, may be used for Pay Item quantity determination in place of weights determined on the Contractor-provided vehicle scales.

Shipping invoice weights of the supplier's truck or transport shall be subject to periodic check weighing on the Contractor's vehicle scales, or other scales designated, according to 00190.20. If the check weight is less than the supplier weight by more than 0.4%, the discrepancy will be resolved by the Engineer.

No payment will be made:

- For quantities in excess of the supplier weight
- When Materials have been lost, wasted, or otherwise not incorporated into the Work
- For additional hauling costs resulting from the check weighing

(e) Volume Basis - Volume will be cubic yard truck measure or in-place measure, gallons, foot board measure (FBM), or thousand foot board measure (MFBM), unless otherwise specified in the Contract and will be measured at least to the nearest 0.1 cubic yard, nearest 1.0 gallon, nearest 0.1 FBM, or nearest 0.1 MFBM, as applicable, unless otherwise specified in the Contract.

Truck measure will be the measured and calculated maximum "water level" capacity of the vehicle. Quantities will be determined at the point of delivery, with no allowance for settlement of Material during transit. When required to facilitate measurement, the vehicle load shall be leveled at the point of delivery. Payment will not be made for Material in excess of the maximum "water level" capacity. Deductions will be made for loads below the maximum "water level" capacity.

When bituminous materials are measured by volume, the volume will be measured at 60 °F or will be corrected to the volume at 60 °F using the correction factors found in the MFTP (ODOT TM 321).

(f) Time Basis - Time will be hour, Day, or year, unless otherwise specified in the Contract, and will be measured to at least the nearest 0.5 hour, nearest 1.0 Day, or nearest 1.0 year, as applicable, unless otherwise specified in the Contract.

(g) Standard Manufactured Items - If standard manufactured items, such as fence, wire, plates, rolled shapes, pipe, conduit and other similar items are specified in the Contract by properties such as gauge, unit weight, or section dimensions, the manufacturing tolerances established by the industry involved will be accepted unless more stringent tolerances are cited in the Contract.

(h) Lump Sum Basis - Lump sum, when used, means the Work described shall be completed and accepted without measurement unless changes are ordered in writing by the Engineer. If estimated quantities of the Work to be performed are listed in the Special Provisions, they provide only a basis for adjusting payment amounts. Estimated quantities are approximate only, and are made from a reasonable interpretation of the ~~Plans and Specifications.~~Contract Documents. Computations based on the details and dimensions shown on the ~~Plans or Specifications~~Contract Documents are not guaranteed to equal estimated quantities.

If the Agency issues no Change Order, the Agency will make no pay adjustment for quantities based on the Contractor's computations that overrun or underrun the estimated quantities.

If the Agency issues Change Orders for changes in the Work, the Engineer will measure such changes according to the standards set by 00195.20 to determine adjustment of payment.

00190.20 Contractor to Provide Vehicle Weigh Scales:

(a) General - If the Specifications require measurement by weighing on vehicle weigh scales, the Contractor shall provide vehicle weigh scales and shall transport Materials to the scales. Subject to the Engineer's approval, weights may be determined by plant or hopper scales according to 00190.30.

Contractor-provided scales shall be furnished, installed and maintained by the Contractor or its supplier, or, subject to the Engineer's approval, may be commercial scales located in the vicinity of the Project.

Unless otherwise provided in the Contract, Pay Items to be measured by weight shall include all Contractor costs for providing, maintaining, inspecting, and testing scales; for furnishing appropriate weigh tickets; for self-printing scales; and for transporting Materials to the scales or to check weighing.

(b) Requirements - The scales shall conform to ORS 618, or the laws of the state in which they are located, and NIST Handbook 44, and shall be:

- Licensed by the Oregon Department of Agriculture, or by the analogous regulatory body for scales located outside the State;
- Technically suitable for weighing the Materials;
- Properly installed and maintained; and
- Accurate to the required tolerances.

The weight of any Materials weighed by anyone other than the Engineer will be subject to check weighing as the Engineer directs.

(c) Approaches - Vehicle scale approaches shall be:

- At each end of the scale platform;
- Straight and in line with the platform; and
- Long enough to accommodate combination vehicles longer than the scale platform so that they are level and allow release of brakes before weighing.

(d) Inspections - Contractor shall have all scales certified, that is inspected and their accuracy tested, by the Oregon Department of Agriculture, an analogous regulatory body for scales located outside the State, or a scale service company as follows:

- Before use if installed at a new site;
- 60 Calendar Days after initial inspection;
- Every ~~six~~ 6 months thereafter; and
- When the Engineer directs additional inspections.

No Materials weighed on scales without current certifications according to this Subsection will be accepted. The Contractor shall provide a copy of all required certifications to the Engineer.

Testing by a scale service company within the State of Oregon shall comply with ORS 618.

If additional inspections directed by the Engineer confirm that the scale accuracy is within the required tolerances, the Agency will pay the cost for inspecting and testing the scales. If the scale accuracy is not within these tolerances, the Contractor shall pay the cost for inspecting and testing the scales.

(e) Inspection Results - If an inspection indicates the scales have been under-weighing (indicating less than the true weight), the Agency will make no additional payment to the Contractor for Materials previously weighed.

If an inspection indicates the scales have been over-weighing (indicating more than the true weight), the weights will be reduced for Materials received after the time the Engineer determines the overweighing began or, if that is not possible, after the last acceptable certification of the scales. The reduction will be the amount of error in excess of the 0.2% maintenance tolerance allowed in the Contract.

(f) Contractor-Provided Weigh Technician - The Contractor shall provide a technician to operate Contractor-provided vehicle weigh scales. The Agency may observe procedures and require check weighing according to the following:

(1) Scale with Automatic Printer - If the scales have an automatic weigh memo printer that does not require manual entry of gross weight information, the Agency may periodically have a representative at the scales to observe the weighing procedures. In addition, the Engineer may periodically check the weight for a load of Materials by directing the haul vehicle to reweigh on a different scale that has been inspected and certified according to 00190.20(b) and 00190.20(d).

If a different scale is not available within a 30 mile round trip from the regular haul route the Agency will allow check weighing on an approved alternate basis. Check weights within 0.4% of the Contractor-provided weight are acceptable.

The Engineer will resolve discrepancies found by check weighing. Agency employee costs will be paid by the Agency. The Contractor shall pay all other costs resulting from the check weighings, including without limitation the use of other scales.

If more than 50 tons per ~~day~~Day of all types of Materials are received from a scale, the Contractor shall make random check weighings at least every tenth ~~day~~Day on which more than 50 tons is received or at each interval that 10,000 tons has been weighed, whichever occurs first, or as directed by the Engineer. The Contractor shall make at least one check weighing on projects where more than 2,000 tons of all types of Materials are received from a scale. The Contractor shall provide the Engineer with the results of the check weighing.

(2) Scale Without Automatic Printer - If the scales require manual entry of gross weight information, the Agency may periodically have a representative weigh witness at the scales to observe the weighing procedures. The Contractor shall inform the Engineer of his intent to use a scale without an automatic printer at least ~~three~~ 3 working ~~days~~Days before weighing begins or before the Contractor changes to a scale that does not have an automatic printer. The Contractor shall pay costs for the weigh witness. The hourly cost of the weigh witness will be as stated in the Special Provisions. In addition, the Engineer may periodically check the weight for a load of Materials by directing the haul vehicle to reweigh on a different scale that has been inspected and certified according to 00190.20(b) and 00190.20(d).

If a different scale is not available within a 30 mile round trip from the regular haul route the Agency will allow check weighing on an approved alternate basis. Check weights within 0.4% of the Contractor-provided weight are acceptable.

The Engineer will resolve discrepancies found by check weighing. Agency employee costs for check weighings will be paid by the Agency. The Contractor shall pay all other costs resulting from the check weighings, including without limitation the use of other scales.

If more than 50 tons per ~~day~~Day of all types of Materials are received from a scale, the Contractor shall make random check weighings at least every tenth day on which more than 50 tons is received or at each interval that 10,000 tons has been weighed, whichever occurs first, or as directed by the Engineer. The Contractor shall make at least one check weighing on all projects where materials are received from a scale without an automatic printer. The Contractor shall provide the Engineer with the results of the check weighing.

(3) Duties of Weigh Technician - The Contractor's weigh technician shall:

- Determine twice a ~~day~~Day, or as otherwise directed by the Engineer, the empty haul weights (tare weights) of hauling vehicles, unless vehicles are tared before each load;
- Furnish daily a listing of the tare weights if 10 or more loads are hauled during that ~~day~~Day;
- Furnish a note listing the net weight for each consecutive ten loads with the following load;
- Furnish a daily listing of the net weights and total weight for each type of Material hauled during that ~~day~~Day; and
- Furnish a legible, serially numbered weigh memo for each load of Materials to the Agency's Materials receiver at the point of delivery, or as directed by the Engineer. The memo shall identify the Project, the Materials, the date, net weight (gross and tare as appropriate), and identification of vehicle, driver and weigh technician.

(g) Agency-Provided Weigh Technician - If the Contractor provides vehicle weigh scales without a weigh technician meeting the requirements of this Subsection, the Agency will provide a weigh technician at the Contractor's expense. The hourly cost for the weigh technician will be as stated in the Special Provisions. The Contractor shall provide a weighhouse for the weigh technician according to Section 00205. The Agency's weigh technician will:

- Determine tare weights;
- Prepare weigh memos for each load;
- Compile the weigh records; and
- Not participate in the production of Materials or the loading of haul vehicles.

00190.30 Plant Scales - The Contractor, with the Engineer's written approval, may weigh plant-mixed Materials on scales that have either:

- An automatic weight batching and mixing control printer system; or
- A weigh hopper printer system.

Any additional costs resulting from the use of these scales shall be borne by the Contractor. Check weighing will be done according to 00190.20(f).

Except for 00190.20(c) regarding approaches, the Contractor's use of plant scales shall comply with all provisions of 00190.20.

The Engineer's approval for the Contractor's use of plant scales to determine pay weights will be rescinded if check weighing or scale inspections indicate the scales do not consistently determine weights within the tolerances allowed by state law.

Section 00195 - Payment

Description

00195.00 Scope and Limit:

(a) General - The Agency will pay only for measured Pay Item quantities incorporated into the Work or performed according to the terms of the Contract. The Contractor understands and agrees that Pay Item quantities listed in the Schedule of Items do not govern payment.

Payment constitutes full compensation to the Contractor for furnishing all Materials, Equipment, labor, and Incidentals necessary to complete the Work; and for risk, loss, damage, and expense arising from the nature or prosecution of the Work or from the action of the elements, subject to the provisions of 00170.80. The Contractor shall include the costs of bonds and insurance for the Project in the unit price for each Pay Item of Work to be performed.

(b) Essential or Incidental Materials or Work - When the Specifications state that the unit price for a Pay Item is compensation for certain Materials or Work essential or Incidental to the Pay Item, the same Materials or Work will not be measured or paid under any other Pay Item.

Provisions and Requirements

00195.10 Payment For Changes in Materials Costs - On certain projects, as identified in the Special Provisions, an escalation/de-escalation clause with respect to certain materials will be in effect during the life of the Contract.

00195.12 Steel Material Price Escalation/De-Escalation Clause - Subsections 00195.12, 00195.12(a), 00195.12(b), 00195.12(c), and 00195.12(d) contain the price escalation/de-escalation clause relating to steel materials (as defined in 00195.12(d)) that is included in this Contract. This exclusive steel material price escalation/de-escalation clause, and the steel escalation/de-escalation program described in 00195.12 through 00195.12(d), are in effect for the life of this Contract regardless of the number of steel material Pay Items, if any, that are included, and whether or not the Contractor elects to participate in the steel escalation/de-escalation program according to 00195.12(d).

(a) Steel Material Price Escalation/De-Escalation Participation - The Contractor may select individual Pay Items to include in the steel escalation/de-escalation program from those Pay Items listed for this Project under 00195.12(d) by following the directions provided in 00195.12(d). The Contractor is not obligated to select any Pay Items. Before or within ~~five~~ 5 business days after the date of the preconstruction conference, the Contractor shall submit in writing to the Project Manager the Pay Items selected by the Contractor to be included in the steel escalation/de-escalation program, in the manner required under 00195.12(d). If the Contractor fails to inform the Project Manager of Pay Items to include in the steel escalation/de-escalation program in the manner and within the time limits stated in 00195.12(d) (or the Contractor otherwise elects not to participate in the program), the Contractor thereby elects not to participate in the program and forfeits all present and future rights to participate in the program for this Project.

The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this steel material price escalation/de-escalation provision will not limit those rights. Adjustment for fluctuations in the cost of steel material will apply only to the Pay Items individually selected by the Contractor from the Pay Items listed under 00195.12(d), and will be made using the respective steel cost basis (CB) listed.

(b) Monthly Steel Materials Value (MV) and Base Steel Materials Value (BV) - The Monthly Steel Materials Value (MV) will be established by the Agency from the IDWPUSISTEEL1 Bureau of Labor Statistics (BLS), Producer Price Indexes (PPI) using non-seasonally adjusted indexes only. Preliminary numbers may be referenced on the IDWPUSISTEEL1 BLS PPI for ~~six~~ 6 months or more before IDWPUSISTEEL1 BLS PPI determines they are final numbers.

The Base Steel Materials Value (BV) for this Project will be the MV published on the Agency website for the month of the bid opening for this Project. The agency will only publish values on the ODOT website for use after the IDWPUSISTEEL1 BLS PPI establishes the numbers as final numbers. The final values of MV and BV will be available at the Agency website. See the ODOT web site page included with the Special Provisions for the web site address where the final values of MV and BV are available.

The Agency has no control of when the IDWPUSISTEEL1 BLS PPI establishes final values. The Agency steel material price escalation/de-escalation adjustments made under 00195.12 through 00195.12(d) may not be reflected on payments made to the Contractor for up to ~~two~~ 2 months after the IDWPUSISTEEL1 BLS PPI applicable values become final. This timing for steel material price escalation/de-escalation adjustments is an agreed term of this Contract and shall not constitute late payment under ORS 279C.570, nor shall the Agency be responsible to pay interest on any such steel material price adjustments.

If the Agency-selected index ceases to be available for any reason, the Agency in its discretion will select and begin using a substitute price source or index to establish the MV each month. The MV will only apply to Pay Items selected by the Contractor and provided in writing to the Project Manager from the Pay Item list contained under, and in the manner and within the time limits required by 00195.12(d). The Agency does not guarantee that steel material will be available at any stated or implied materials price.

(c) Monthly Steel Materials Price Adjustment - If the Contractor has properly informed the Project Manager of Pay Items to include in the steel escalation/de-escalation program as required by 00195.12(a) and 00195.12(d), a price adjustment evaluation will be made for the Pay Items individually selected. No adjustments will be made using the BV or MV until such time as they are listed as final values by the IDWPUSISTEEL1 BLS PPI. The price adjustment as calculated in this provision for a given Pay Item will use the MV for the month the Work associated with that Pay Item is performed and added to the monthly progress estimate. A price adjustment for that Pay Item will only be made if the MV for the month the Work associated with the Pay Item is performed and added to the monthly progress estimate differs by more than 10% from the BV. A price adjustment will be made, as and when required by 00195.12 through 00195.12(d), only for the Pay Items, if any, that were selected by the Contractor in the manner and within the time limits required under 00195.12(a) and 00195.12(d).

The Monthly Steel Materials Price Adjustment will be determined as follows:

- If the MV is within 10% ± of the BV, there will be no adjustment.
- If the MV is more than 110% of the BV, then:

  $$PA = (((MV-BV) \div BV) - 0.10) \times (CB \times PIP)$$

- If the MV is less than 90% of the BV, then:

  $$PA = (((MV-BV) \div BV) + 0.10) \times (CB \times PIP)$$

Where:

PA = Price Adjustment, dollars
MV = Monthly Steel Materials Value from BLS PPI for the month determined above (after becomes final)

BV = Base Steel Materials Value from month of the bid opening (after becomes final)
PIP = Amount paid for the Pay Item for the month for which the adjustment is made
CB = Cost Basis for the applicable steel material, in percent (see 00195.12(d))

(d) Steel Materials Pay Item Selection - The Agency has a process using estimated quantities to determine which Pay Items containing steel material qualify for the steel escalation/de-escalation program by meeting a minimum threshold, and are therefore included in the eligible Pay Items listed in the Special Provisions.

For purposes of 00195.12 through 00195.12(d), "steel material" means structural and reinforcing steel, steel studs, sheet piling, guardrail, ductile iron pipe and other steel products used for the construction, reconstruction or major renovation of a road or highway.

The Contractor may elect to participate in the steel escalation/de-escalation program for this Project by marking the list in the Special Provisions checking each box next to each Pay Item the Contractor wants included in the program and submitting this information in writing, signed and dated by the Contractor, to the Project Manager before or within ~~seven~~ 7 Calendar Days after the date of the preconstruction conference. The steel material price escalation/de-escalation clause for price adjustments for fluctuations in the cost of steel material will apply only to the Pay Items selected by the Contractor, from the Pay Item list included in the Special Provisions, and provided in writing to the Project Manager in the manner and within the time limits stated above.

If the Contractor fails to inform the Project Manager of Pay Items to include in the steel escalation/de-escalation program in the manner and within the time limits stated above (or the Contractor otherwise elects not to participate in the program), the Contractor thereby elects not to participate in the program and forfeits all present and future rights to participate in the program for this Contract and this Project.

00195.20 Changes to Plans or Character of Work:

(a) Insignificant Changed Work - If the changes made under 00140.30 do not significantly change the character or unit cost of the Work to be performed under the Contract, the Agency will pay for such work at the Pay Item price.

If the Work involved in the change is measured on a lump sum basis and its character is not significantly changed, payment for the Changed Work will be determined:

- As described in the applicable Section of the Specifications;
- If not described there, on a theoretical unit price determined by dividing the Contractor's lump sum price by the estimated quantity of the Pay Item listed in the Special Provisions; or
- If neither of the above apply, the Engineer will make an equitable adjustment.

(b) Significant Changed Work - If the changes made under 00140.30 significantly alter the character, unit cost, or lump sum cost of the Work, the Agency will adjust the Contract. Adjustments will exclude any loss of anticipated profits. The parties shall agree upon the basis for payment and the amount of adjustment prior to the Contractor commencing the Changed Work. If the basis and amount cannot be agreed upon, the Engineer will make an equitable adjustment, which may increase or decrease the Contract Amount and Contract Time.

Any such adjustments may be less than, but will not be more than the amount justified by the Engineer on the basis of the established procedures set out in Section 00197 for determining rates. This does not limit the application of Section 00199.

The term "Significant Changed Work" shall apply only to that circumstance in which the character of the Work, as changed, differs materially in kind, nature, or unit cost from that involved or included in the originally proposed construction.

00195.30 Differing Site Conditions - Upon written notification, as required in 00140.40, the Engineer will investigate the identified conditions. If the Engineer determines that the conditions materially differ and cause an increase or decrease in the cost or time required to perform any Work under the Contract, an adjustment in the Contract Amount or Contract Time, excluding loss of anticipated profits, will be made, and the Contract modified accordingly, in writing. The Engineer will notify the Contractor as to whether or not an adjustment of the Contract is warranted.

No Contract adjustment which benefits the Contractor will be allowed unless the Contractor has provided the required written notice. Any such adjustments will be made according to 00195.20.

00195.40 Unreasonable Delay by the Agency - If the Contractor believes that performance of all or any portion of the Work is suspended, delayed, or interrupted for an unreasonable period of time in excess of that originally anticipated or customary in the construction industry, due to acts or omissions of the Agency, or persons acting for the Agency, and that additional compensation, Contract Time, or both, are due the Contractor because of the suspension, delay or interruption, the Contractor shall immediately file a written notice of delay according to 00180.60. The Contractor shall then promptly submit a properly supported request for any additional compensation, Contract Time, or both, according to the applicable provisions in 00180.60 through 00180.80 and Section 00199.

The Engineer will promptly evaluate a properly submitted request for additional compensation. If the Engineer determines that the delay was unreasonable, and that the cost required for the Contractor to perform the Contract has increased as a result of the unreasonable suspension, delay or interruption, the Engineer will make an equitable adjustment, excluding profit, and modify the Contract in writing accordingly. The Engineer will notify the Contractor of the determination and whether an adjustment to the Contract is warranted.

Under this provision, no Contract adjustment will be allowed:

- Unless the Contractor has provided the written notice required by 00180.60;
- For costs incurred more than 10 Calendar Days before the Engineer receives the Contractor's properly submitted written request;
- For any portion of a delay that the Engineer deems to be a reasonable delay, or for which an adjustment is provided for or excluded under other terms of the Contract; or
- To the extent that performance would nevertheless have been suspended, delayed or interrupted by causes other than those described in this Subsection.

00195.50 Progress Payments and Retained Amounts:

(a) Progress Payments - The Agency's payment of progress payments, or determination of satisfactory completion of Pay Items or Work or release of retainage under 00195.50(d), shall not be construed as ~~acceptance~~Final Acceptance or approval of any part of the Work, and shall not relieve the Contractor of responsibility for defective Materials or workmanship or for latent defects and warranty obligations.

The estimates upon which progress payments are based are not represented to be accurate estimates. All estimated quantities are subject to correction in the final estimate. If the Contractor uses these estimates as a basis for making payments to Subcontractors, the Contractor assumes all risk and bears any losses that result.

If the estimated amount due the Contractor for any given month is less than $1,000, the Agency will make no payment for that month unless requested by the Contractor.

(1) Progress Estimates - At the same time each month, the Engineer will make an estimate of the amount and value of Pay Item Work completed. The amount of Work completed will be the sum of the estimated number of units completed for unit price Pay Items plus the estimated percentage completed of lump sum Pay Items.

The estimated value of the Work completed will then be determined by using the Contract unit price for unit price Pay Items, and by using one of the following methods to determine the value of the lump sum Pay Items:

- The "theoretical unit price", when the Special Provisions contain an estimated number of units;
- A Contractor-submitted, Engineer-approved Schedule of Values, when there is no theoretical unit price available; or
- Engineer's determination, when there is neither an available theoretical unit price, nor an approved, Contractor-submitted Schedule of Values.

The amounts to be allowed for lump sum Pay Items in progress payments will not exceed the reasonable value of the Work performed, as determined by the Engineer.

Incidentals such as formwork, falsework, shoring, and cribbing shall be included in the unit prices for the various Pay Items requiring their use, unless specified as a separate Pay Item. No payment will be made for Pay Items that include Incidentals until units or portions of such Pay Item Work are in place and completed. The costs of Incidentals will be paid in proportion to the percentage of Pay Item Work completed.

(2) Value of Materials on Hand - The Engineer will also make an estimate of the amount and value of acceptable Materials on hand, i.e., already delivered and stored according to 00195.60(a), to be incorporated into the Work.

(3) Value of Work Accomplished - The sum of the values in (1) and (2) above will be collectively referred to in this Subsection as the "value of Work accomplished", subject to (4) below.

(4) Limitations on Value of Work Accomplished - In determining the "value of Work accomplished", the Engineer's estimate will be based on the unit prices for the various Pay Items. Any amounts not included in progress payments due to substantial mathematical unbalancing of Pay Item prices will be included in the final payment issued according to 00195.90(b).

(5) Reductions to Progress Payments - With each progress payment, the Contractor will receive a Contract payment voucher and summary setting forth the value of Work accomplished reduced by the following:

- Amounts previously paid;
- Amounts deductible or owed to the Agency for any cause specified in the Contract;
- Additional amounts retained to protect the Agency's interests according to Subsection (e) below.

(b) Retainage - The amount to be retained from progress payments will be 2.5% of the value of Work accomplished, and will be retained in one of the forms specified in Subsection (c) below. If the Agency determines that satisfactory progress is not being made on the Work, the Agency

may withhold up to 5% of the value of Work accomplished from subsequent progress payments. No retainage will be withheld from Work performed as Force Account Work, escalation/de-escalation, bonuses, or other items decided by the Agency.

As provided in 00170.65(a) additional retainage of 25% of amounts earned will be withheld and released according to ORS 279C.845 when the Contractor fails to file the certified statements required in ORS 279C.845, FHWA Form 1273, and 00170.65.

(c) Forms of Retainage - Forms of acceptable retainage are specified below in Subsections (1) through (3). "Cash, Alternate A" is the Agency-preferred form of retainage. If the Agency incurs additional costs as a result of the Contractor's election to use a form of retainage other than Cash, Alternate A, the Agency may recover such costs from the Contractor by a reduction of the final payment.

(1) Cash, Alternate A - Retainage will be deducted from progress payments and held by the Agency until final payment is made according to 00195.90, unless otherwise specified in the Contract.

The Agency will deposit the cash retainage withheld in an interest-bearing account in a bank, savings bank, trust company, or savings association for the benefit of the Agency, as provided by ORS 279C.560(~~4~~5). Interest earned on the account shall accrue to the Contractor. Amounts retained and interest earned will be included in the final payment made according to 00195.90.

Any retainage withheld on Work performed by a Subcontractor will be released to the Contractor according to 00195.~~90~~50(d).

(2) Cash, Alternate B (Retainage Surety Bond) - Upon receipt of an approved retainage surety bond, the Agency will limit the amount of cash retainage withheld to $10,000. The surety bond must be in the bond form provided by the Agency. The bond must be provided by the same Surety that provides the Performance and Payment Bonds.

If the Contractor elects this form of retainage, the Agency will withhold from progress payments up to 2.5% of the value of the Work accomplished as cash retainage until the retained amount equals $10,000. After that amount is retained, no further cash retainage will be withheld until the additional required retainage that would have been withheld exceeds the face amount of the retainage surety bond provided. Thereafter, retainage will be withheld from progress payments according to these Specifications. According to 00195.50(b), if at any time the Agency determines that satisfactory progress is not being made on the Work, the Agency may withhold up to 5% of the value of the Work accomplished from subsequent progress payments.

If an acceptable retainage surety bond is provided, the Contractor shall notify all Subcontractors of the existence of the retainage surety bond and shall advise them of their rights under ORS 279C.560(~~6).~~7) and ORS 701.435.

Amounts of retainage withheld under the provision will be included in the final payment according to 00195.90.

Any retainage withheld on Work performed by a Subcontractor shall be released to the Contractor according to 00195.50(d).

(3) Bonds ~~and~~, Securities ~~- The Contractor may~~ **, and Other Instruments** - In accordance with ORS 279C.560, unless the Agency finds in writing that accepting a bond, security or other instrument poses an extraordinary risk that is not typically associated with the bond,

security or other instrument, the Agency will approve the Contractor's written request to deposit bonds ~~or~~, securities or other instruments with the Agency or in a custodial account or other account satisfactory to the Agency with ~~any~~an approved bank or trust company, to be held instead of cash retainage for the benefit of the Agency ~~(ORS 279C.560).~~. In such event, the Agency will reduce the cash retainage by an amount equal to the value of the bonds ~~and~~, securities~~.~~ and other instruments. Interest or earnings on the bonds ~~and~~, securities and other instruments shall accrue to the Contractor.

Bonds ~~and~~, securities and other instruments deposited instead of cash retainage shall be assigned to or made payable to the Agency and shall be of a kind approved by the Director of the Oregon Department of Administrative Services, including but not limited to:

- Bills, certificates, notes or bonds of the United States;
- Other obligations of the United States or ~~its~~ agencies of the United States;
- Obligations of ~~any~~a corporation wholly owned by the federal government; ~~and~~
- Indebtedness of the Federal National Mortgage Association~~.~~;
- General obligation bonds of the State of Oregon or a political subdivision of the State of Oregon;
- Irrevocable letters of credit issued by an insured institution, as defined in ORS 706.008.

The Contractor shall execute and provide such documentation and instructions respecting the bonds ~~and~~, securities and other instruments as the Agency may require to protect its interests. When the Engineer determines that all requirements for the protection of the Agency's interest have been fulfilled, the bonds and securities deposited instead of cash retainage will be released to the Contractor.

(d) ~~Reduction~~Release of Retainage - As the Work progresses, release of the amounts retained under (b) above will only be considered for Pay Items that have been satisfactorily completed. For purposes of this Subsection, a Pay Item will be considered satisfactorily completed only if all of the Work for the Pay Item is complete and all contractual requirements pertaining to the Pay Item and Work have been satisfied. Work not included in a Pay Item, or which constitutes part of an uncompleted Pay Item, will not be regarded as satisfactorily completed Work for the purposes of this Subsection.~~As the Work progresses, the amounts to be retained under (b) of this Subsection are subject to reduction in the Engineer's sole discretion. Retainage reductions will be considered only as follows:~~

~~When the Work is 97.5% or more completed, the Engineer may, without application by the Contractor, reduce the retained amount to 100% of the value of the Work remaining.~~
~~When a Subcontractor has satisfactorily completed all of its Work, it may request release of retainage for that Work from the Contractor. The Contractor shall request reduction of retainage in the amount withheld for the Subcontractor's Work after certifying to the Agency that the Subcontractor's Work is complete, and that all contractual requirements pertaining to the Subcontractor's Work have been satisfied. Within 60 Calendar Days of the end of the month in which the Agency receives the Contractor's certification regarding the Subcontractor's Work, the Agency will either notify the Contractor of any deficiencies which require completion before release of retainage, or verify that the Subcontractor's Work complies with the Contract and release all retainage for that Work with the next scheduled progress payment. Within 10 Calendar Days of receipt of retainage, the Contractor shall pay to the Subcontractor all such retainage released except for latent defects or warranty.~~
~~The Agency will only release retainage for satisfactorily completed portions of the Work represented by Pay Items in the Schedule of Items, or by Pay Items added by Change Order.~~
Work not ~~represented by~~included in a Pay Item, ~~but~~or which constitutes part of an uncompleted

Pay Item, will not be regarded as satisfactorily completed Work for the purposes of this Subsection.

~~If retainage has been reduced or eliminated, the Agency reserves the right to protect its interests by retaining amounts from further progress payments at the rates provided in 00195.50(b).~~ Beginning with the fourth month after First Notification and every third month thereafter, the Agency will release retainage for satisfactorily completed Pay Items in the Schedule of Items, or for satisfactorily completed Pay Items added by Contract Change Order. Retainage will be released with the scheduled progress payment for the fourth month after First Notification and with the scheduled progress payment for each third month thereafter. Within 10 Calendar Days of receipt of retainage, the Contractor shall pay to each Subcontractor all such released retainage that pertains to the Work of that Subcontractor.

A determination of satisfactory completion of Pay Items or Work or release of retainage shall not be construed as acceptance or approval of the Work and shall not relieve the Contractor of responsibility for defective Materials or workmanship or for latent defects and warranty obligations.

(e) Withholding Payments - The Engineer may withhold such amounts from progress payments or final payment as may reasonably protect the Agency's interests until the Contractor has:

- Complied with all orders issued by the Engineer according to the Specifications; and
- Satisfied all legal actions filed against the Agency, the Agency's governing body and its members, and Agency employees that the Contractor is obliged to defend. (see 00170.72)

Notwithstanding ORS 279C.555 or ORS 279C.570~~,~~ or 00195.50(d), if a Contractor is required to file ~~certified~~ statements on the prevailing rate of wages, but fails to do so, the Agency will retain 25% of any amount earned as required in 00170.65.

(f) Prompt Payment Policy - Payments shall be made promptly according to ORS 279C.570.

00195.60 Advance Allowance for Materials on Hand:

(a) General - If the total value of Materials on hand is at least $1,000 or the total value of a single class of Materials on hand is at least $500, the Engineer may authorize an advance allowance for the Materials in the progress payments. The Agency will not make advance allowances on the Materials unless the following three conditions are satisfied:

(1) Request for Advance Allowance - If Materials on hand meet the requirement of (2) below, an advance allowance will be made if:

- A written request for advance allowance for Materials on hand has been received by the Engineer at least ~~five~~ 5 Calendar Days before the pay period cutoff date; and
- The request is accompanied by written consent of the Contractor's Surety, if required by the Agency.

(2) Stored or Stockpiled Conditions - The Materials shall have been delivered and/or acceptably stored or stockpiled according to the Specifications and as follows:

- At the Project Site;
- On Agency-owned property;
- On property in the State of Oregon on which the property owner has authorized storage in writing. The written authorization must allow the Agency to enter upon the property

and remove Materials for at least ~~six~~ 6 months after completion of the Project. The Contractor shall furnish a copy of the written permission to the Agency; or

- On property outside the State of Oregon on which the property owner has authorized storage in writing, provided that such storage location is allowed by the Special Provisions or authorized in writing by the Engineer. The permit must allow the Agency to enter upon the property and remove Materials for at least ~~six~~ 6 months after completion of the Project. The Contractor shall furnish a copy of the written permission to the Agency.

To be eligible for advance allowance, the Materials shall:

- Meet Specification requirements;
- Have the required Materials conformance and quality compliance documents on file with the Engineer (see Section 00165);
- Be in a form ready for incorporation into the Work; and
- Be clearly marked and identified as being specifically fabricated, or produced, and reserved for use on the Project.

(3) Responsibility for Protection - The Contractor has full control and responsibility for the protection of Materials on hand from the elements and against damage, loss, theft, or other impairment until the entire Project has been completed and accepted by the Agency.

If Materials are damaged, lost, stolen, or otherwise impaired while stored, the monetary value advanced for them, if any, will be deducted from the next progress payment.

If these conditions in 00195.60(a-1) through 00195.60(a-3) have been satisfied, the amount of advance allowance, less the retainage described in 00195.50, will be determined by one of the following methods as elected by the Engineer:

- Net cost to the Contractor of the Materials, f.o.b. the Project Site or other approved site; or
- Price (or portion of it attributable to the Materials), less the cost of incorporating the Materials into the Project, as estimated by the Engineer.

(b) Proof of Payment - The Contractor shall provide the Engineer with proof of payment to the Materials suppliers for purchased Materials within 30 Calendar Days of the date of the progress payment that includes the advance allowance.

If proof of payment is not provided, sums advanced will be deducted from future progress payments, and the Engineer will not approve further prepayment advance allowance requests.

(c) Terminated Contract - If the Contract is terminated, the Contractor shall provide the Agency immediate possession of all Materials for which advance allowances have been received, as provided above. If, for any reason, immediate possession of the Materials cannot be provided, the Contractor shall immediately refund to the Agency the total amount advanced for the Materials. The Agency may deduct any amount not so refunded from final payment.

00195.70 Payment under Terminated Contract - Payment for Work performed under a Contract that is terminated according to the provisions of 00180.90 will be determined under (a) or (b) of this Subsection.

(a) Termination for Default - Upon termination of the Contract for the Contractor's default, the Agency will make no further payment until the Project has been completed. The Agency will make progress payments to the party to whom the Contract is assigned, but may withhold an

amount sufficient to cover anticipated Agency costs, as determined by the Engineer, to complete the Project.

Upon completion of the Project, the Engineer will determine the total amount that the defaulting Contractor would have been entitled to receive for the Work, under the terms of the Contract, had the Contractor completed the Work (the "cost of the Work").

If the cost of the Work, less the sum of all amounts previously paid to the Contractor, exceeds the expense incurred by the Agency in completing the Work, including without limitation expense for additional managerial and administrative services, the Agency will pay the excess to the Contractor, subject to the consent of the Contractor's Surety.

If the expense incurred by the Agency in completing the Work exceeds the Contract Amount, the Contractor or the Contractor's Surety shall pay to the Agency the amount of the excess expense.

The Engineer will determine the expense incurred by the Agency and the total amount of Agency damage resulting from the Contractor's default. That determination will be final as provided in 00150.00.

If a termination for default is determined by a court of competent jurisdiction to be unjustified, it shall be deemed a termination for public convenience, and payment to the Contractor will be made as provided in Subsection (b) below.

(b) Termination for Public Convenience:

(1) General - Full or partial termination of the Contract shall not relieve the Contractor of responsibility for completed ~~portions of the~~or performed Work, or relieve the Contractor's Surety of the obligation for any just claims arising from the completed or performed Work.

(2) Mobilization - If mobilization is not a separate Pay Item, and payment is not otherwise provided for under the Contract, the Agency may pay the Contractor for mobilization expenses, including moving Equipment to and from the Project Site. If allowed, payment of mobilization expenses will be based on cost documentation submitted by the Contractor to the Engineer.

(3) All Other Work - The Agency shall pay the Contractor at the unit price for the number of Pay Item units of completed, accepted Work. For units of Pay Items partially completed, payment will be as mutually agreed, or, if not agreed, as the Engineer determines to be fair and equitable. No claim for loss of anticipated profits will be allowed. The Agency will purchase Materials left on hand according to 00195.80.

00195.80 Allowance for Materials Left on Hand:

(a) Purchase of Unused Materials - If Materials are delivered to the Project Site, or otherwise acceptably stored at the order of the Engineer, but not incorporated into the Work due to complete or partial elimination of Pay Items, changes in Plans, or termination of the Contract for public convenience according to 00180.90, and it is not commercially feasible for the Contractor to return them for credit or otherwise dispose of them on the open market; the Agency will purchase them according to the formula and conditions specified in Subsection (b) below.

(b) Purchase Formula and Conditions:

(1) Formula - The Agency will apply the following formula in determining the Contractor's allowance for Materials left on hand:

Contractor's Actual Cost, plus 5% Overhead Allowance, minus Advance Allowances under 00195.60, but no markup or profit.

(2) Conditions - The Agency will not purchase the Contractor's Materials left on hand unless the Contractor satisfies the following conditions:

- Requests the Agency's purchase of unused Materials;
- Shows acquisition of the Materials according to 00160.10;
- Shows that the Materials meet Specifications; and
- Provides receipts, bills and other records of actual cost of Materials delivered to the designated delivery points.

00195.90 Final Payment:

(a) Final Estimate - As soon as practicable after Final Inspection of the Project, as provided in 00150.90, the Engineer will prepare a final estimate of the quantities of the Pay Items ~~performed~~completed. With this estimate of quantities as a base, the total amount due the Contractor will be determined according to the terms of the Contract including without limitation any amounts due for Extra Work performed.

(b) Final Payment - The amount of final payment will be the difference between the total amount due the Contractor and the sum of all payments previously made. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.
After computation of the final amount due, and after Final Acceptance of the Project, final payment will be mailed to the Contractor's last known address as shown in the records of the Agency.

Beginning 30 Calendar Days after the date of Third Notification, interest will begin to accrue at the rate established by ORS 279C.570 on any money due and payable to the Contractor as final payment, determined as described above. No interest will be paid on money withheld due to outstanding amounts owed by the Contractor under the provisions of 00170.10.

(c) No Waiver of Right to Make Adjustment - The fact that the Agency has made any measurement, estimate, determination or certification either before or after completion of the Project, Final Acceptance, Agency assumption of possession of the Project Site, determination of satisfactory completion of Pay Items or Work or release of retainage under 00195.50(d) or payment for any part of the Work, shall not prevent either party from:

- Showing the true amount and character of the Work;
- Showing that any measurement, estimate, determination or certification is incorrect ~~(except for Agency verifications under 00195.50(d));~~;
- Recovering from the other party damages that may have been suffered because the other party failed to comply with the Contract.

00195.95 Error in Final Quantities and Amounts:

(a) Request for Correction of Compensation - If the Contractor believes the quantities and amounts detailed in the final Contract payment voucher, prepared by the Engineer according

to 00195.90, to be incorrect, the Contractor shall submit an itemized statement to the Engineer detailing all proposed corrections.

This statement must be submitted to the Engineer within 90 Calendar Days from the date the voucher was mailed to the Contractor, according to 00195.90(b). Any request for compensation not submitted and supported by an itemized statement within the 90 Calendar Day period will not be paid by the Agency. This does not limit the application of Section 00199.

(b) Acceptance or Rejection of Request:

(1) Consideration of Request - The Engineer will consider and investigate the Contractor's request for correction of compensation submitted according to 00195.95(a), and will promptly advise the Contractor of acceptance or rejection of the request in full or in part.

(2) Acceptance of Request - If the Engineer accepts the Contractor's request(s) in full or in part, the Engineer will prepare a post-final Contract payment voucher, including all accepted corrections, and will forward it to the Contractor.

(3) Rejection of Request - If the Engineer rejects the request(s) in full, the Engineer will issue a written notice of rejection and mail it to the Contractor.

(4) Contractor Objection to Revised Voucher or Notice of Rejection - If the Contractor disagrees with the revised voucher or notice of rejection, the Contractor may request review according to the procedure specified in 00199.40. If the Contractor fails to submit a request for 00199.40 review within 30 Calendar Days after the Engineer mails a post-final Contract payment voucher or notice of rejection, the Contractor waives all rights to a claim based on errors in quantities and amounts.

If the Engineer rejects the Contractor's request on the basis that the issue was not one that qualified for treatment under this Section, no review according to 00199.40 will be allowed.

Section 00196 - Payment for Extra Work

Description

00196.00 General - Only work not included in the Contract as awarded but deemed by the Engineer to be necessary to complete the Project (see 00140.60) will be paid as Extra Work. Regardless of alterations and changes, any item of Work provided for in the Contract will not constitute Extra Work. Payment for alterations and changes to Work will be made according to 00195.20.

Compensation for Extra Work will be paid only for Work authorized in writing by the Engineer and performed as specified. Work performed before issuance of the Engineer's written authorization shall be at the Contractor's risk. Extra Work will be paid as determined by the Engineer, according to 00196.10 and 00196.20.

Provisions and Requirements

00196.10 Negotiated Price - If the Engineer can reasonably determine a price estimate for Extra Work, the Engineer may then give written authorization to the Contractor to begin the Extra Work. As soon as practicable, but within 10 Calendar Days after that authorization, the Contractor shall respond in writing to the Engineer's Extra Work price estimate by submitting to the Engineer an Extra Work price quote. The price quote shall detail the following items related to the Extra Work:

- Types and amounts of Materials
- Hours of Equipment use and hours of labor
- Travel
- Overhead and profit
- Other costs associated with the proposed Extra Work

Pending approval of the price quote, the Engineer will maintain force account records of the Extra Work. As soon as practicable, but within 10 Calendar Days of receipt of a properly supported price quote, the Engineer will review the price quote and advise the Contractor if it is accepted or rejected. The Engineer will not accept a price quote that cannot be justified on a Force Account basis. If the Contractor's price is accepted, the Engineer will issue a Change Order, and the Extra Work will be paid at the accepted price.

00196.20 Force Account - If the Engineer and the Contractor cannot agree on a price for the Extra Work, the Engineer may issue a Force Account Work order requiring the Extra Work to be paid as Force Account Work. Force Account Work records and payment will be made according to Section 00197.

Section 00197 - Payment for Force Account Work

Force Account Work

00197.00 Scope - The Materials, Equipment and labor rates and procedures established in this Section apply ~~only~~ to Extra Work ordered by the Engineer to be performed as Force Account Work. ~~These~~With the exceptions identified in 00197.01(b), these rates ~~do not~~and procedures also apply to ~~any~~ other Work ~~performed under the Contract.~~when according to other Sections this Section 00197 applies, including without limitation the following:

- 00140.70 - Cost Reduction Proposals
- 00195.20 - Changes to Plans or Character of Work
- 00195.30 - Differing Site Conditions
- 00199.30(b) - Claims Requirements

00197.01 General:

(a) Extra Work on a Force Account Basis - Before ordering Force Account Work, the Engineer will discuss the proposed work with the Contractor, and will seek the Contractor's comments and advice concerning the formulation of Force Account Work specifications. The Engineer is not bound by the Contractor's comments and advice, and has final authority to:

- Determine and direct the Materials, Equipment and labor to be used on the approved Force Account Work; and
- Determine the time of the Contractor's performance of the ordered Force Account Work.

If the Engineer orders the performance of Extra Work as Force Account Work, the Engineer will record, on a daily basis, the Materials, Equipment, labor, and Special Services used for the Force Account Work during that day. The Engineer and the Contractor shall sign the record daily to indicate agreement on the Materials, Equipment, labor, and Special Services used for the Force Account Work performed on that day.

The following shall be reflected on the daily record:

- Materials used in the Force Account Work as directed by the Engineer, except those furnished and paid under rental rates for use of Equipment;
- Equipment which the Engineer considers necessary to perform the Force Account Work. Equipment hours will be recorded to the nearest quarter hour;
- Labor costs, including that of Equipment operators and supervisors in direct charge of the specific operations while engaged in the Force Account Work;
- Special Services; and
- The Engineer's and Contractor's signatures confirming its accuracy.

(b) Other Work - When according to other Sections this Section 00197 applies, the following exceptions apply to the Work under those other Sections, except for Extra Work ordered by the Engineer to be performed as Force Account Work.

- 00197.01(a) does not apply.
- Cost Efficiency - Agency will not be responsible for additional costs that are a direct or indirect result of the Contractor's inefficient means and methods or that reasonably could have been avoided if the Materials, Equipment, labor or services had been obtained at a more commercially reasonable cost.

- Standby Time - Equipment that is necessary for the Work but is not being operated to progress the Work will be considered to be on standby and will be limited to the standby rates and hour limitations in 00197.20(e). Equipment costs will be limited to a combination of operating time and standby time of not more than 8 hours in a 24 hour period or 40 hours in a 1 week period. The Equipment must be onsite and available for use to be eligible for standby time.

  For a period of 7 or fewer Calendar Days: If a continuous period of standby time for a piece of Equipment does not exceed 7 Calendar Days, the accumulated standby cost for that continuous period of standby time shall be limited to the standby rates and hour limitations in 00197.20(e).

  For a period of more than 7 Calendar Days: Unless the Engineer has otherwise agreed in advance in writing, if a continuous period of standby time for a piece of Equipment exceeds 7 Calendar Days, the accumulated standby cost shall be limited to:

  - For the first 7 Calendar Days, the standby rates and hour limitations in 00197.20(e), and
  - For the portion of the continuous period of standby time after the first 7 Calendar Days, the lesser of:
    - The standby rates and hour limitations in 00197.20(e); or
    - The cost for moving that piece of Equipment to and from the Project Site according to 00197.20(d).

00197.10 Materials:

(a) General - The Contractor will be paid for Materials actually used in the Force Account Work as directed by the Engineer, except for those furnished and paid for under rental rates included with the use of Equipment. Payments will be at actual cost, including transportation costs to the specified location, from the supplier to the purchaser, whether the purchaser is the Contractor, a Subcontractor, or other forces. All costs are subject to the provisions of this Subsection.

(b) Trade Discount - If a commercial trade discount is offered or available to the purchaser, it shall be credited to the Agency, even though the discount may not have actually been taken. The Agency will not take any discounts for prompt or early payment, whether or not offered or taken.

(c) Not Directly Purchased From Supplier - If Materials cannot be obtained by direct purchase from and direct billing by the supplier, the cost shall be considered to be the price billed to the purchaser less commercial trade discounts, as determined by the Engineer, but not more than the purchaser paid for the Materials. No markup other than actual handling costs will be permitted.

(d) Purchaser-Owned Source - If Materials are obtained from a supply or source wholly or partly owned by the purchaser, the cost shall not exceed the price paid by the purchaser for similar Materials furnished from that source on Pay Items, or the current wholesale price for the Materials delivered to the Project Site, whichever is lower.

00197.20 Equipment:

(a) General - Equipment approved by the Engineer to perform the Force Account Work will be eligible for payment at the established rates only during the hours it is operated or on standby if so ordered by the Engineer. Equipment hours will be recorded on the daily record to the nearest quarter hour.

Except as modified by these provisions, Equipment use approved by the Engineer will be paid at the rental rates given in the most current edition of the Rental Rate Blue Books for Construction Equipment ("Blue Book"), Volumes 1, 2, and 3, published by Penton Media, Inc., and available from EquipmentWatch (phone 1-800-669-3282).

(b) Equipment Description - On the billing form for Equipment costs, the Contractor shall submit to the Engineer sufficient information for each piece of Equipment and its attachments to enable the Engineer to determine the proper rental rate from the Blue Book.

(c) Rental Rates (without Operator):

(1) Rental Rate Formula - Rental rates for Equipment will be paid on an hourly basis for Equipment and for attachments according to the following formula:

$$\text{Hourly Rate} = \frac{\dfrac{\text{Monthly Base Rate x Rate Adjustment Factor}}{\text{176 hours/month}}}{\text{176 hours/month}} + \text{Hourly Operating Rate}$$

Some attachments are considered "standard Equipment" and are already included in the monthly base rate for the Equipment. That information can be obtained from EquipmentWatch.

(2) Monthly Base Rate - The monthly base rate used above for the machinery and for attachments represents the major costs of Equipment ownership, such as depreciation, interest, taxes, insurance, storage, and major repairs.

(3) Rate Adjustment Factor - The rate adjustment factor used above will be determined as per page iii of each section of the Blue Book.

(4) Hourly Operating Rate - The hourly operating rate used above for the machinery and for attachments represents the major costs of Equipment operations, such as fuel and oil, lubrications, field repairs, tires or ground engaging components, and expendable parts.

(5) Limitations - The Blue Book "Regional Adjustment Factor" shall not apply.

If multiple attachments are included with the rental Equipment, and are not considered "standard Equipment", only the attachment having the higher rental rate will be eligible for payment, provided the attachment has been approved by the Engineer as necessary to the Force Account Work.

Rental will not be allowed for small tools that have a daily rental rate of less than $5, or for unlisted Equipment that has a fair market value of $400 or less.

The above rates apply to approved Equipment in good working condition. Equipment not in good working condition, or larger than required to efficiently perform the work, may be rejected by the Engineer or accepted and paid for at reduced rates.

(d) Moving Equipment - If it is necessary to transport Equipment located beyond the Project Site exclusively for Force Account Work, the actual cost to transport the Equipment to, and return it from, its On-Site Work location will be allowed as an additional item of expense. However, the return cost will not exceed the original delivery cost. These costs will not be allowed for Equipment that is brought to the Project Site for Force Account Work if the Equipment is also used on Pay Item or related Work.

If transportation of such Equipment is by common carrier, payment will be made in the amount paid for the freight. No markups will be allowed on common carrier transportation costs. If the Equipment is hauled with the Contractor's own forces, transportation costs will include the rental rate of the hauling unit and the hauling unit operator's wage. If Equipment is transferred under its own power, the rental rate allowed for transportation time will be 75% of the appropriate hourly rate for the Equipment, without attachments, plus the Equipment operator's wage.

(e) Standby Time - If ordered by the Engineer, standby time will be paid at 40% of the hourly rental rate calculated according to this Subsection, excluding the hourly operating rate. Rates for standby time that are calculated at less than $1 per hour will not be paid. Payment will be limited to not more than ~~eight~~ 8 hours in a 24-hour period or 40 hours in a ~~one~~ 1 week period.

(f) Blue Book Omissions - If a rental rate has not been established in the Blue Book, the Contractor may:

- If approved by the Engineer, use the rate of the most similar model found in the Blue Book, considering such characteristics as manufacturer, capacity, horsepower, age and fuel type;
- Request EquipmentWatch to furnish a written response for a rental rate on the Equipment, which shall be presented to the Engineer for approval; or
- Request that the Engineer establish a rental rate.

(g) Outside Rental Equipment - If Contractor-owned or Subcontractor-owned Equipment is not available, and Equipment is rented from outside sources, payment will be based on the actual paid invoice.

If the invoice specifies that rental rate does not include fuel, lubricants, field repairs, and servicing, an amount equal to the Blue Book hourly operating cost may be added for those items that were excluded.

The Agency may reduce the payment when the invoice amount plus allowance is higher than the amount authorized under (c) through (f) of this Subsection.

The provisions of 00180.20(c) apply to owner-operated Equipment.

00197.30 Labor - The Contractor will be paid for all labor engaged directly on Force Account Work, including Equipment operators and supervisors in direct charge of the specific force account operations~~.~~, as follows:

~~**(a) Standard Calculation** - The hourly amount paid to the Contractor for each employee engaged on Force Account Work will be two times the actual base hourly wage (excluding fringe benefits, vacation, and all other direct or indirect costs including subsistence) paid to the employee for:~~

~~**(1)** Work under each Force Account Work order, up to an accumulated total value for labor under that order of $10,000; and~~

~~**(2)** Workers whose work class has an industrial accident insurance rate of 25% or less as determined by the National Council on Compensation Insurance (NCCI) for the assigned risk pool for the appropriate worker class.~~

~~This amount paid to the Contractor will be full compensation for all costs associated with labor on Force Account Work including wages, fringe benefits, vacation, insurance, markup and other direct or indirect costs except for per diem costs. If per diem is paid to workers for similar Pay Item Work, per diem costs will be paid on an actual cost basis for the Force Account Work. The markup described in 00197.80 will not be added, except that the supplemental markup for Force Account Work performed by Subcontractors will be allowed.~~

~~**(b) Work Value for Labor over $10,000 or NCCI Rate over 25%** - After the accumulated value of labor performed under a Force Account Work order exceeds either 00197.30(a-1) or 00197.30(a-2), payment for Force Account Work labor will be calculated as follows:~~

(~~1~~(a) Wages - The actual wages paid to laborers and supervisors, if those wages are paid at rates not more than those for comparable labor currently employed on the Project, or at the recognized, current, prevailing rates in the locality of the Project.

(~~2~~b) Required Contributions - The actual cost of industrial accident insurance, unemployment compensation contributions, payroll transit district taxes, and social security for old age assistance contributions incurred or required under statutory law and these Specifications. The actual cost of industrial accident insurance is the National Council on Compensation Insurance (NCCI) rate for the assigned risk pool for the appropriate work class multiplied by the experience modification factor for the Contractor.

(~~3~~c) Required Benefits - The actual amount paid to, or on behalf of, workers as per diem and travel allowances, health and welfare benefits, pension fund benefits, or other benefits~~,~~ when such ~~amounts~~other benefits are required by a collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Project~~.~~.

~~The cost of labor calculated under this Subsection will also be subject to the applicable markups in 00197.80.~~

00197.40 Invoices for Special Services - Invoices for Special Services that reflect current market pricing may be accepted without complete itemization of Materials, Equipment, and labor costs, if the itemization is impractical or not customary. The invoice for Special Services shall show credit for commercial trade discounts offered or available.

No percentage markup will be allowed other than that specified in 00197.80.

00197.80 Percentage Allowances - To the Contractor's actual costs incurred, as limited in this Section 00197, amounts equal to a percentage markup of such costs will be allowed and paid to the Contractor as follows:

Subsection	Percent
00197.10 Materials	17
00197.20 Equipment	17
00197.30~~(b)~~ Labor	22
00197.40 Special Services	17

When a Subcontractor performs ordered Force Account Work, the Contractor will be allowed a supplemental markup of 8% on each Force Account Work order.

These allowances made to the Contractor will constitute complete compensation for overhead, general and administrative expense, profit, and all other Force Account Work costs that were incurred by the Contractor, or by other forces that the Contractor furnished. No other reimbursement, compensation, or payment will be made.

00197.90 Billings - Billings for Force Account Work by the Contractor shall be submitted for the Engineer's approval on forms provided by the Agency or approved by the Engineer. Billings for Materials (other than Incidental items out of the inventory of the Contractor or Subcontractors), rental Equipment from sources other than the Contractor or Subcontractors, and Special Services, shall be accompanied by copies of invoices for the goods and services. The invoices shall be fully itemized showing dates, quantities, unit prices, and complete descriptions of goods and services provided. Invoices for amounts of $10 or less per invoice are not required, unless requested by the Engineer.

Costs included on the billings shall comply with ~~the guidelines of~~00197.01(a) and 00197.10 through 00197.40.

When a billing for Force Account Work has been paid at the Project level, no further corrections will be made because of further review if those corrections amount to less than $10.

Section 00199 - Disagreements, Protests, and Claims

Description

00199.00 General - This Section details the process through which the parties agree to resolve any disagreement concerning additional compensation or concerning a combination of additional compensation and Contract Time. (See 00180.80 for disagreements and claims concerning additional Contract Time only, and 00195.95 for disagreements and claims concerning correction of final compensation.) The Agency will not consider direct disagreements, protests, or claims from ~~Subcontractors, Materials suppliers~~subcontractors, Suppliers, or any other Entity not a party to the Contract.

Provisions and Requirements

00199.10 Procedure for Resolving Disagreements - When disagreements occur concerning additional compensation or a combination of additional compensation and Contract Time, the Contractor shall first pursue resolution through the Engineer of all issues in the dispute, including without limitation the items to be included in the written notice in 00199.20. If the discussion fails to provide satisfactory resolution of the disagreement, the Contractor shall follow the protest procedures outlined in 00199.20. If the Engineer denies all or part of the Contractor's protest, and the Contractor desires to further pursue the issues, the Contractor shall submit a claim for processing according to 00199.30.

00199.20 Protest Procedure - ~~If~~If the Contractor disagrees with anything required in a Change Order or other written or oral order from the Engineer, including any direction, instruction, interpretation, or determination, or if the Contractor asserts a disagreement or dispute on any other basis, except 0195.95, that, in the Contractor's opinion, entitles or would entitle the Contractor to additional compensation or a combination of compensation and Contract Time, the Contractor shall do all of the following in order to pursue a protest and preserve its claim:

(a) Oral Notice - Give oral notice of protest to the Engineer and outline the areas of disagreement before starting or continuing the protested Work.

(b) Written Notice - File a proper written notice of protest on form 734-2887 with the Engineer within ~~seven~~ 7 Calendar Days after receiving the protested order. In the notice the Contractor shall:

- Describe the acts or omissions of the Agency or its agents that allegedly caused or may cause damage to the Contractor, citing specific facts, persons, dates and Work involved;
- Describe the nature of the damages;
- Cite the specific Contract provision(s) that support the protest;
- Include the estimated dollar cost, if any, of the protested Work, and furnish a list of estimated Materials, Equipment and labor for which the Contractor might request additional compensation; and
- If additional compensation is estimated to be due, include the estimated amount of additional time required, if any.

~~The Engineer has no responsibility to evaluate the protest unless the Contractor has timely filed a proper notice submitting all of the above information.~~ Failure to comply with ~~this~~these notice ~~requirement~~requirements renders the notice improper.

(c) Records - Keep complete records of all costs and time incurred throughout the protested Work, and allow the Engineer access to those and other supporting records. Provide daily

records of protested Work, on a weekly basis, on a schedule to be set by agreement with the Engineer.

(d) Comparison of Records - Provide the Engineer adequate facilities for keeping cost and time records of the protested Work. The Contractor and the Engineer will compare records and either bring them into agreement at the end of each day, or record and attempt to explain any differences.

(e) Work to Proceed - In spite of any protest, proceed promptly with the Work ordered by the Engineer.

(f) Evaluation of Protest - The Engineer ~~has no responsibility for evaluating a protest that is not timely filed, or for which adequate supporting documentation has not been kept. Provided the procedures above are followed, the Engineer will~~ will promptly evaluate all protests ~~and, if~~, after the Contractor has fully complied with the requirements described in 00199.20(b). If the protest is denied, ~~advise~~the Engineer will notify the Contractor in writing of the reasons for full or partial denial. If a protest is found to be valid, the Engineer will, within a reasonable time, make an equitable adjustment of the Contract. Adjustment of time will be evaluated according to 00180.80.

The Engineer has no responsibility for evaluating and may reject a protest that does not comply with 00199.20(b). If the protest is rejected, the Engineer will notify the Contractor in writing of the reasons for rejection.

(g) Protest Evaluation by Third Party Neutral - If the Engineer agrees that the Contractor has fully complied with the requirements described in 00199.20(b), and if the Engineer fully or partially denies, in writing, the Contractor's protest according to 00199.20(f), the Contractor may request that a mutually selected Third Party Neutral review the protest. Procedures for selecting, using, and paying for the cost of the Third Party Neutral will be specified by Change Order.

If the Contractor does not accept the Engineer's evaluation of the protest, or either the Contractor or Engineer disagrees with the resolution recommended by the Third Party Neutral, the Contractor may pursue a claim as described in 00199.30.

00199.30 Claims Procedure:

(a) General - If the Contractor believes that additional compensation is due, or a combination of additional compensation and Contract Time, and has pursued and exhausted all the procedures provided in 00199.10 and 00199.20 to resolve a disagreement and protest, the Contractor may file a claim.

The Agency's Contract is with the Contractor. There is no contractual relationship between the Agency and any ~~Subcontractor.~~subcontractors, Suppliers or any Entity other than the Contractor. It is the Contractor's responsibility to fully ~~analyze~~evaluate any claim before presenting it to the Agency. In addition, when a claim includes Work done or costs incurred by ~~a Subcontractor, Materials supplier~~any subcontractors, Suppliers, or any Entity other than the Contractor, the Contractor remains solely responsible for presenting the claim to the Agency.

Claims that include Work done or costs incurred by any subcontractors, Suppliers, or any Entity other than the Contractor will not be considered by the Agency unless the Contractor has:

- Completed and provided its own written ~~analysis and~~ evaluation of the claim; ~~and~~
- Verified by its own independent review and ~~analysis~~ evaluation of the amount of compensation sought~~.~~; and

- Certified the claim in accordance with 00199.30(b) (Part 10).

(b) Claims Requirements - At any time during the progress of the Work, but not later than ~~15~~ 45 Calendar Days following the date of the Second Notification, the Contractor shall submit to the Engineer in writing, claims for additional compensation or a combination of additional compensation and Contract Time additional to that specified in the Contract. For a claim not submitted within the ~~15~~ 45 day limit, that has not met the requirements of 00199.20, or is not filed as provided in 00199.30, the Contractor waives any claim for additional compensation or for additional compensation and Contract Time, and the Agency may reject the claim.

Written claims to the Engineer or the Agency by the Contractor shall be delivered to the Agency address shown in the Special Provisions, unless a different address is agreed to by the Engineer, and shall be delivered:

- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested); or
- By overnight delivery service of a private industry courier.

Claims will be considered as having been received by the Agency:

- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or
- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

The Agency reserves the right at any time and at any step in the claim decision or review process to request additional information, records or documentation related to the claim or the Contract either directly or through agents working toward resolution of the disputed or claimed events and issues.

Claims shall be made in writing, and shall include all information, records and documentation necessary for the Agency to properly and completely evaluate the claim.

To be considered, claims for additional compensation, or for additional compensation and Contract Time, shall be completed according to 00199.30 and shall be submitted with the required information and in the format below and labeled as required below for each claimed issue:

(Part 1) ~~Executive summary~~Summary (label page 1.1 through page 1~~.?)~~.X) - In the ~~Executive~~ summary, include a detailed, factual statement of the claim for additional compensation and Contract Time, if any, with necessary dates and locations of Work involved in the claim~~,~~ and the dates of when the event arose~~, and when notice was given to the Agency~~. Also include detailed facts supporting the Contractor's position relative to the Engineer's decision (see 00199.20(f));

(Part 2) Proof of notice (label page 2.1 through page 2.X) - Submit a copy of form 734-2887, with all attachments, that was given to the Agency. Include the date when that written notice and the date when oral notice was given:

(Part 3) Copies of the Contract Specifications that support the Contractor's claim (label page ~~2~~ 3.1 through page ~~2.?);~~3.X);

(Part ~~3~~4) Theory of entitlement supporting the claim (label page ~~3~~4.1 through page ~~3.?)~~4.X) - Include a narrative of how or why the specific Contract Specifications support the claim and a statement of the reasons why such Specifications support the claim;

(Part ~~4~~5) Itemized list of claimed amounts (label page ~~4~~5.1 through page ~~4.?)~~5.X) - Claimed damages that resulted from the event with a narrative of the theories and records and documents used to arrive at the value of the damages;

(Part ~~5~~6) Additional Contract Time requests (label page ~~5~~6.1 through page ~~5.?)~~6.X) - If the claim is for a combination of additional compensation and Contract Time, submit a copy of the schedule that was in effect when the event occurred and a detailed narrative which explains how the event impacted Contract Time. In addition, if an Agency-caused delay is claimed:

- Include the specific days and dates under claim;
- Provide detailed facts about the specific acts or omissions of the Agency that allegedly caused the delay, and the specific reasons why the resulting delay was unreasonable; and
- ~~A~~Provide a schedule ~~analysis~~evaluation that accurately describes the impacts of the claimed delay~~;~~.

~~(~~Also see 00180.80 for additional requirements regarding claims for Contract Time and causes that are eligible and ineligible for consideration~~.);~~:

(Part ~~6~~7) Copies of actual expense records (label page ~~6~~7.1 through page ~~6.?)~~7.X) - Include documents that contain the detailed records and which support and total to the exact amount of additional compensation sought. Include the information and calculations necessary to support that amount. That amount may be calculated on the basis of Section 00197, if applicable, or may be calculated using direct and indirect costs presented in the following categories:

- Direct Materials;
- Direct Equipment. The rate claimed for each piece of Equipment shall not exceed the actual cost. In the absence of actual Equipment costs, the Equipment rates shall not exceed 75~~%~~ percent of those calculated under the provisions of 00197.20. For each piece of Equipment, the Contractor shall include a detailed description of the Equipment and attachments, specific days and dates of use or standby, and specific hours of use or standby;
- Direct labor;
- Job overhead;
- General and administrative overhead; and
- Other categories as specified by the Contractor or the Agency;

(Part ~~7~~8) Supporting records and documents (label page ~~7~~8.1 through page ~~7.?)~~8.X) - Include copies of, or excerpts from the following:

- Any documents that support the claim, such as manuals standard to the industry and used by the Contractor; and
- Any daily reports or diaries related to the event, photographs or media that help explain the issue or event (optional), or all other information the Contractor chooses to provide (optional);

~~**(Part 8)** Contractor evaluation of a lower tier claim (label page 8.1 through 8.?) - If the claim includes Work done or costs incurred by a Subcontractor, Materials supplier, or any Entity other than the Contractor, the following are required:~~

- ~~Data required by the other Subsections of 00199.30(b);~~
- ~~Copy of the Contractor's separate analysis and evaluation;~~
- ~~Copy of the Contractor's independent review and analysis of the amount of damages sought; and~~

(Part 9) Certification (label page 9.1 through 9~~.?)~~.X) - A certified statement, signed by a person authorized to execute Change Orders, by the Contractor, ~~Subcontractor~~subcontractor, Supplier, or ~~Materials supplier, as appropriate~~Entity, originating the claim, as to the validity of facts and costs ~~containing~~with the following ~~language~~certification:

Under penalty of law for perjury or falsification, the undersigned, (Name), (Title), (Company) certifies that this claim for additional compensation for Work on the Contract is a true statement of the actual costs incurred (in the amount of $_____, exclusive of interest) and is fully documented and supported under the Contract between the parties.

Signature: _____

Date: _____, 20___

Subscribed and sworn before me this ____ day of _____, _____, 20___

_____

_____

Notary Public

My commission expires _____.

(Part 10) Contractor evaluation of a lower tier claim (label page 10.1 through 10.X) - If the claim includes Work done or costs incurred by any subcontractors, Suppliers, or any Entity other than the Contractor, the following are required:

- Data required by the other Subsections of 00199.30(b);
- Copies of the Contractor's, subcontractor's, Supplier's and Entity's, at all tiers above the level of which the claim originates, separate evaluation of entitlement;
- Copies of the Contractor's, subcontractor's, Supplier's and Entity's, at all tiers above the level of which the claim originates, independent verification and evaluation of the amount of damages sought; and
- A person authorized to execute Change Orders on behalf of the Contractor, subcontractor, Supplier and Entity, at all tiers above the level of which the claim originates, must ~~countersign this~~ sign a statement~~.~~ with the following certification:

~~Claims shall be made in writing, and shall include all information necessary for the Agency to properly and completely analyze the claim. All pages shall have page numbers and be marked with the numbering system shown above. The Agency reserves the right at any time to request additional information related to the claim or the Contract either directly or through Agents working toward resolution of the disputed or claimed events and issues.~~

~~**(c) Records Required** - The Contractor shall keep full and complete records of the actual costs incurred for the submitted claim. These records shall include all worksheets used to prepare the claim establishing the cost components for items of the claim.~~

~~**(d) Access to Records** - The Contractor shall provide the Engineer access to all Contractor records required to determine the facts, contentions, and costs involved in the claim. The Engineer may perform an audit of these records. The Contractor shall retain all Contract records for a period of at least three years after Final Acceptance of the Project by the Agency, or until all disputes, including litigation, if any, are resolved (the "record retention period"). The Agency and/or its agents shall be provided full access to all Contract records during the record retention period.~~

(e*Under penalty of law for perjury or falsification, the undersigned, (Name) (Title), (Company) certifies that this claim originating from the subcontractor, Supplier or Entity (Company) for additional compensation for Work on the Contract is a reasonable statement, independently verified, of the costs incurred (in the amount of $_____, exclusive of interest) and is fully documented and supported under the Contract between the parties.*

Signature: _____

Date: _____, 20___

Subscribed and sworn before me this _____ day of _____, 20__

_____

Notary Public

My commission expires _____.

If the Engineer determines that additional information, records or documentation is needed to allow proper evaluation of the claim submittal, the Engineer will request the information, records or documentation. The Contractor shall submit to the Engineer within 14 Calendar Days, or as otherwise agreed by the parties, the required additional information, records and documentation.

If the Engineer determines that the claim submittal with the additional information, records and documentation submitted is incomplete and not accepted as a claim, the Engineer will notify the Contractor in writing and the submittal will be rejected and will not be considered under 00199.40.

(c) Records Requirements - The Contractor shall comply with 00170.07.

(d) Compliance Required - Full compliance by the Contractor with the provisions of this Section is a condition precedent to the commencement of any lawsuit by the Contractor to enforce any claim.

00199.40 Claim Decision; Review; Exhaustion of Administrative Remedies - The Agency intends to resolve all claims at the lowest possible administrative level. The Engineer will also determine whether multiple claims should be advanced separately or together.

If the Engineer denies the claim for additional compensation or a combination of additional compensation and Contract Time, in full or in part, according to 00199.40(a), the Contractor may request review of the denial. The disputed claim for additional compensation or a combination of additional compensation and Contract Time may then be resolved, in full or in part, at any of the four progressive steps of claim review procedure as specified in (b) through (e) of this Subsection.

If the Engineer has denied a claim, in full or in part, for Contract Time only according to 00180.80, or has denied a claim, in full or in part, for correction of final compensation according to 00195.95, those disputed claims may then be resolved, in full or in part, at any of the four progressive steps of claim review procedure as specified in (b) through (e) of this Subsection.

A person authorized by the Contractor to execute Change Orders on behalf of the Contractor must be present and attend all claim hearings. For all claims, all of the actions and review under each step of the review process shall occur before the review can be advanced to the next higher step.

~~If, at any step in the claim decision or review process, the Contractor fails to promptly submit requested information or documentation that the Agency deems necessary to analyze the claim, the Contractor is deemed to have waived its right to further review, and the claim will not be considered properly filed and preserved.~~

The Engineer may determine to skip the Step 1: Region Level Review, in which case the claim or claims will advance to Step 2: Agency Level Review.

(a) Decision by the Engineer - The Engineer will, as soon as practicable, consider, investigate, and evaluate a Contractor's claim for additional compensation, or for a combination of additional compensation and Contract Time, if submitted as required by 00199.30.

Once the Engineer determines the Agency is in receipt of a properly submitted claim, the Engineer will arrange a meeting, within 21 Calendar Days or as otherwise agreed by the parties, with the Contractor in order to present the claim for formal review and discussion.

If the Engineer determines that the Contractor must furnish additional information, records or documentation ~~is needed~~ to allow proper ~~analysis~~evaluation of the claim, the ~~Contractor shall meet with the~~ Engineer will schedule a second meeting, to be held within 14 Calendar Days~~,~~ or as otherwise agreed by the parties, ~~to~~at which the Contractor shall present the ~~additional~~requested information~~ or~~ , records and documentation~~, or make other arrangements with the Engineer to supply that material~~.

The Engineer will ~~advise the Contractor of the~~provide a written decision to ~~accept or deny the claim, and the reasons for any full or partial denial of the claim,~~ the Contractor within 30 ~~Calendar Days of receipt of the Contractor's claim, or the receipt of requested additional information or documentation regarding~~ Calendar Days of the ~~claim, whichever is later, unless the Engineer and Contractor have agreed upon a longer response time.~~ last Engineer-level meeting.

If the Contractor does not accept the Engineer's decision, the Contractor may, within 10 Calendar Days of receipt of the written decision, request in writing that the Engineer arrange a review at Step 1 (see (b) below).

(b) Step 1: Region Level Review - The Contractor shall request that the Engineer arrange a meeting with the Region-level reviewer in order to present the denied or partially denied claim for formal review and discussion. The meeting will take place within 21 Calendar Days of the Agency's receipt of the request, or as otherwise agreed by the parties.

If the Region-level reviewer determines that the Contractor must furnish additional information, records or documentation to allow proper ~~analysis~~evaluation of the claim, the reviewer will schedule a second meeting, to be held within 14 Calendar Days, or as otherwise agreed by the parties, at which the Contractor shall present the requested information~~ or~~, records and documentation.

The Region-level reviewer will provide a written decision to the Contractor within 30 Calendar Days of the last Region-level meeting.

If the Contractor does not accept the Step 1 decision, the Contractor may, within 10 Calendar Days of receipt of the written decision, request in writing that the Engineer arrange a review at Step 2 (see (c) below).

(c) Step 2: Agency Level Review - The Contractor shall request a meeting with the Contract Administration Engineer~~,~~ (CAE) to present the claim for final Agency review. The presentation will take place within 21 Calendar Days of the Agency's receipt of the Contractor's written request, or as otherwise agreed by the parties.

If the ~~Contract Administration Engineer~~CAE determines that the Contractor must furnish additional information, records or documentation to allow proper ~~analysis~~evaluation of the claim,

the ~~Contract Administration Engineer~~CAE will schedule a second meeting~~,~~ to be held within 14 Calendar Days or as otherwise agreed by the parties, at which the Contractor shall present the requested information ~~or~~, records and documentation.

The ~~Contract Administration Engineer~~claim is subject to 00199.60, if not all of the records requested by the CAE were furnished.

The CAE will provide a written decision to the Contractor, subject to 00199.60, if applicable, regarding the claim within 30 Calendar Days of the final Step 2 meeting.

If the Contractor does not accept the Step 2 decision, the Contractor may, within 10 Calendar Days of receipt of the written decision, request in writing through the Engineer that the claim be advanced to Step 3 or 4 (see (d) and (e) below), as applicable. For purposes of determining which process to use for claims under Step 3 or 4 concerning a combination of additional compensation and Contract Time or for Contract Time only, the value of the claim or portion of the claim for Contract Time will be assumed to be the appropriate Liquidated Damages given in 00180.50 of the Special Provisions multiplied by the number of Calendar Days in question. If applicable, advancement of the claim is subject to the provisions of 00199.60 regarding waiver and dismissal of the claim or portions of the claim.

(d) Step 3: Arbitration; Claims Review Board:

(1) Claims Less Than $~~25~~50,000 - At this step, the claim will be resolved by binding arbitration before a single arbitrator according to the Construction Industry Arbitration Rules of the American Arbitration Association or such other arbitration service and rules as agreed by the parties.

Arbitration filing costs and any arbitrator's fees will be divided equally between the Agency and the Contractor.

(2) Claims of $~~25~~50,000 to $~~250~~500,000 - At this step, the Contractor shall present the claim to a Claims Review Board (referred to as "Board") for consideration, review and recommended resolution. The Board will be comprised of three persons. ODOT will establish and maintain, in consultation with representatives of the construction industry, a panel of more than 12 qualified individuals available to serve on Boards.

If a claim within the scope of this step is properly referred for Board consideration and review, copies of biographies of all persons on the panel will be sent to the Contractor. Within 20 Calendar Days after the biographies are mailed, the Contractor and the Engineer shall each nominate, in writing, three individuals from the panel available to serve on the Board. ~~Each party shall affirm the availability of its nominees.~~

Within 10 Calendar Days after receipt of the nominations, the Contractor and the Engineer shall (a) each appoint to the Board one of the three ~~nominated~~individuals by the other, and (b) inform each other of the appointment~~, and (c) advise their three nominees, in writing, of the appointments.~~. The two appointees, now Board Members, shall select ~~one of the remaining members of~~an individual from the panel to serve as the third Board ~~Chair.~~ Member.

If the two ~~appointees~~Board Members cannot agree on the selection of the third Board ~~Chair~~Member, the Circuit Court in the county in which the Agency's main office is located will resolve the dispute. In this event, the Engineer will act through the Agency's legal counsel to request the Circuit Court to ~~appoint one of the remaining members of the panel to serve as~~select an individual from the panel to serve as the third Board Member. Once the three Board Members have been selected, the three Board Members will decide which of the three will be the Board Chair.

The Board may request the Engineer to designate a person not associated with the Contract to act as the recording secretary for the Board. The recording secretary is not a Board member, and will only assist the Board with administrative tasks related to its consideration and review of the referred claim.

The Agency and the Contractor will equally share the costs of the Board members. The Agency will pay the costs of the Board's recording secretary.

Members of the Board are to act impartially and independently in the consideration of facts and conditions surrounding the dispute. Board recommendations concerning the dispute are considered advisory only, shall not be binding on either party, and shall not constitute evidence in any legal proceeding for any reason.

The Board will schedule and conduct an informal hearing at which the Contractor and the Agency will each have an opportunity to present evidence and argument. The Contractor and the Agency shall each submit a brief written summary of the claim to each Board member and the other party at least 10 Calendar Days before the hearing. Unless directed otherwise by the Board Chair, the summary shall include, for each issue under dispute:

- A short statement describing the disputed issue;
- A short position statement by the party on the issue;
- A clear and concise explanation of the contractual basis for that position, including specific reference to Contract Documents;
- A clear and concise description of the costs claimed for each issue, including without limitation specific documents demonstrating productivity, time and costs; and
- Exhibits, including without limitation copies of plan sheets, extracts from the Standard Specifications~~, Supplemental Specifications,~~ and Special Provisions, correspondence, photographs, or other evidence to support the position.

The proceedings will be conducted in a manner determined by the Chair, in consultation with the other Board members. Unless directed otherwise by the Chair, the hearing will be conducted according to the following guidelines:

- The hearing will be informal;
- The witnesses will not be sworn;
- The Contractor will present its case first;
- The Agency will then present its case;
- Both parties will then have opportunity to present rebuttal;
- The Board may ask questions and, to promote open discussion of the issues, both parties may respond or emphasize issues;
- The parties' attorneys may observe the hearing and may respond to direct questions from the Board, but may not make factual presentations or legal arguments; and
- The Board will conclude the hearing when it appears to the Board Chair that each party has had sufficient opportunity to support its case and the Board has no further questions.

Within 10 Calendar Days after conclusion of the hearing, the Board will forward to the Agency's designated representative and the Contractor the Board's written recommendation for resolution of the claim. Within 10 Calendar Days of its receipt of the Board's

recommendation, the Agency will provide to the Contractor the Agency's written decision regarding the claim.

If the Contractor does not accept the Agency's decision regarding the claim, the Contractor may proceed to litigation as described in Step 4 (see (e) below).

(3) Claims Over $~~250~~500,000 - If the Contractor and the Engineer agree, the parties may employ the Step 3 Board review process according to 00199.40(d-2). If not, the Contractor may proceed to Step 4 (see (e) below).

(e) Step 4: Litigation - This step applies to:

- Claims over $~~250~~500,000;
- Appeals of arbitration awards issued in Step 3 at 00199.40(d-1) above, according to ORS 36.600 through ORS 36.~~695~~740; and
- ~~Appeals of~~ Agency decisions issued under Step 3 at 00199.40(d~~-~~-2) above.

The Contractor must follow each step in order, and exhaust all available administrative remedies before resort to litigation. Lawsuits must be properly filed in a court of competent jurisdiction within ~~six~~ 6 months from the date of the final decision that exhausted the Contractor's available administrative remedies under this Section 00199.

~~In any litigation, the entire text of any order or permit issued by a governmental or regulatory authority, as well as any documents referenced or incorporated therein by reference, shall be admissible for the purpose of Contract interpretation.~~

~~The Contract shall not be construed against either party regardless of which party drafted it. Other than as modified by the Contract, the applicable rules of contract construction and evidence shall apply. This Contract shall be governed by and construed according to the laws of the State of Oregon without regard to principles of conflict of laws.~~

~~Any dispute between the Agency and the Contractor that arises from or relates to this Contract and that is not resolved under the provisions of Section 00199 shall be brought and conducted solely and exclusively within the Circuit Court for the State of Oregon in the county where the Agency's main office is located; provided, however, if a dispute must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this Subsection be construed as a waiver by the State of Oregon on any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR BY EXECUTION OF THE CONTRACT HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.~~

The Contractor shall comply with 00170.00.

00199.50 Mediation - Notwithstanding the formal claims procedure specified above, the parties may enter into nonbinding mediation by mutual agreement at any time, in which case the parties may also agree to suspend the time requirements in Section 00199 pending the outcome of the mediation process. The rules, time and place for mediation, as well as selection of the mediator, shall be established by mutual agreement. Costs shall be divided equally between the Contractor and the Agency. Either party may terminate mediation at any time upon ~~five~~ 5 Calendar Days notice to the other, after which the time requirements of Section 00199 shall be automatically reinstated and shall resume from the point at which the time requirements were suspended.

00199.60 Review of Determination Regarding Records - If not all of the records requested by the CAE under 00199.40(c) Step 2 were provided, then the CAE will determine:

- If the records are of the type described in 00170.07; and
- If the records have not been maintained or the records, or access to the records, has not been provided to the Agency as required by 00170.07 and this Section; and
- If the records are material and necessary for proper evaluation of part or all of the claim; and
- The portions of the claim for which the records are material and necessary for proper evaluation.

If the CAE makes the foregoing determinations, then subject to the review process described below, all portions of the claim for which the CAE determined the records are material and necessary for proper evaluation are immediately waived and irrevocably dismissed.

Even if the records have not been maintained or the records, or access to the records, have not been provided to the Agency in a given instance, the CAE may determine that sufficient records have been provided for the Agency to properly evaluate the claim in that instance. If the CAE makes this determination, the claim or portions of the claim will not be waived or dismissed under this provision.

If the Contractor does not accept the CAE's written determination that the records are material and necessary for proper evaluation of part or all of the claim, and the portions of the claim for which the records are material and necessary, the Contractor may, within 14 Calendar Days of receipt of the CAE's determination, request, in writing, a review of such determination by the Construction Engineer (CE). If the Contractor does not request a review of the CAE's determination, the CAE's determination shall then become the Agency's final determination as of the expiration of the time limit to request review.

If the Contractor requests the review, the CE will schedule a review meeting within 14 Calendar Days, or as otherwise agreed by the parties, of when the CE receives the written review request. The Agency and the Contractor will each have an opportunity to explain their respective positions at the review meeting in a manner determined by the CE.

Within 10 Calendar Days of the review meeting, the CE will issue a written proposed finding of whether the records not maintained or not provided to the Agency, or for which access was not provided to the Agency, are material and necessary for proper evaluation of part or all of the claim. If the CE makes that finding, then the CE will also make a proposed written finding as to what portions of the claim the records are material and necessary and, therefore, waived and irrevocably dismissed.

Even if the records have not been maintained or the records, or access to the records, have not been provided to the Agency in a given instance, the CE may determine that sufficient records have been provided for the Agency to properly evaluate the claim in that instance. If the CE makes this determination, then the claim or portions of the claim will not be waived or dismissed under this provision.

The CE's proposed findings will be submitted to the Contractor and the Agency's Director. The Contractor may submit written objections concerning the proposed findings to the Director within 5 Calendar Days of receipt of such findings. If written objections are submitted, the Director may adopt or modify the proposed findings, and the Director's findings shall be the Agency's final determination. If no written objections are submitted within the 5 Calendar Day time limit, the CE's proposed findings shall then become the Agency's final determination as of the expiration of the time limit to submit written objections.

If the Agency's final determination is that the records are material and necessary for proper evaluation of part or all of the claim, then the claim or that portion of the claim for which the records

are material and necessary is waived and irrevocably dismissed, unless the Contractor provides the records, or access to the records, to the CAE within 5 Calendar Days of the Agency's final determination. If the Contractor provides the records, or access to the records, within this time limit, the CAE will schedule a meeting with the Contractor within 14 Calendar Days or as otherwise agreed by the parties, to discuss the records.

The Agency's final determination that records are material and necessary for proper evaluation of part or all of the claim, and the Agency's final determination of the portions of the claim for which the records are material and necessary, shall be final and binding.

If the entire claim is waived and irrevocably dismissed pursuant to the Agency's final determination there will be no further decision by the Agency on the claim or further review of the claim under 00199.40 and the claim will not be eligible for mediation under 00199.50. If only portions of the claim are waived and irrevocably dismissed pursuant to the Agency's final determination, the CAE will provide a written decision to the Contractor regarding the remaining portions of the claim within 30 Calendar Days of the final Step 2 meeting, or the Agency's final determination regarding the records, whichever is later. There will be no further decision by the Agency on or further review under 00199.40 of the portions of the claim waived and irrevocably dismissed pursuant to Agency's final determination and those portions will not be eligible for mediation under 00199.50.

PART 00200 - TEMPORARY FEATURES AND APPURTENANCES

Section 00205 - Field Laboratory, Weighhouse, Etc.

Description

00205.00 Scope - This work consists of providing facilities for Agency use to perform testing, weighing and other necessary functions during the course of the Project.

Materials and Equipment

00205.10 Contractor-Furnished Field Laboratory - Provide a leveled field laboratory for Agency use in close proximity to the Contractor's plant at least ~~five~~5 calendar days before aggregate production, paving, or processing work begins under the Contract, meeting the safety and health requirements of the Oregon Department of Consumer and Business Services, the Oregon Health Division, the State Fire Marshall, and the following minimum requirements:

- Length - 16 feet
- Width - 8 feet
- Ceiling Height - 7 feet
- Floor
- Insulation - Walls and ceiling - R-11
- Doors - At least one, 3 feet wide, all with locks
- Windows:
  - Four
  - Adequate for good lighting
  - Capable of being opened for adequate ventilation
  - One providing a view of the crushing or processing plant
- Interior Walls and Ceiling - White
- Counter - 20 feet long, 30 inches wide, 36 inches high, with a durable, smooth surface
- Sink - One deep double with adequate supply of cold potable, clear, running water
- Electrical Power System:
  - 120/240 V, single phase, 60 A service
  - Wired according to the National Electrical Code
- Electrical Service:
  - Continuous, 24 hours per day during crushing and aggregate mixing operations
  - For 24 hours following termination or interruption of operations
- Electrical Outlets - six duplex
- Electrical Light Fixtures - Enough to provide good overall lighting
- Heating and Air Conditioning - Adequate to provide suitable heating and cooling
- Exhaust Ventilation System - Adequate for all activities performed in the laboratory, including aggregate drying and vacuum extractions of AC
- Toilet - One, portable, for use by Agency employees

The site will be approved by the Engineer before work is to begin.

Remove the field laboratory when the Project is complete.

00205.11 Agency-Furnished Field Laboratory - Provide a level site for an Agency-furnished laboratory trailer at least ~~five~~5 calendar days before aggregate production, paving, or processing work begins under the Contract, at a location in close proximity to the Contractor's plant. The site will be approved by the Engineer before work is to begin.

Employ a commercial hauler to bring the trailer to the Project, relocate at the site if necessary, and to return the trailer to its storage area. Employ a licensed electrician to connect and disconnect the power source. Provide an adequate supply of potable water, electricity, and a portable toilet for use by Agency employees, according to 00205.10.

00205.12 Weighhouse - When materials are weighed on platform-type scales or by other means and the Contractor chooses to have the Agency provide a weigher, provide a weatherproof weighhouse or other approved shelter for the weighperson. The weighhouse shall meet the safety and health requirements of the Oregon Department of Consumer and Business Services, the Oregon Health Division, the State Fire Marshall and the following minimum requirements:

- Length - 9 feet
- Width - 6 feet
- Ceiling Height - 7 feet
- Floor
- Protect Scale Recording Device and Agency's weigher from weather
- Provide space to store scale testing equipment
- Provide adequate shelf space
- Provide artificial lighting and good visibility throughout
- Provide adequate heat, as required
- Provide stool and other facilities for keeping records and performing other duties of the weigher
- Doors - At least one, all with locks
- Windows:
  - Capable of being opened for adequate ventilation, unless air conditioning is provided
  - One, facing the scale
  - One, at each end
  - Adequate size and position to permit view of loading operations and movements of hauling vehicles
- Toilet - One, portable, for use by Agency employees

Remove the weighhouse when the Project is complete.

Measurement

00205.80 Contractor-Furnished Field Laboratory - Contractor-furnished field laboratories will be measured on the unit basis.

00205.81 Agency-Furnished Field Laboratory - Agency-furnished field laboratory work described in 00205.11 will be measured on a unit basis for each Agency-furnished field laboratory required to be located at the Contractor's site of operations.

00205.82 Weighhouse - No measurement will be made for providing weighhouses.

Payment

00205.90 Contractor-Furnished Field Laboratory - The accepted quantities of Contractor furnished field laboratories will be paid for at the Contract unit price, per each, for the item "Furnishing Field Laboratory".

Payment will be payment in full for furnishing the specified laboratory, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

00205.91 Agency-Furnished Field Laboratory - The accepted quantities of performing the work described in 00205.11 will be made at the Contract unit price, per each, for the item "Agency-Furnished Field Laboratory".

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

00205.92 Weighhouse - No separate or additional payment will be made for providing weighhouses. Payment will be included in payment made for the appropriate items under which this item is required.

Section 00210 - Mobilization

Description

00210.00 Scope - This work consists of operations and preparatory work necessary to become ready to perform the work or an item of work.

Construction

00210.40 Mobilization - Mobilization includes, but is not limited to, the following:

- Move personnel, equipment, supplies, and incidentals to the Project site.
- Establish offices, buildings, and other facilities necessary for work on the Project.
- Perform other work and operations or incur costs as necessary before beginning work on the Project.

Measurement

00210.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00210.90 Payment - Payment for mobilization will be made at the Contract lump sum amount for the item "Mobilization".

The amounts paid for mobilization in the Contract progress payment will be based on the percent of the original Contract amount that is earned from other Contract items, not including advances on materials, and as follows:

- When 5~~%~~ percent is earned, either 50~~%~~ percent of the amount for mobilization or 5~~%~~ percent of the original Contract amount, whichever is the least.
- When 10~~%~~ percent is earned, either 100~~%~~ percent of mobilization or 10~~%~~ percent of the original Contract amount, whichever is the least.
- When all work is completed, amount of mobilization exceeding 10~~%~~ percent of the original Contract amount.

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the Contract.

When the Contract Schedule of Items does not indicate payment for mobilization, no separate or additional payment will be made for mobilization. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00220 - Accommodations for Public Traffic

Description

00220.00 Scope - This work consists of maintaining facilities to accommodate public traffic through and within the Project for the life of the Contract. Public traffic includes motor vehicles, bicycles, and pedestrians.

00220.01 Beginning of Contractor's Responsibility - The Contractor's responsibilities for accommodating public traffic begin on the day any on-site work begins within the Project limits.

00220.02 Public Safety and Mobility - Provide for the safety and mobility of the public and:

- Be responsible for damages according to 00170.80.
- Conduct work at all times so that there is the least possible interference with or hazard to the traveling public and the affected community.
- Locate stockpile materials and park construction equipment and vehicles that are not in active use a minimum of 30 feet from the traveled way. If this is not possible, protect the stockpile materials, equipment, and vehicles, with barrier or as directed.
- Provide and maintain safe temporary access to business and residence driveways, temporary intersections, and temporary connections with roads, streets, and bicycle and pedestrian facilities.
- Provide approved protection and delineation between each work area and public traffic.
- Allow emergency vehicles immediate passage at all times.
- ~~When included in the Contract Schedule of Items, use~~Use portable changeable message signs (PCMS) according to ~~provide appropriate work zone information to the public~~Section 00225.
- For all sidewalk or sidewalk ramp closures, install signs and other TCD as shown on the ~~standard drawings.~~plans. Mount signs between the panels of ~~the type~~a Type II barricade ~~or, if installed on a single-post TSS, locate the signs behind type II~~and place barricades~~.~~ facing pedestrian traffic.
  - Close the sidewalk at a point where there is an alternate way to proceed, or provide signing and other TCD to indicate an alternate pedestrian route. Place closure signing at the closure point in the middle of the existing pedestrian facility facing pedestrian traffic.
  - Provide additional TCM and an alternate pedestrian route that, as nearly as is practical, matches existing facility features and meets the accessibility requirements in Part 6 of the MUTCD and the requirements of the Americans with Disabilities Act (ADA).
    - Pave the alternate pedestrian route surface or provide an approved, non~~-~~-slip ~~36~~60 inch minimum wide surface meeting the requirements of the ~~Americans with Disabilities Act (ADA). If appropriate, delineate this route and protect~~ADA.
    - Where a 60 inch minimum width along the entire alternate pedestrian route is not possible, provide 60 by 60 inch passing spaces every 200 feet along the route.
  - Protect pedestrians and delineate the alternate pedestrian route by placing pedestrian ~~work zone delineation fencing. Fencing is to remain~~channelizing devices (PCD), or other approved devices, between the alternate pedestrian route and the work area. Keep PCD in place, except as required for actual work, until the ~~sidewalk~~existing pedestrian facility is reopened~~ to pedestrian traffic.~~ .
  - Reopen the ~~sidewalk~~existing pedestrian facility during non-work hours or continue to provide an alternate ~~route for pedestrians. Provide alternate pedestrian routes that match~~

~~existing facilities and provide additional TCM to meet the accessibility requirements in Part VI of the MUTCD~~pedestrian route.

- Do not impede the flow of traffic or close any lanes of traffic except as listed in 00220.40(e).
- Do not stop or hold vehicles on ~~the traveled way, at intersections, or other connecting roadways~~a highway within the Project ~~limits~~Site for more than 20 minutes.
- Do not block driveways for more than ~~two~~ 2 hours unless otherwise authorized in writing.
- Do not close any lanes until the area is signed according to the plans and the requirements of this Section and Section 00225.
- Do not perform work ~~which would restrict or interrupt~~that restricts traffic ~~movement on opposite~~access to and from both sides of the traveled way at the same time.
- Do not use temporary steel plating within the roadway or shoulder having a pre-construction posted speed zone greater than 35 mph.
- Do not place work zone signs or sign supports that will block existing walkways or existing bikeways, except at the closure point of a walkway or bikeway.

00220.03 Work Zone Notifications - Provide the following work zone notifications:

(a) Over-Dimensional Vehicle Restrictions - When a project restricts the width, length, height, or weight of vehicles through a work zone or detours trucks around a work zone, ~~notify the Motor Carrier Transportation Division (MCTD) by using the web based electronic version~~fill out and submit a completed copy of the "Highway Restriction Notice-Size and/or Weight" form (Form No. 734~~-~~-2357~~)~~), available from the ODOT Motor Carrier Transportation web site, at least ~~28~~ 35 calendar days before the restriction or detour takes effect.

(b) Closures - Submit to the Engineer, in writing, for approval, all proposed closure schedules, as follows:

- **Lanes** - A minimum of 7 calendar days before a lane closures begin.
- **Roads** - A minimum of 14 calendar days before closure. Also, notify in writing, all affected emergency services, school districts, and US Postal Service a minimum of 14 days before the any closure.
- **Interchange Ramps** - A minimum of 14 calendar days before closure or starting work that limits access to the interchange ramp.
- **Bicycle and Pedestrian Facilities** - A minimum of 14 calendar days before a bike lane, sidewalk, and multi-use path closure. After receiving written approval, provide 48 hour public notification before the closure.

Construction

00220.40 General Requirements - Provide the following for public traffic in all construction areas:

(a) Traffic Nuisance Abatement - If loose rock or dust exists on roadway surfaces and shoulders, the Engineer may direct one or more of the following:

- Use flaggers or pilot cars and flaggers.
- Apply a fine spray of water to the surface as directed.
- Sweep paved surfaces with power brooms.

(b) Detours and Stage Construction - Construct and remove, if required, detours, stage construction roadways, shoulders, and temporary bridges, including accessory features shown or ordered.

(c) Driveways - Provide reasonable access as follows:

- Replace and maintain business accesses, driveways, approaches, crossings, and intersections as directed.
- Use reasonably well-graded aggregate material.

- Before placing the permanent base, do one of the following:
  - Uniformly spread the temporary aggregate material over the subgrade.
  - Remove and place the temporary aggregate material in the shoulder slope area if it meets quality requirements.
  - Dispose of the temporary aggregate material in a manner satisfactory to the Engineer.

(d) Adjacent to Excavations - Where paved shoulders adjacent to excavations are less than 4 feet wide, protect the traffic as follows:

- At the end of each working day, backfill pavement edge excavations to the elevation of the existing pavement with permanent base material or with a temporary wedge of aggregate as shown on the standard drawings.
- Do not excavate along both edges of the pavement adjacent to traffic at the same time. Before excavating at the edge of the pavement on the opposite side of the roadway, complete the construction to existing pavement elevation on the side which was excavated first.
- Remove the temporary wedge of aggregate material, if used, before placing permanent base material, and place it in the shoulder slope area or spread it uniformly over the subgrade.

(e) Lane Restrictions ~~- Do not close any traffic lanes during the periods listed below:~~:

~~**(1) Weekdays:**~~

~~Between 7:00 a.m. and 9:00 a.m. and~~ **(1) Closed Lanes** - One or more traffic lanes may be closed when allowed, shown, or directed during the following periods of time except as indicated in 00220.40(e-2):

- Monday between ~~4:00 p~~12:01 a.m. and ~~6~~7:00 ~~p~~ a.m.
- Daily, Monday through Thursday
- ~~Between 7~~ between 9:00 a.m. and ~~9~~4:00 ~~a~~ p.m.
- Friday ~~morning~~

- ~~**(2) Weekends** - Between~~ between 9:00 a.m. and 3:00 p.m. ~~on~~
- Daily, Monday through Friday between 6:00 p.m. and ~~midnight on Sunday~~7:00 a.m.

~~(3)~~**(2) Opened Lanes** - Keep all traffic lanes open during the following periods:

a. Holidays - Between noon on the day preceding a legal holiday or holiday weekend and midnight on a legal holiday or the last day of holiday weekend, except for Thanksgiving,

when no lanes may be closed between noon on Wednesday and midnight on the following Sunday.

For the purposes of this Section, legal holidays are as follows:

- New Year's Day on January 1
- Memorial Day on the last Monday in May
- Independence Day on July 4
- Labor Day on the first Monday in September
- Thanksgiving Day on the fourth Thursday in November
- Christmas Day on December 25

When a holiday falls on Sunday, the following Monday shall be recognized as a legal holiday. When a holiday falls on Saturday, the preceding Friday shall be recognized as a legal holiday.

~~(4)~~b. **Special Events** - Between noon on the day preceding and midnight on the final day of the special event.

Remove all barricades and objects from the roadway during the periods in which traffic lanes are to remain open.

Maintenance

00220.60 Surface Maintenance Responsibilities - Provide adequately maintained accommodations at all times for public traffic through and within the Project according to this Section and Section 00225.

(a) During Construction - The responsibility for maintaining all surface during construction is as follows:

(1) Contractor Responsibility - Do the following at Contractor's expense:

- Keep ~~roads, streets, bikeways, sidewalks, multi-use paths, and shoulders~~surfaces being used by public traffic, free of ~~debris, aggregate,~~all dirt, mud, ~~and other~~gravel, materials ~~that impede traffic~~, or other debris.
- Repair damage to surfaces caused by the Contractor's operations.
- Maintain all detour ~~or~~and stage construction ~~surfacings not constructed~~surfacing as specified or directed.

Before winter shutdown begins, do the following:

- Provide paved traffic lanes at least 12 feet wide with ~~two~~ 2 feet wide paved shoulders for each direction of traffic.
- Do not leave abrupt edges.
- Remove or cover temporary construction signs unless otherwise directed.
- Clean, install, and reinstall all necessary channelization and pavement markings, as directed.

If this winter shutdown work is not completed and in place, the Agency may do the work according to 00220.60(d).

(2) Agency Responsibility - The Agency will be responsible to do the following at Agency expense:

- Maintain existing surfacings and shoulders that are being used by public traffic at the start of the Project which have not been damaged by Contractor operations.
- Maintain surfaces of detours and intermediate stage construction during the time they are being used by public traffic, but only if constructed according to the plans or as directed.
- Maintain existing surfaces and shoulders of detours located outside the Project limits during the time they are being used by public traffic.
- Sand icy pavements and remove the sand residue.
- Remove snow from traveled ways as required to accommodate public traffic.

~~The Agency may authorize the Contractor to perform this work according to Section 00196.~~

(b) During Suspensions - Maintain surfacings for which the Contractor is responsible according to 00220.60(a-1), the work according to 00170.80, and work zone traffic control according to Section 00225 during suspensions of the work as follows:

(1) Suspensions Due To Contractor Fault or Neglect - If the suspension is due to any cause within the control or responsibility of the Contractor, including failure to do the following:

- Perform any provisions of the Contract.
- Correct conditions unsafe for the general public, workers or Agency employees.
- Carry out orders given by the Engineer.

Then assume sole responsibility for making provisions for traffic acceptable to the Engineer, and be responsible for the costs of maintaining surfaces under traffic, the work, and work zone traffic control during the suspension.

(2) Suspensions Due To Other Causes - If the suspension is due to unforeseen circumstances, or causes not included in 00220.60(b-1), and if the suspension occurs within the Contract time or adjusted Contract time:

- Place uncompleted traveled ways, shoulders, driveways, approaches, connections, and detours necessary for traffic in a maintainable, acceptable condition. Be responsible for the work
- Be responsible for work zone traffic control.

The Agency will then assume responsibility for maintenance of the roadway surfaces during the suspension.

(c) Resuming Contract Work after Suspension - After any suspension do not resume Contract work until approved.

(d) Right of Agency To Perform Work At Contractor Expense - If the Contractor fails to provide adequate accommodations for traffic and to maintain the traveled ways and connections as provided in the Contract, the Engineer may proceed immediately to provide adequate

accommodations and maintenance. The cost of this work will be deducted from monies due, or that become due, to the Contractor.

00220.70 Opening Sections To Traffic - When it is in the public interest the Engineer may order any portion of the work opened to traffic. If the portion opened to traffic has been finished in an acceptable manner, it will be designated as "accepted for traffic", and the Contractor will be relieved of maintaining it for legal, public traffic. If the portion of the work to be opened to traffic has not been finished in an acceptable manner, it shall be maintained under traffic by the Contractor in a condition serviceable and adequate for traffic until it is finished in an acceptable manner, except as provided in 00220.60(b).

Maintain portions of the work designated "accepted for traffic" ~~as Extra Work~~ if so ordered. Maintain portions of the work opened to traffic but not "accepted for traffic" at no additional compensation, except watering ordered to protect the work or to alleviate dust will be paid for as provided in Section 00340.

The "accepted for traffic" ~~portion(s)~~portions of the work will:

- Be accepted only to the extent the Contractor is relieved of maintaining these portions for legal, public traffic after acceptance.
- Not entitle the Contractor to reduction of retainage.
- Not relieve the Contractor's responsibility for defective materials or work.
- Not relieve the Contractor's responsibility for damages to the work from causes other than legal, public traffic except as provided in 00170.80.
- Not constitute a waiver of any provision of the Contract.

If the Contractor delays the completion of shoulders, drainage structures, or other feature of the work, the Engineer may order all or any portion of the work to be opened to traffic. In this case, the Contractor shall be responsible for maintenance as described in 00220.60(a-1), during the period the work is opened to traffic until final acceptance. Conduct the remaining operations to cause the least obstruction to traffic, and pay all additional costs caused by the presence of traffic.

Measurement

00220.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00220.90 Payment - No separate or additional payment will be made for work performed under this Section, unless otherwise provided or pay items are provided under other Sections.

In addition, no payment will be made for costs incurred by the Contractor because of:

- Inconvenience, additional length of travel to conform to established traffic patterns and planned access features~~; or~~.
- Compliance with laws governing traffic regulations and load limitations.

Costs anticipated because traffic will be using portions of the work will be included in the Contract prices for the various items of work involved.

Section 00225 - Work Zone Traffic Control

Description

00225.00 Scope - This work consists of providing temporary traffic control measures (TCM) and furnishing, installing, moving, operating, maintaining, inspecting, and removing traffic control devices (TCD) throughout the Project area according to the standard drawings, the traffic control plan (TCP) for the Project, these Specifications, or as directed.

00225.01 Abbreviations, Definitions, and Standards:

(a) Abbreviations:

ADT - Average Daily Traffic

PCD - Pedestrian Channelizing Devices

PCMS - Portable Changeable Message Sign

TCD - Traffic Control Devices

TCM - Traffic Control Measures

TCP - Traffic Control Plan

TCS - Traffic Control Supervisor

TSS - Temporary Sign Support

~~**PCMS** - Portable Changeable Message Sign~~

(b) Definitions:

Traffic Control Devices ~~**(TCD)**~~ - Signs, signals, markings, and other devices placed on, over, or adjacent to a roadway used to regulate, warn, or guide public traffic by authority of a public body or official having jurisdiction.

Traffic Control Measures ~~**(TCM)**~~ - Elements of the TCP including, but not limited to, TCD, personnel, materials and equipment used to control public traffic through a work zone.

Traffic Control Plan ~~**(TCP)**~~ - A written and drawn plan for providing the safe and efficient movement of public traffic through or around a work zone while protecting workers, incident responders, and equipment.

Work Area - The portion of the highway closed to public traffic and set aside for workers, construction equipment, and construction materials. The work area is typically delineated by channelizing devices or separated from traffic using temporary barriers.

Work Zone - An area within highway construction, maintenance, or utility work activities which extends from the first road work, bridge work, or utility work warning sign to the last sign or the last TCD.

(c) Standards - When designing, applying, installing, maintaining, inspecting, and removing traffic control devices, use and follow the most current versions in effect of the following:

- Oregon Department of Transportation's "Sign Policy and Guidelines for the State Highway System"
- The Manual on Uniform Traffic Control Devices (MUTCD)
- FHWA "Standard Highway ~~Sign~~Signs" manual

- ODOT "Oregon Temporary Traffic Control Handbook for Operations of 3 Days or Less" when directed by the Engineer only for mobile pavement marking operations or surveying work
- ODOT "Oregon Portable Changeable Message Sign Handbook", available on the ODOT Traffic Control Plans Unit website

00225.02 General Requirements - ~~Be responsible to provide~~Provide and maintain all TCM. The Engineer may verbally or in writing require immediate changes to the TCM being used on the Project. Immediately make these changes, as directed. Submit all proposed TCM revisions to the Engineer for approval.

Do not start work on any stage of construction until the TCP has been reviewed and accepted and all TCM are in place and the TCP is operating satisfactorily. During construction, determine if ~~additional~~ TCM ~~are required~~, in addition to those in place, are required and immediately notify the Engineer. Immediately make changes as approved or directed, but do not place or remove devices without prior approval.

Work may be suspended as specified in 00180.70 or the TCM may be performed by the Agency if the Contractor fails to correct an unsafe condition. Costs for work performed by the Agency will be deducted from monies due the Contractor.

Install a 48 inch "TRUCKS" sign with an 18 inch "500 FEET" rider, approximately 500 feet before each point of access of all noncommercial stockpile sites, work zone staging area, material sources, waste areas, and plant set-up areas to a public roadway.

~~Install a 54 inch "TRUCKS LEAVING HIGHWAY 1500 FT" sign approximately 1,500 feet in advance of each entrance point to the work area. Install a 54 inch "TRUCKS ENTERING HIGHWAY 1500 FT" sign approximately 1,500 feet in advance of each exit point from the work area.~~

Do not ~~allow construction vehicles to accelerate or decelerate in a travel lane~~ use an open ~~to~~ traffic lane on a freeway or multi-lane facility as an acceleration or deceleration lane for construction vehicles. Provide additional surfacing or width within the work area or, if allowed, close a traffic lane for construction vehicle acceleration or deceleration. Do not use a flagger to allow construction vehicles to access an open traffic lane on a freeway or a multi-lane facility.

When a through road intersects the work zone, place a ~~48 inch~~ "ROAD WORK AHEAD" (W20-1-48) sign in advance of the intersection at sign spacing "A" from the "TCD Spacing Table" shown on the standard drawings~~.~~, or as shown in the TCP. These signs do not require sign flag boards, unless otherwise directed.

When paving operations create an abrupt edge, protect traffic by installing signing according to the "2-Lane, 2-Way Roadway Overlay Area" detail shown on the standard drawings. Protect longitudinal and transverse pavement joints by placing and maintaining an asphalt concrete wedge according to 00225.06(c-1).

When a cold planed pavement surface is used by traffic, install a ~~48 inch~~Type "O4" "BUMP" (W8-1-48) sign ~~at the~~ approximately 100 feet in advance of the transverse paving edge. Install a ~~48 inch~~ "GROOVED PAVEMENT" (W8-15-48) sign with a "Motorcycle" (W8-15P-24) rider in advance of the ~~bump~~"Bump" sign at sign spacing "A" from the "TCD Spacing Table" shown on the standard drawings. Face ~~both~~ signs toward incoming traffic and install them before opening the

cold planed surface area to ~~active~~public traffic. Protect exposed transverse and longitudinal cold planed pavement edges according to 00225.06(c-2).

During flagging operations, monitor the length of traffic queues and when extended traffic queues develop, protect traffic by providing advance ~~flagger(s)~~flaggers and additional signing according to the "Extended Traffic Queues for Advance Flagging" detail shown on the standard drawings.

00225.03 Traffic Control Outside Project Site - Provide TCM outside the Project Site when required.

00225.04 Regulations and Codes - All electrical equipment, materials, and work shall conform to NEC requirements and all other laws that apply.

00225.05 Contractor Traffic Control Plan - The Contractor will be allowed to use the Agency's TCP, modify the Agency's TCP, or use a different TCP. Submit the following, for approval, ~~the Contractor TCP in writing five~~5 calendar days before the ~~pre-construction~~preconstruction conference~~. If modifying or if not using the Agency TCP, submit the following~~:

(a) Agency or Contractor Traffic Control Plan - If the Agency's TCP is used without modification, a written notification indicating that the Agency's TCP will be used without modification.

If the Contractor will be using a modified Agency TCP, or if the Contractor will not be using the Agency's TCP, provide stamped working drawings according to 00150.35 which include the following:

- Proposed TCP showing all TCM and quantities of all TCD.
- Proposed order and duration of the TCM.
- ~~Two copies~~A detailed temporary striping plan.

(b) Tourist-Oriented Directional and Business Logo Signs - One copy of a sketch map of the Project showing all existing tourist-oriented directional (TOD) and business logo signs and a written narrative describing how these signs will be kept in service and protected throughout all the construction stages.

~~• A detailed temporary striping plan.~~

~~Further TCP revisions will be subject to a Contract change order before implementation.~~

If there are no TOD or business logo signs on the project, a written notification that no TOD or business logo signs exist within the project limits.

If additional modifications are made to the Contractor modified Agency TCP or the Contractor's TCP, submit stamped working drawings, according to 00225.05(a), at least 14 calendar days before beginning the construction activities that require the TCP changes.

00225.06 Routing Traffic Over Surfacings - Control traffic being routed over surfaces as follows:

(a) Aggregates - When directed, control traffic over aggregate with flaggers or flaggers and pilot ~~car(s).~~cars.

(b) Asphalt Treated Permeable Base ~~**(ATPB)**~~ - When directed, control traffic over ~~ATPB~~asphalt treated permeable base (ATPB) with flaggers or flaggers and pilot ~~car(s).~~cars.

(c) Asphalt Concrete - Control traffic over asphalt concrete as follows:

(1) Paving - When the longitudinal joint is greater than 1 inch in height, install additional TCD according to 00225.02. Complete the placing of ~~HMAC~~ACP and construction of paving joints according to 00744.44, 00744.45, 00745.~~61~~47, and 00745.~~62~~48, as applicable.

(2) Cold Plane Pavement Removal - Complete the pavement removal according to 00620.40. When the area cannot be paved back during the same shift and the depth of pavement removal is greater than 1 inch, install additional TCD according to 00225.02.

(d) Oil Mats or Chip Seals - Control traffic over asphalt oil mats or chip seals with flaggers and pilot ~~car(s),~~cars, unless otherwise directed, until the entire surface has been swept or bladed after the aggregate was placed as tabulated below:

~~ADT~~ ADT	Minimum Pilot Cars
Over 1500	2
1500 and Less	1

(e) Sand Seals - Control traffic with flaggers and pilot ~~car(s)~~cars during application of asphalt and until it is covered with aggregate, unless otherwise directed.

Materials

00225.10 General - Evaluate the condition of TCD using the criteria shown in the most current version in effect of the American Traffic Safety Services Association (ATSSA) publication titled "Quality Guidelines for ~~Work Zone~~Temporary Traffic Control Devices and Features". Use new TCD or ~~acceptable TCD~~TCD meeting the "Acceptable" quality category of the ATSSA publication for all installations unless otherwise specified. Provide test results, quality compliance certificates, equipment lists, and drawings when specified. Acceptance will be by the QPL, test results, quality compliance certificates, equipment lists, drawings, and testing as necessary to assure compliance with the Specifications. After TCD have been installed and accepted on the Project, inspect and maintain the condition of the devices.

All work zone TCD shall comply with the crashworthy requirements of the National Cooperative Highway Research Program (NCHRP) Report 350~~.~~ or with the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).

00225.11 Temporary Signing - Furnish ~~new or acceptable~~ temporary signs ~~and accessories~~ meeting the ~~following~~ requirements of the "Acceptable" category shown in the ATSSA "Quality Guidelines for Temporary Traffic Control Devices and Features" handbook, available from the ATSSA website, and the following:

(a) Signs - Use materials and fabricate signs conforming to Sections 00940 and 02910 and the following:

(1) Size and Shape - Use standard size and shape signs meeting the requirements of 00225.01(c) unless otherwise specified or ordered. Double-face signs will not be allowed except for the flagger "STOP/SLOW" paddle.

(2) Type - Use Type "O3", "O4" or "O5" signs, unless otherwise indicated in this Section or in the TCP. Fabricate these signs on one of the following materials:

- New sheet aluminum sign blanks.
- New extruded aluminum panels.
- Used sheet aluminum sign blanks that are without bends, tears, holes, or dents and that have been cleaned to bare metal.
- 3/4 inch high-density overlay plywood.
- 3/4 inch medium-density overlay plywood.

(3) Folding or Turning Signs - Temporary signs on posts may be the folding or turning type as long as they can be locked when not in use so the sign message is not visible to any traffic.

(4) Roll-up Signs - Use roll-up signs with ~~fluorescent orange~~retroreflective roll-up sign sheeting from the QPL.

(b) Sign Supports:

(1) Wood Sign Posts - Use wood sign posts in the sizes and quantities as shown on the standard drawings and according to 02110.40, except posts may be untreated.

(2) Portable Sign Supports - Use portable sign supports from the QPL and conforming to the following:

- Free standing.
- Capable of supporting signs in vehicle-caused turbulence and in winds common to the area where they are used. If additional ballast is required to maintain the signs in an upright position, use sandbags to anchor the sign support legs. Place a sandbag filled with loose sand (approximately 25 pounds) across the bottom of each leg as needed.

(3) Concrete Barrier Sign Supports - Use concrete barrier sign supports that meet the following:

- Conform to the standard drawings.
- Attach securely to the top of the concrete barrier.
- Support a maximum 12 square feet of total sign area.

(4) Temporary Sign Supports - Fabricate and use TSS as shown on the standard drawings and according to 02110.40, except posts may be untreated.

(5) Perforated Steel Square Tube Sign Supports - Use perforated steel square tube sign supports from the QPL and as shown on the standard drawings.

(c) Sign Covers:

(1) Temporary Signs - ~~Sign~~Use sign covers for temporary signs ~~shall be~~that meet the following requirements:

- From the QPL or made from one of the following materials:
  - One-piece plywood.

- ~~Other sign cover from the QPL.~~
- Type 2 riprap geotextile fabric.
- Large enough to completely cover the sign and attached rider signs.
- Easy to attach to and remove from the sign without damaging the sign face.
- Black~~,~~ and non-reflective ~~and opaque~~.
- Opaque to prevent message visibility under day and nighttime conditions.

(2) Permanent Signs - Sign covers for permanent signs shall conform to Section 00941.

(d) Sign Flags - Sign flags shall be:

- Fluorescent red-orange.
- Square 16 ~~inch square~~by 16 inches or larger.
- Made from an acceptable tightly woven fabric or plastic sheeting.

~~**(e) Amber Flashers** - Amber flashers shall:~~

- ~~Be industry standard 8 inch traffic signal head with visors.~~
- ~~Be visible the full width of the traveled way and shoulders 1,200 feet from the flashers.~~
- ~~110/120 volt or 12 volt, rechargeable, battery-operated.~~
- ~~Provide a constant flash rate of one flash per second ± 10%.~~
- ~~Provide an illuminated period of each flash of 30% ± 10% of each flash cycle.~~

~~(f~~

(e) Sign Flag Boards - Use sign flag boards as shown on the standard drawings.

(~~g) Flashing~~f) Flagger Stop/Slow Paddles - Use ~~flashing~~flagger "STOP/SLOW" paddles from the QPL.

00225.12 Temporary Barricades, Guardrail, Barrier, Attenuators, and ~~Pedestrian Fencing~~Channelizing Devices - Furnish temporary barricades, guardrail, barrier, attenuators, work zone fencing, pedestrian ~~fencing~~channelizing devices, and accessories meeting the following requirements:

(a) Barricades - Use barricades from the QPL and as shown on the standard drawings.

(b) Guardrail - Use guardrail meeting the requirements of Section 00810 except posts may be untreated. Use guardrail terminals from the QPL and as shown on the standard drawings.

Reuse salvaged guardrail materials that comply with the requirements of 00810.15.

(c) Concrete Barrier - Use concrete barrier meeting the requirements of Section 00820, and have the same cross section, height, and loop configuration within individual runs and the following:

- Pin-and-loop concrete barrier as shown on the standard drawings (three ASTM A 36 loops, 32 inch height).
- Tall concrete barrier as shown on the standard drawings (two ASTM A 36 perforated C-shapes, 42 inch height).

Provide concrete barrier for temporary applications that are in acceptable condition, without cracks, chips, spalls, or corroded loops or C-shape connectors.

The concrete barrier shall have functioning scuppers, unless otherwise approved.

(d) Impact Attenuators - Furnish impact attenuators from the QPL and as shown on the standard drawings.

(e) Glare Shields - Use glare shields from the QPL that are a minimum 24 inches in height.

(f) ~~Pedestrian~~Work Zone Fencing - Use ~~pedestrian~~ work zone ~~delineation~~ fencing from the QPL.

(g) Reflective Barrier Panels - Use reflective barrier panels from the QPL.

(h) Pedestrian Channelizing Devices - Use PCD from the QPL and as shown on the standard drawings or in the TCP.

00225.13 Temporary Traffic Delineation - Furnish temporary traffic delineation items and accessories meeting the following requirements:

(a) Tubular Markers - Use tubular markers from the QPL.

(b) Conical Markers - Use conical markers from the QPL.

(c) Surface Mounted Tubular Markers - Use surface mounted tubular markers from the QPL.

(d) Plastic Drums - Use plastic drums from the QPL. ~~Provide drums with type "OO" encapsulated lens reflective sheeting~~Use retroreflective drum sheeting meeting the requirements of ASTM D 4956 Type III or Type IV.

(e) Delineators - Use new delineators from the QPL or salvaged reflectorized delineators (W-1) or (Y-1), as appropriate, and conforming to the requirements of Section 00840 and the following:

(1) Guardrail - At guardrail locations, use Type 4 delineators.

(2) Concrete Barrier - At concrete barrier locations, use Type 5 delineators.

(f) Pavement Markers:

(1) Reflective Pavement Markers - Use new Type "1" reflective pavement markers from the QPL.

(2) Flexible Oiling Pavement Markers - Use new flexible oiling pavement markers from the QPL.

(3) Flexible Overlay Pavement Markers - Use new flexible overlay pavement markers from the QPL.

(g) Temporary Tape - Use temporary removable, temporary non-removable, and temporary non-reflective tape from the QPL.

(h) Painted Striping:

(1) Paint - Use striping paint from the QPL.

(2) Beads - Use glass beads from the QPL.

00225.14 Temporary Illumination - Furnish materials for temporary illumination meeting the requirements of Sections 00960, 00970, 02920, 02926, and the temporary illumination plans.

00225.15 Traffic Signals - Furnish cable, guy wires, hardware, wood poles, wood pole foundations, and guy anchors that are able to support the dead load of the equipment shown and withstand a 100 mph, 3-second gust wind speed with an Importance factor (Ir) equal to 0.71 according to the 4th Edition AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals~~.~~.

(a) Temporary Traffic Signals - Use materials for temporary traffic signals that conform to Sections 00960, 00990, 02120, 02920, 02925, and the following:

(1) General - Used materials are allowed if restored to new condition or have very minor wear that is undetectable without close inspection. Do not use permanent signal equipment as part of the temporary signal installation.

(2) Cable and Wire - Use all new cable and wire.

(3) Wood Poles - Use poles that are of acceptable condition without visible signs of deterioration or significant longitudinal splits. Poles shall have no more than 8 drilled holes for messenger and tether cable eyebolt attachments. Holes shall not be closer than 6 inches.

(4) Concrete - Use commercial grade concrete according to Section 00440.

(5) Traffic Signal Control Devices - The controller program~~, PROM~~ and monitor programming will be furnished by ~~the Agency. When the temporary signal is removed, return the PROM to~~ the Agency.

(b) Portable Traffic Signals - Use new or like-new portable traffic signals from the QPL.

00225.16 Temporary Electrical Signs - Furnish electrical signs meeting the following requirements:

(a) Sequential Arrow Signs - Use ~~trailer mounted type~~ Type "C" sequential arrow signs from the QPL.

(b) Portable Changeable Message Signs - ~~Use trailer mounted~~Use PCMS ~~units~~ from the QPL.

00225.17 Flagger Station Lighting - Furnish flagger station lighting from the QPL and meeting the following requirements:

- Illuminates the flagger so that the flagger is visible, and is discernable as a flagger, from a distance of 1,000 feet.
- Illuminates the flagger from above at a height of 18 feet ± 3 feet.
- The light is shielded from approaching traffic.

Equipment

00225.20 General - Equipment will be accepted based on compliance with the Specifications and the Engineer.

00225.~~27 Flaggers~~ ~~- Provide~~ **23 Temporary Traffic Delineation** - Provide pavement marking equipment according to 00850.20.

00225.25 Safety Apparel - Workers, except flaggers ~~with~~, working within highway right-of-way and exposed to traffic or construction equipment shall wear high-visibility safety apparel that meets the Performance Class requirements of the most current version of ANSI/ISEA 107, "American National Standard for High Visibility Safety Apparel and Headwear Devices". Wear safety apparel that at least meets the following minimum requirements:

~~**(a) Flagger Equipment** - Equip flaggers as follows:~~

- ~~Clothing to cover the complete~~Daytime - Class 2 upper body ~~except head, neck, and arms below the point~~garment.
- Nighttime - One of the ~~shoulders.~~following:
  - ~~An~~ Class 3 upper body garment.
  - Class 2 upper body garment and Class E trousers or gaiters.
- ANSI Class ~~II~~ 2 or Class 3 fluorescent orange~~,~~ red, fluorescent yellow~~, strong yellow~~ -green or ~~fluorescent versions~~a combination of the two of these colors~~, retroreflective vest, shirt, or jacket. The vest, shirt, or jacket shall be designed to identify the wearer as a person and be visible through~~ for the ~~full range of body motions~~apparel background material color.
- ~~A fluorescent~~Fluorescent yellow-green, orange, yellow, or bright white hardhat or baseball-style cap. Wear hardhats when there is danger of falling or flying objects or electrical shock or burns.

Wearing high visibility safety apparel that exceeds the minimum class requirements is allowed.

00225.27 Flaggers - Provide flaggers with the following:

(a) Flagger Equipment - Equip flaggers as follows:

- For daytime and nighttime flagging operations, wear high-visibility safety apparel that meets the Performance Class requirements of the most current version of ANSI/ISEA 107, "American National Standard for High Visibility Safety Apparel and Headwear Devices". Wear safety apparel that at least meets one of the following minimum requirements:
  - Class 3 upper body garment.
  - Class 2 upper body garment and Class E trouser or gaiters.
- Safety apparel with background material colors according to 00225.25.
- A hardhat or baseball-style cap according to 00225.25.
- A minimum 18 ~~inch x~~ by 18 inch "STOP/SLOW" paddle made of rigid substrate and fabricated using type "R1"/"O4" sheeting, or a ~~flashing~~flagger STOP/SLOW paddle from the QPL. A 24 ~~inch x~~by 24 inch STOP/SLOW paddle is recommended for higher speed situations or where more ~~conspicuity~~visibility is desired.
- Portable, self-contained two-way radio and repeaters, as required, with a range suitable for communications throughout the Project Site.

(b) Flagger Station Lighting - Use flagger station lighting from the QPL and conforming to the following:

- Provide sufficient flagger illumination ~~sufficient~~ to ~~ensure the safety of~~completely illuminate the flagger~~, motorists, and workers~~ during flagging operations.
- Provide shielding to prevent light beams from being directed toward traffic.

00225.28 Traffic Control Supervisor - Equip Traffic Control Supervisor (TCS) as follows:

- ~~Clothing, vest, and, hard hat or cap equivalent to that of flaggers.~~
- Safety apparel according to 00225.25.
- Portable, self-contained two-way radio with a range suitable for the Project Site, when necessary.
- Cellular telephone active ~~24 hours a day~~at all times.
- A vehicle that is equipped with a roof or post mounted rotating amber light or strobe light that is visible for 360~~°~~. degrees.

00225.29 Pilot Cars - Provide pilot cars with the following features:

- No smaller than a compact pickup truck or a midsize car.
- Four wheels.
- A "PILOT CAR FOLLOW ME" (G20-4-18) sign mounted in a conspicuous location on the rear of the vehicle.
- A roof or post mounted rotating amber light or strobe light that is visible for 360°.
- A two-way radio with a range suitable for the Project Site.

Labor

00225.30 General - Observe all laws concerning safety, health, and sanitation standards according to 00170.60. Provide flaggers, TCS, ~~signal operators,~~ and pilot car operators, to stop, direct, and maintain traffic control through the work zone.

00225.31 Qualifications - Use flaggers, TCS, ~~signal operators,~~ and pilot car operators that meet the following requirements:

- Have a valid drivers license.
- Are at least 18 years old.
- Have the mental and physical ability to provide timely, clear, and positive guidance to the traveling public.
- Have a sense of responsibility for public and work crew safety.
- Have a professional appearance.
- Have a courteous but firm manner.
- Have completed an approved work zone traffic control flagging course within the past ~~three~~ 3 years and have in their possession a current, official state Flagger Certification card from ~~either~~ Oregon, Washington, Idaho, or Montana.

00225.32 Traffic Control Supervisor~~—~~ - When the bid schedule does not include an item for a TCS, appoint a trained person on the Project Site during working hours and on call at all other times who:

- Meets the requirements of 00225.31.

- Inspects and maintains TCD location, operation, quality, cleanliness, and effectiveness.
- Is equipped with a cellular telephone.
- Is equipped with a two-way radio, when necessary.
- Has the authority to assign and control flagging operations.
- Has filed their name and phone number with the Engineer and local police.
- Notifies the Engineer of any corrective measures made to the TCP if the TCP is not functioning as required, or to accommodate site conditions. Maintain the original intent of the TCP and do not implement changes to the TCP before revisions are approved by the Engineer.

When the bid schedule includes an item for a TCS, provide a TCS who meets the requirements of 00225.31. The TCS shall possess a current ODOT "Oregon Certified Traffic Control Supervisor" card. A TCS with a current card from another State Department of Transportation or from the American Traffic Safety Services Association may obtain an Oregon Certified TCS card upon successful completion of ODOT's ~~one-day~~ Recertification Class.

~~The TCS duties include the following:~~

- ~~Meets the requirements of 00225.31.~~
- ~~Files his/her name and phone number with the Engineer and local police.~~

~~Notify the Engineer of any corrections being made to the TCP when it is not functioning as required.~~
~~Inspect TCD during each construction work shift for proper function, location, installation, message, cleanliness, and effect on the traveling public.~~

~~Check post-mounted signs once a week. Inspect traffic control devices to be left in place for more than 24-hours during non-working hours immediately following initial placement of TCD. Conduct additional TCD inspections for extended periods, as requested. Check for effectiveness in both daylight and darkness.~~

- ~~Review and inspect nighttime lighting and its effect on the traveling public.~~
- ~~Make temporary revisions to the TCP in the event of an emergency. Immediately follow-up with and report any changes to the Engineer.~~
- ~~Oversee all requirements of the Contract to ensure the convenience, safety and orderly movement of vehicular, bicycle, and pedestrian traffic.~~

Before beginning work on the Project, the TCS shall:

- File with the Engineer and local police, their name and a telephone number at which the TCS can be contacted at all times.
- Have the documents listed in 00225.01 and applicable standards and specifications available ~~on the Project~~ at all times.

The TCS duties include the following:

- Supervise work zone traffic control measures, operations, activities, and conditions, including lane closures, lane or traffic shifts, detours, flagging operations, rolling slowdowns, and temporary traffic signal work.
- Oversee all applicable requirements of the Contract to ensure the convenience, safety and orderly movement of motor vehicle, bicycle, and pedestrian traffic.

- Attend meetings specifically scheduled to discuss the TCP and TCM.
- Discuss proposed TCM and coordinate implementation of the TCP with the Contractor and the Engineer.
- Make revisions to the TCP according to the following:
  - Make temporary revisions to the TCP in the event of an emergency and immediately follow-up with and report any changes to the Engineer.
  - Notify the Engineer before making any revisions to the TCP and indicate why revisions are necessary.
  - The TCS may make minor revisions to the TCP to accommodate site conditions if the original intent of the TCP is maintained and revisions have been approved by the Engineer.
  - Submit stamped working drawings that include the revisions according to 00225.05 and 00150.35 if the Contractor is using a modified Agency TCP or not using the Agency TCP.
- Coordinate the implementation and operation of all TCM, including those of subcontractors, suppliers, and any adjacent construction or maintenance operation.
- Provide supervision and oversight to maintain all TCM when in operation.
- Coordinate the Project's activities (such as ramp, road, or lane closures) with appropriate police, fire control agencies, city or county agencies, medical emergency responders, school districts, Postmaster, and public transit agencies.
- At least once per TCS construction work shift, conduct a TCD inspection according to the following:
  - Inspect following initial placement or installation of TCD.
  - Inspect devices in place for proper location, installation, operation, quality, cleanliness, and effectiveness on public traffic.
  - Inspect TCD effectiveness in daylight and at night.
  - Inspect post-mounted signs.
  - Inspect temporary illumination and flagger station lighting at night, when in place.
  - Conduct additional TCD inspections for extended periods, as requested.
  - Prepare and sign a "Traffic Control Inspection Report" form (Form No. 734-2474). Submit the report to the Engineer no later than the end of the next TCS construction work shift.

- ~~Discussing proposed TCM and coordinating implementation of the TCP with the Engineer.~~
- ~~Coordinating all TCM, including those of subcontractors, suppliers, and any adjacent construction or maintenance operation.~~
- ~~Coordinating the Project's activities (such as ramp closures, road closures, and lane closures) with appropriate police, fire control agencies, city or county engineering, medical emergency agencies, school districts, Postmaster and transit companies.~~
- ~~Prepare and sign a daily Traffic Control inspection report. Submit the report to the Engineer no later than the end of the next working day. As a minimum, include the following items in the report:~~
  - ~~When signs and TCD are installed and removed~~
  - ~~Locations of signs and TCD~~
  - ~~Revisions to the TCP (include copy of signed approval by the Engineer)~~
  - ~~Lighting utilized at night~~
  - ~~Observations of traffic conditions~~
  - ~~When TCD are damaged or replaced~~

- ~~How TCD were damaged and by whom~~
- ~~Accidents or incidents occurring within the work zone~~

- ~~The TCS may make minor revisions to the TCP to accommodate site conditions as long as the original intent of the TCP is maintained and the revision has been approved by the Engineer.~~
- ~~Attending Project meetings specifically scheduled to discuss the TCP and TCM.~~
- ~~Providing supervision over all TCM on a 24-hour per day basis.~~

Do not designate the Project superintendent as the TCS.

The TCS shall not act as a flagger or pilot car operator, except in an emergency or to relieve the flagger or pilot car operator for a period of less than 15 minutes.

~~Maintain a 24-hour telephone number at which the TCS can be contacted.~~

Make arrangements so that the TCS will be available ~~on~~ every ~~working~~ day, on call at all times, and available upon the Engineer's request at other than normal working hours. ~~During~~

In the event of a work zone incident during non-work periods, the TCS~~, or authorized representative,~~ shall ~~report~~be capable of reporting to the Project site within ~~45 minutes~~1 hour after ~~notification in the event of a work zone incident.~~being notified. The TCS shall have appropriate ~~manpower~~personnel, equipment, and material available at all times to expeditiously correct any deficiency in the TCM for the Project.

Notify the Engineer of an alternate TCS who can assume the duties of the assigned TCS in the event of that person's inability to perform. Alternate TCS shall be adequately trained and certified ~~to the same degree as the assigned TCS.~~according to 00225.31 and 00225.32. Notify the Engineer ~~within 24~~ at least 12 hours ~~of~~before designating the TCS for the following ~~24~~ 12-hour period. Make succeeding notifications within 24 hours every time a subsequent TCS is appointed to the Project.

~~The on-duty TCS shall not act as a flagger except in an emergency.~~

Construction

00225.40 General - Install, inspect, move, operate, maintain, and remove temporary TCD according to the plans, these Specifications, and the following:

- Install, maintain, and move all TCD by working with the direction of traffic.
- Provide additional TCM, according to 00225.02, when necessary or directed.

- Turn, cover, or remove the existing TCD as directed when they are not necessary or conflict with temporary devices. Remove and obliterate, without damaging the wearing surface, all evidence of all temporary TCD when the Contract is completed.
- Remove TCD in a sequence reverse to installation.

Temporary TCD are to remain the property of the Contractor.

Existing TCD shall remain in operation throughout the Contract or until replaced by new, permanent TCD as appropriate.

00225.41 Temporary Signing - Once temporary signs have been accepted and paid for on the Project, do not remove them from the Project, until directed by the Engineer.

Install all temporary signing according to the plans, Section 00940, the MUTCD, the "Sign Policy and Guidelines for the State Highway System", FHWA "Standard Highway Sign" manual and the following:

(a) Speed Signs - Use speed signs as follows:

(1) Advisory Speed Signs - Install ~~the advisory~~ Type "O4" advisory speed warning signs or riders as shown or directed.

~~When advisory Type "O4" speed signs are used, cover the appropriate Type "W1" speed zone signs with sign covers according to Section 00941. Uncover them when the advisory Type "O4" speed signs are removed or covered. At the trailing end of the Project, install a Type "W1" speed zone sign with the original designated speed. If existing Type "W1" speed signs are 500 feet or less beyond the Project, additional signs are not required.~~

~~When there is no work on the Project or when directed, cover or remove the advisory Type "O4" speed signs and restore the original Type "W1" speed zone signs.~~

(2) Regulatory Speed Zone Signs - Install and maintain ~~the~~ regulatory speed zone signs as directed and according to the "Temporary Speed Zone Order" signed by the State Traffic Engineer.

When regulatory Type "W1" speed zone signs are used, cover ~~the appropriate~~conflicting existing Type "W1" speed zone signs with sign covers according to Section 00941. ~~When there is no work on the Project or when directed, cover~~Cover or remove ~~the~~temporary regulatory Type "W1" speed zone signs and restore the original speed zone signs according to the "Temporary Speed Zone Order" and when directed.

If an existing regulatory Type "W1" speed zone sign displaying the original speed is 1,000 feet or less beyond the limits of the temporary speed zone, additional temporary regulatory Type "W1" speed zone signs displaying the original speed are not required.

(b) Sign Supports:

(1) Wood Sign Posts - Except as provided in the following (2) through (5), mount all temporary signs on wood sign posts as shown and as shown on the standard drawings.

When sign posts are installed in rock, a shorter post may be used ~~provided~~if the post is installed in a buried concrete footing at least 12 inches in diameter and 2 feet deep.

(2) Portable Sign Supports - Use portable sign supports as follows:

- When signs are needed at a single location for no more than 48 consecutive hours.
- Position the support so the lowest point of the sign is at least 1 foot above the roadway surface.
- ~~Install flags on~~Turn, cover, or remove signs ~~according to 00225.41(c).~~
- ~~Remove from road~~ at the end of each work shift when the condition is no longer in effect.
- Use with roll-up signs.
- Use ballast to prevent ~~blow down~~tipping of the signs in high wind.

(3) Concrete Barrier Sign Supports - Mount signs on concrete barrier so the:

- Lowest point of the sign is at least 7 feet above the roadway surface.
- Sign and post are held securely ~~with a~~ to concrete barrier by an approved device ~~that prevents blowdown~~.
- Sign can be turned and locked in a position parallel to the flow of traffic when not in use.

(4) Temporary Sign Supports - Use TSS as follows:

- When signs are needed at a single location for more than 48 consecutive hours.
- When not practical to post mount due to location or when utility conflicts exists.
- Do not tip over TSS at any time.
- Position ~~the TSS's~~ double post TSS behind ~~a~~8 foot type III barricade, as shown on the standard drawing or in the TCP. Where horizontal width prevents an 8 foot barricade, provide a 4 foot type III barricade, as shown or as directed.
- When not in use, locate TSS ~~outside the clear zone~~as far from public traffic as practical and turn away from traffic, or cover the sign ~~and retain~~. Retain the type III barricade for delineation.

(5) Perforated Steel Square Tube Sign Supports - ~~Square~~Perforated steel square tube sign supports may be used as a substitute for wood sign posts. Install perforated steel square tube sign supports as shown on the standard drawings.

(c) Sign Flag Boards and Sign Flags - Use two sign flag boards and flags as follows:

(1) Sign Flag Boards - Install two sign flag boards, as shown ~~on the standard drawings, the plans, and 00225.02~~or specified.

(2) Sign Flags - ~~Install at least two sign~~Sign flags may be installed above ~~all~~ signs mounted on portable sign supports. Mount flags so the entire sign is visible.

~~**(d) Amber Flashers** - Use either 110/120 volt flashers or 12 volt rechargeable flashers.~~

~~(e~~
(d) Roll-up Signs - Roll-up signs may be used at a single location for no more than 48 consecutive hours.

~~(f~~

(e) Inconsistent Temporary Signs - Ensure that all temporary signs are properly used and consistent with the work zone. When signage is no longer required for staging or shift work, ~~do the following:~~remove all temporary signs, sign flag boards, supports, sign covers, and ballast.

~~• Remove from the road all temporary signs, supports, and ballast.~~
When temporary sign messages conflict with work zone conditions, traffic patterns, or other staging configurations, but signs are needed later in Project, do the following:

- Turn or cover the signs so ~~that~~ the message is not visible to any traffic.
- Remove or cover sign flag boards.
- When covering signs and sign flag boards, use covers meeting the ~~sign flag boards.~~requirements of 00225.11(c-1).
- ~~Remove or cover flags with an opaque, black, reflective sheath.~~

- ~~Remove or turn off amber flashers.~~

When it is determined that only minor work remains on the Project and the work area does not encroach on ~~the roadway~~traffic lanes or ~~shoulder~~shoulders, do the following:

- Remove all temporary signs, ~~supports, and ballast~~ including the advance construction ~~signs~~ and ~~sign flag boards.~~
- ~~Provide~~Project identification signs ~~for minor work~~.
- Remove all sign flag boards and ballasts.
- Use roll-up signs on portable sign supports for minor or short duration work.

(~~g~~f) Permanent Signing - When permanent sign messages conflict with adjacent temporary signing, work zone conditions, traffic patterns or other staging configurations, do the following:

- Turn or cover the signs so the message is not visible to any traffic.
- When covering signs, use sign covers meeting the requirements of 00225.11(c-1).

When work zone conditions change and permanent sign messages no longer conflict with temporary signing, uncover permanent signs. Install ~~the~~or uncover appropriate permanent signing as required, before changing traffic control staging.

00225.42 Temporary Barricades, Guardrail, Barrier, Attenuators, and ~~Pedestrian Fencing~~Channelizing Devices ~~-~~ Install temporary barricades, guardrail, barrier, attenuators, pedestrian fencing, and accessories as follows:

(a) Barricades - Use and place barricades as shown or as directed.

(b) Guardrail - Construct temporary guardrail as shown and according to Section 00810.

(c) Concrete Barrier - When placing concrete barrier on pavement surfaces, connect all the barrier sections together with standard barrier pins~~barrier adjacent to a road, maintain a minimum of 24 inches from face of barrier to edge of traffic lane. Flare the leading end as shown in the table below and treat ends as shown on the plans~~.

When placing barrier adjacent to a traffic lane, maintain a minimum of 24 inches from face of barrier to the edge of the traffic lane, or as shown or directed. Flare the leading end as shown in the table below and treat ends as shown on the plans.

Speed (mph)	Flare Rate
65	19:1
55	16:1
50	14:1
45	~~13~~12:1
40	~~11~~10:1

~~Pin or restrain~~Secure temporary concrete barrier to AC or Portland cement concrete pavement surfaces by pinning when the distance behind the barrier is limited to less than 3 feet. When pinning ~~or restraining~~the barrier, maintain a minimum of 1 foot between the back face of barrier and a drop-off or obstruction. Use the appropriate pinning ~~or restraint~~ detail shown on the standard drawings.

When securing temporary concrete barrier to bridge decks by restraining the barrier, use temporary concrete barrier, deck anchors, and anchor layouts as shown.

(d) Impact Attenuators - Assemble and install impact attenuators according to the manufacturer's recommendations and as follows:

- May be placed on pallets, which are no more than 4 inches high, as approved.
- Place and fill the modules with the weight of dry sand as shown on the standard drawings.
- Mix salt with the sand to the proportions recommended by the manufacturer or at least 5~~%~~ percent by volume when no manufacturer recommendations are given.
- Attach an object marker to the lead module as shown on the standard drawings.
- Use attenuators designed for the ~~original~~ pre-construction posted speed.
- For narrow site systems, ~~pin or restrain~~secure the first two barrier sections by pinning or restraining as shown on the standard drawings.

(e) Glare Shields - Install glare shields as shown or as directed and according to the following:

- Install at spacing recommended by the manufacturer.
- Install all glare shield blades vertical and true to line.
- Firmly attach the base plate anchor bolts to the concrete barrier to withstand a 1,000 pound vertical pull and to prevent horizontal and rotational displacement. Maximum spacing between anchor bolts on modular units shall be 30 inches.
- Repair any damage to the concrete barrier caused by the Contractor's operations at no additional cost to the Agency.
- Modular or single element glare shields that are installed in a continuous run shall be of the same manufacture and of like appearance throughout the entire installation.

(f) ~~Temporary Pedestrian~~Work Zone Fencing - Install ~~temporary pedestrian~~ work zone ~~delineation~~ fencing as shown or as directed.

(g) Reflective Barrier Panels - Install reflective barrier panels on temporary concrete barrier as shown or directed and as follows:

- Install two panels on each barrier section.
- Maintain a 4 foot gap between panels on each barrier section.
- Alternate silver-white and fluorescent orange color panels.
- Attach the panels to the face of the concrete barrier with a minimum of four anchors.
- Install the bottom edge of panels 20 inches above the bottom of the concrete barrier.

(h) Pedestrian Channelizing Devices - Install PCD as shown on the standard drawings or in the TCP. Provide a continuous route by interconnecting all adjacent PCD. Provide a clean unobstructed path for pedestrians according to 00220.02 and ADA requirements.

00225.43 Temporary Traffic Delineation - Install and remove traffic delineation items and accessories as follows:

(a) Tubular and Conical Markers - Install tubular or conical markers as shown or directed.

Place tubular or conical markers no more than 10 feet apart along both sides of driveways, streets, and road connections within work areas.

Within individual runs of tubular or conical markers, use one shape for the entire run. Conical markers may substitute for tubular markers.

(b) Surface Mounted Tubular Markers - Install surface mounted tubular markers as shown or directed.

~~**(1) Surface Mounted Tubular Marker Removal** -~~Remove surface mounted tubular marker bases in a manner that leaves any remaining adhesive material with a textured surface condition similar to the texture of the surrounding top lift wearing course pavement surface. Make the surface dull and non-reflective. Remove adhesive from the pavement surface using a method that will not damage the pavement surface.

(c) Plastic Drums - Install plastic drums as shown or as directed.

(d) Delineators - Install traffic delineators as shown on the standard drawings or as directed. Install delineators on temporary concrete barrier and temporary guardrail as follows:

- Space on 50 foot centers. Closer spacing may be required as directed.
- Use yellow when installed on the left side of traffic.
- Use white when installed on the right side of traffic.
- Use bi-directional markers for median applications.
- Position to face oncoming traffic.

(e) Pavement Markers - Unless otherwise shown~~ on the plans~~, install pavement markers as follows:

- Three single markers spaced 5 feet apart to simulate a 10~~ feet~~ foot skip line with a gap of 30 feet to the next skip line.
- Single markers spaced ~~5~~ 10 feet apart for solid~~,~~ no passing lines.
- Double markers spaced ~~5~~ 10 feet apart for double solid~~,~~ no passing lines.

Use yellow markers for highway centerline. Use white markers for lines between adjacent lanes in the same direction of traffic.

~~Flexible~~Temporary pavement markers shall remain in place until the permanent markings are complete. Replace missing markers at no additional cost to the Agency. ~~Remove the markers from the top lift of pavement within five days after the Contractor is notified of the placement of permanent markings through the work area. Remove the flexible paving markers without damaging the roadway surface, or cut the markers off within 1/8 inch of the roadway surface~~On the final pavement wearing course, place permanent markings a maximum of 28 calendar days after placing temporary pavement markers, or as directed.

Remove temporary markers from the pavement wearing course within 5 calendar days after the placement of permanent markings. Remove temporary pavement markers without damaging the roadway surface. Flexible pavement markers may be cut off within 1/8 inch of the roadway surface.

Use flexible oiling pavement markers approved for mixes with temperatures greater than 325 °F.

(1) Reflective Pavement Markers - Use reflective pavement markers when shown according to Section 00855. Establish alignment with control points at 200 foot intervals on tangents and at 50 foot intervals on curves.

(2) Flexible Oiling Pavement Markers - Use flexible oiling pavement markers just before applying asphalt for chip seals, sand seals, and oil mats. Remove marker covers before reopening the roadway to traffic.

If a segment of roadway is not completed when the roadway is reopened to traffic, install another set of markers just before the next application of asphalt.

(3) Flexible Overlay Pavement Markers - Use flexible overlay pavement markers as follows:

- On surfaces that do not require chip seals, sand seals, and oil mats.
- On underlying surfaces that temporarily carry traffic.
- When temporary striping is determined as not practical by the Engineer.

Install the pavement markers before reopening the roadway to traffic. Remove the markers on ~~underlying surfaces~~pavement base courses before placing the next surface layer.

(4) Existing Pavement Marker Removal - Remove and dispose of existing raised or recessed pavement markers as needed for Stage Construction or as directed. Remove ~~the~~pavement markers from permanent pavement wearing ~~course surfaces so~~courses without damaging the roadway surface ~~is not damaged~~ and ~~a~~ensure the surface texture remains similar to that of the surrounding area~~ remains.~~. Make the surface dull and non-reflective. Remove adhesive from the pavement surface using a method that will not damage the pavement surface.

(f) Temporary Tape - Replace damaged or missing tape at no additional cost to the Agency. Remove temporary tape without damaging the roadway surface.

Install temporary tape as shown and ~~the following~~as follows:

(1) Temporary Removable Tape - Install temporary removable tape on existing surfaces or pavement wearing ~~course~~courses as shown~~,~~ or as directed. When staging across new bridge deck surfaces, use temporary removable tape. Remove the temporary removable tape before placing subsequent surfaces and after installing permanent pavement markings.

(2) Temporary Non-Removable Tape - Install non-removable tape on base courses as shown or as directed.

(3) Temporary Non-Reflective Tape - Install non-reflective tape over durable pavement markings to be retained as shown or directed.

(g) Temporary ~~Striping~~ Pavement Markings - Before opening roadways to traffic, unless otherwise ~~allowed,~~specified in 00225.43(h), apply temporary ~~painted stripes~~pavement markings on pavement base courses~~ and pavement markers on the~~, wearing ~~surface~~courses, and new bridge deck surfaces at locations ~~designated~~shown, or as directed. Immediately remove all unacceptable ~~striping~~pavement markings and replace with acceptable ~~striping~~markings at no additional cost to the Agency.

Temporary pavement markings may be placed using paint, temporary tape, or pavement markers as follows:

(1) Base Courses - On pavement base courses apply , use paint, temporary tape, or pavement markers for temporary pavement markings, as shown in the standard drawings or in the TCP.

For painted striping, apply 4 inch wide by 10 foot long stripes with 30 foot gaps for skip line striping. Apply 4 inch wide, continuous stripes for solid line striping. Apply bead binder at a thickness of 15 mils wet, equivalent to 17 gallons/mile for a 4 inch wide solid line. Apply glass beads at a rate of 5 pounds per gallon of paint. Apply 4 inch wide by 10 foot long stripes with 30 foot gaps for skip striping. Apply 4 inch wide, continuous stripe for

Before opening a traffic lane on a base course adjacent to temporary concrete barrier that is located on the right-hand side of the traffic lane, place right-hand edge line stripingmarkings using paint or a continuous removable tape, or as directed.

Before opening a traffic lane adjacent to temporary concrete barrier that is located on the left-hand side of the traffic lane, place left-hand edge line markings using paint, a continuous strip of temporary removable tape, with pavement markers spaced 10 feet apart, or as directed.

(2) Wearing Course - On the pavement wearing courses course, use pavement markers or paint, temporary removable tape to simulate lane, or pavement markers for skip line or solid line markings, as follows:

- For left-hand solid lines. When a travel lane is adjacent to and slip lines striping, use temporary concrete barrier, replace theremovable tape or pavement markers.
- For right-hand solid edge line withmarkings, use paint or a continuous strip of temporary removable tape, as directed. When.
- Where inlaid permanent pavement markings are to be placed, use paint for temporary pavement markings.
- Where durable permanent pavement markings are to be placed, apply temporary line markings using painted striping the edge line, use a continuous strip of temporary removable tape.until durable permanent pavement markings can be applied according to 00225.43(g-4).

(3Before opening a traffic lane on a wearing course adjacent to temporary concrete barrier that is located on the right-hand side of the traffic lane, place right-hand solid edge line markings using a continuous strip of temporary removable tape, or as directed.

Before opening a traffic lane on a wearing course adjacent to temporary concrete barrier that is located on the left-hand side of the traffic lane, place left-hand solid edge line markings using a continuous strip of temporary removable tape, with pavement markers spaced 10 feet apart, or as directed.

(3) New Bridge Deck Surfaces - On new bridge deck surfaces use temporary removable tape for temporary pavement markings for skip line or solid line striping, as shown or as directed.

(4) **Durable Permanent Pavement Markings** - On pavement wearing courses where durable permanent pavement markings are to be placed, apply temporary painted striping for lane line delineation until durable permanent pavement markings can be applied, unless otherwise directed. Reduce the application rate of the paint to a thickness of 10 mils wet, equivalent to 12 gallons per mile for a 4 inch wide solid stripe. Apply reflective elements at a rate of 5 pounds per gallon of paint. Only one application is required.

Place temporary painted striping directly adjacent to the final location of the durable permanent pavement markings. Place so thatthe temporary painted striping so the durable permanent pavement markings can be aligned with the existing striping onat the adjacentend of the project limits. Removal of this the temporary painted striping is not required, if aligned as abovedescribed in this subsection.

When scheduled installation of durable permanent pavement markings will exceed, or will likely exceed, four weeks28 calendar days after placement of the wearing surface, furnish and place temporary painted striping at the standard rate stated in 00225.43(g-1). Removal of this striping is not required, if aligned as abovedescribed in this subsection.

(h) Pavement Edge Delineation - Place tubular or conical markers to delineate the edge of pavement whenimmediately after construction work removes or obscures the painted edge stripes (shoulder stripe (or fog line) or when paving creates an abrupt or sloped edge drop-off 1 inch or more in height along the lines). If the left shoulder. Locate and maintain the is less than 8 feet wide, tubular or conical markers as follows:may be substituted by installing Type 5 delineators on the concrete barrier at 25 foot spacing before left-hand edge line markings are removed or obscured.

Place tubular or conical markers to delineate the edge of pavement immediately after construction work or paving operations create an abrupt or sloped edge drop-off 1 inch or more in height along the right-hand or left-hand shoulder.

Maintain pavement edge delineation until temporary pavement markings can be applied according to 00225.43(g). Temporary pavement markings must be applied within 14 calendar days after the painted edge stripe has been removed or obscured. Locate and maintain the tubular and conical markers as follows:

- Between existing delineatorstraffic and the abrupt edge.
- Space markers as shown for traffic delineators on the standard drawings, except do not exceed at a maximum spacing of 200 feet.
- Patrol daily and restore them to their proper position at least once inat the early morningstart of each work shift and once inat the late afternoonend of each work shift until the tubular or conical markers are no longer required.
- Remove after a new edge stripe has been painted and new delineators are in place.
- Between traffic and abrupt edge.
- Place delineation immediately.

(i) Stripe and Legend Removal - When removing striping and legends for stage construction, remove them by sandblasting, hydro-blasting, steel shot blasting, or grinding so the pavement surface is not damaged below a depth of 1/8 inch. Remove durable markings and durable legends by steel shot blasting or grinding the pavement surface to a depth no greater than 1/8 inch, or other approved method so the pavement surface is not damaged. Do not use paint or asphalt to cover existing stripes. Repair any damaged surfaces to the Engineer's satisfaction at no additional compensation.

Do not use grinding to remove stripes from the wearing course or existing surfaces, unless the area is to be paved over during the Project.

Use vacuum shrouded equipment or other equally effective containment procedures.

Contain and collect all removed paint, durable markings, and spent abrasive and dispose of according to 00290.20.

Remove striping on pavement base courses when a change in striping is necessary and when the pavement will not be covered with an additional base course. Remove striping and pavement markers on the wearing course so that the permanent markings can be applied. Remove all remaining striping and pavement markers from the wearing course after the permanent markings have been applied, as directed.

Remove legends so that the legend outline is not recognizable on the pavement surface.

Coordinate all removal work with the construction activity. Remove striping, legends, and pavement markers during the same ~~day(s)~~days the traffic shift is accomplished unless otherwise approved.

(j) Pavement Legends and Bars - Before opening roadways to traffic, unless otherwise allowed, apply temporary pavement legends and bars on pavement base courses at locations designated. Apply bead binder at a thickness of 15 mils wet and glass beads at a rate of 5 pounds per gallon of paint.

00225.44 Temporary Illumination - Construct and remove temporary illumination according to the plans and Sections 00950, 00960, 00970, 02920, and ~~02925~~02926.

00225.45 Traffic Signals - Provide traffic signals according to the following:

(a) Temporary Traffic Signals - Construct, adjust, and remove temporary traffic signals according to the plans, Sections 00950, 00960, 00990, 02920, 02925, and the following:

(1) Removal - Remove the temporary traffic signal when directed. Remove all wood poles and guy anchors in their entirety. Abandon vehicle detector loops in place. Contractor furnished equipment remains the property of the Contractor.

(2) Power Service - Be responsible for utility coordination, hook-up, and power consumption.

(3) Wood Poles - Backguy wood poles so that they are vertical with all dead loads applied.

(4) Suspension of Heads - Adapt signal mounting hardware as needed for mounting on wood poles.

(5) Testing and Turn-on - Certify that all traffic signal controllers and related control equipment for temporary signals have passed the Oregon Department of Transportation laboratory tests. Successfully tested controllers and related control equipment will be assigned permanent certification tags and will not require further environmental testing. Deliver controllers to the Traffic System Services Unit for functional testing.

(b) Portable Traffic Signals - Unless otherwise indicated in the TCP, provide and install portable temporary traffic signals as shown on the standard drawings and the following:

(1) Location and Set-up - Locate and set up portable temporary traffic signals according to the following:

- Locate the portable temporary traffic signal so that one vehicle signal head is directly over the traveled way with minimum vertical clearances of 17 feet.
- Provide conflict monitoring of green and yellow field indications.
- If there are indications in conflict or if there is operational failure, set the default to red flash.
- Hardwire interconnect the ~~two~~ units for timing and conflict monitoring.
- Provide cellular or other immediate methods of failure notification.

Do not install portable temporary traffic signals if driveways or road approaches are between the portable temporary traffic signals.

(2) Vehicle Detection - Provide vehicle detection at the stop line for each direction of traffic.

(3) Testing and Turn-on - Notify the Engineer 14 calendar days before turning on the portable temporary traffic signal. The Engineer will do the following:

- Inspect the installation and confirm the date and time the portable traffic signal is to be turned on.
- Notify the Contractor, in writing, with a list of deficiencies that need correction.
- Provide timing parameters to the Contractor for input into the portable temporary traffic signal.

Correct all deficiencies identified by the Engineer before turning on the portable temporary traffic signal. Do not change the timing parameters without the approval of the Engineer. Use flaggers to control traffic during initial turn on of the signal. The flaggers shall remain on standby for 2 hours after the signal is turned on and operating properly.

Correct deficiencies at no additional cost to the Agency.

(c) Existing Traffic Signals - Adjust existing traffic signals according to the plans and Sections 00950, 00960, 00990, 02920, and 02925.

00225.46 Temporary Electrical Items - Provide and install electrical resources as follows:

(a) Sequential Arrow Signs - Use the sequential arrow signs as follows:

- To indicate a lane closure only. Use one sequential arrow sign for each lane being closed.
- Install where the sign is visible from 1/2 mile minimum.
- Mount at a height of 7 feet from bottom of sign to ground.
- Do not use on 2-Lane, 2-Way roadway.
- For shoulder work use caution mode only.
- Provide a solar/battery power source.

(b) Portable Changeable Message Signs ~~**(PCMS)** -~~ - Use PCMS according to the "Oregon Portable Changeable Message Sign Handbook" and as follows:

- Program concise accurate messages according to the "Oregon Portable Changeable Message Sign Handbook".

- Install beyond the outside shoulder~~ or~~, behind existing barrier or guardrail, as shown in the TCP, or as directed when conditions do not allow the PCMS to be located beyond the traffic lane.
- Install the PCMS device where ~~the sign is visible~~it can be seen from 1/2 mile minimum. The PCMS message should be legible from 800 feet in the daytime and 600 feet at night.
- Mount ~~at a height of 7 feet from~~ so that the bottom of the sign ~~to~~is 7 feet above the ground.
- ~~Entire~~Program so that the entire message is displayed within ~~7.5~~ 8 seconds.
- Use a maximum of two panels to display an entire message.
- Separate two PCMS used in sequence by 1,000 feet minimum.
- Messages shall not scroll horizontally or vertically across the face of the sign.
- When the PCMS is not ~~displaying appropriate~~being used to display any messages~~, as directed~~ for more than 5 consecutive calendar days, remove the PCMS from the roadway and locate the device ~~outside~~at least 30 feet from the ~~clear zone~~edge of the nearest traffic lane, place behind a barrier system, or as directed.
- Provide a solar/battery power source.
- ~~Use clear, concise messages, approved by the Engineer, that convey applicable work zone information to the motorist.~~
- Obtain approval from the Engineer before displaying or altering messages.

(c) Temporary Power Source - Arrange for, provide, and pay for all electrical power.

00225.47 Flaggers and Flagger Station Lighting - Use flaggers and flagger station lighting as follows:

(a) Flaggers - Locate flaggers far enough in advance of the work area to permit adequate time for the motorist to respond to the flagger's instructions. All flaggers, including advance flaggers, shall use a STOP/SLOW paddle. Do not use the roll-up STOP/SLOW paddle for non-emergency flagging operations.

During advance flagging operations, the advance flagger shall only display the "SLOW" face of the paddle by covering the "STOP" face of the paddle with ~~black, opaque, nonreflective material.~~a sign cover according to 00225.11(c-1).

Position flaggers, as directed, at locations where traffic can enter the highway within the limits of the work zone. Flaggers shall direct vehicles entering the highway to follow the pilot car line.

Flagging stations shall be staffed continuously or until the Engineer determines flagging is no longer required.

(b) Flagger Station Lighting - Provide continuous flagger station lighting for nighttime flagging as follows:

- Locate the light equipment on the same side of the roadway as the flagger between 5 to 10 feet from the edge of the ~~travel~~traffic lane, on or beyond the roadway shoulder, or as directed.
- ~~Place~~Position and orient the flagger station lighting to direct the ~~lighting~~maximum amount of light toward the flagger and away from the approaching traffic in the near lane~~ at approximately a 15° horizontal angle ±10° perpendicular to the centerline of the roadway~~.
- Aim all of the luminaires directly at the flagger.

- Increase the output wattage or number of luminaires as the luminance from, and number of, surrounding and background lights increases. Do not provide a total output more than 2,500 watts, unless otherwise directed.

00225.48 Traffic Control Supervisor - Supervise the safe operation of traffic control within the construction work zone.

00225.49 Pilot Cars~~ - Operate~~ - Safely operate pilot cars at a ~~safe and~~ prudent speed, and at a speed that does not exceed that posted on the temporary advisory speed signing.

Maintenance

00225.60 Temporary ~~TCD~~Traffic Control Devices - Evaluate the condition of TCD and maintain them using the criteria shown in the most current ~~American Traffic Safety Services Association (~~version of the ATSSA~~)~~ publication titled "Quality Guidelines for ~~Work Zone~~Temporary Traffic Control Devices and Features". Except for electrical devices, replace all TCD that, according to the ATSSA publication, are in ~~marginal~~"Marginal" or ~~unacceptable~~"Unacceptable" condition with equal devices~~,~~ that are in new or ~~acceptable~~"Acceptable" condition, within a time period agreed upon by the Engineer.

Electrical devices that are in ~~marginal~~"Marginal" or ~~unacceptable~~"Unacceptable" condition may be repaired instead of being replaced, as long as the repairs are satisfactorily completed within a time period agreed upon by the Engineer.

The replacement or repair of TCD, found to be in ~~marginal~~"Marginal" or ~~unacceptable~~"Unacceptable" condition, shall be made at no additional cost to the Agency except as in 00225.90(a-1).

Evaluate, maintain, repair or replace TCD, and perform other duties including the following:

- Keep the devices in proper position, clean, and legible at all times.
- Keep lights, reflectors, and flashers clean, visible, and operable during both daylight and darkness.
- Trim or remove vegetative growth or other materials so the devices can be seen.
- Verify, by inspection, the effectiveness of the installations at frequent intervals, both in daylight and darkness, at actual travel speeds.
- Repair, replace, or restore damaged or destroyed devices to maintain continuity and effectiveness.
- Maintain temporary TCD during suspensions of work the same as if work were in progress.

~~**00225.61 Signs**~~When the bid schedule does not include an item for a TCS, the Contractor's Superintendent or designee shall prepare and sign a daily "Traffic Control Inspection Report" (Form No. 734-2474) each working day. Submit the report to the Engineer no later than the end of the next working day.

00225.61 Signs and Other Existing ~~TCD~~Traffic Control Devices - Maintain existing guide signs, warning signs, regulatory signs, specific service signs (business logos), tourist-oriented directional signs (TODS), and other existing TCD, in the same manner as temporary signs and devices associated with the Project.

00225.62 Temporary ~~Concrete~~ Barrier, Guardrail, and Attenuators - Maintain or replace materials and equipment as follows:

(a) Temporary Concrete Barrier and Guardrail - Immediately repair any concrete barrier segment or guardrail element that is damaged by the Contractor during or after placement. Repair it to the Engineer's satisfaction or replace it with an undamaged section at no additional cost to the Agency.

(b) Temporary Impact Attenuators - Complete repair of damaged impact attenuators, except for narrow site systems, within 24 hours of being notified of the damage. Complete repair of damaged narrow site systems within ~~four~~ 4 hours of discovery of or of being notified of the damage.

When impact attenuator, truck mounted attenuator, or narrow site attenuator systems are used, have enough modules, cartridges, components, and replacement parts on-site to replace one complete installation~~.~~ or have on-site a complete replacement attenuator. Re~~-~~-stock replacement ~~parts~~items or complete replacement attenuators within 24 hours of use. All modules, cartridges, components, replacement parts, and replacement ~~parts~~attenuators not used~~,~~ remain the property of the Contractor.

Replace damaged modules, cartridges, components, and replacement parts with modules, cartridges, components, and replacement parts of the same manufacturer and type, and with attenuation capabilities equal to the original, installed system.

00225.63 Temporary Traffic Delineation - At no additional cost to the Agency, evaluate and maintain or immediately replace all unacceptable temporary traffic delineation with acceptable materials as follows:

(a) Pavement Markers - Damaged or missing markers. Maintain proper alignment and spacing of markers.

(b) Temporary Tape - Damaged or missing temporary tape. Maintain proper alignment and placement of temporary tape.

When removing damaged delineation from the pavement surface, remove adhesives, hardware, damaged delineation fragments or other materials using a method that will not damage the pavement surface. Repair any damaged surfaces to the Engineer's satisfaction at no additional cost to the Agency.

00225.64 Illumination and Sign Illumination - Maintain existing illumination and sign illumination after adjusting or working on them until accepted.

Routine maintenance of existing illumination and sign illumination will be performed by the Agency at the Agency's expense before the Contractor works on them and after work on them is completed and accepted.

00225.65 Traffic Signals - Maintain or replace materials and equipment as follows:

(a) Temporary Traffic Signals - After successful turn-on of the temporary signal, except for equipment inside the controller cabinet, assume ~~all~~operation and maintenance of the temporary traffic signal ~~installation~~ until it is removed~~. After notification by the Agency, if the Contractor is not able to respond to a maintenance request, Agency electricians will make repairs at the Contractor's expense~~.

The operation and maintenance of the equipment inside the controller cabinet will be the responsibility of the Agency, except the Contractor shall furnish replacement parts that fail within the controller cabinet while the temporary traffic signal is in use.

After notification by the Agency, if the Contractor is not able to respond to a maintenance request for the temporary traffic signal or a request for replacement parts for the inside of the controller cabinet, Agency electricians will make repairs at the Contractor's expense.

If the temporary traffic signal fails during operation for any reason, immediately provide flaggers to control traffic until the temporary traffic signal is operational. No additional payment will be made for flagging as a result of a temporary traffic signal failure.

(b) Portable Traffic Signals - After successful turn-on, perform all required maintenance during operation of the portable traffic signal. Maintain a log for each portable traffic signal that contains at least the following information:

- Dates and times when service and maintenance is performed.
- A description of equipment that was serviced and a brief description of why the service was performed.
- All operational and equipment failures of the unit.
- Repairs made to the unit.
- Past operational history of the unit.
- All timing parameters input into the controller.

The log shall remain with the corresponding portable traffic signal at all times.

The Agency will not replace or repair any part of portable traffic signals.

If the portable traffic signal fails during operation for any reason, immediately provide flaggers to control traffic until the portable traffic signal is operational. If the portable traffic signal fails a second time within 30 calendar days of the first failure, remove it from the Project and control traffic with flaggers until a replacement portable traffic signal is installed, activated, and working properly. No additional payment will be made for flagging as a result of a portable traffic signal failure.

(c) Existing Traffic Signals - Maintain existing signals after adjusting or working on them until accepted.

Routine maintenance of existing signals will be performed by the Agency at the Agency's expense before the Contractor works on them and after work on them is completed and accepted.

00225.66 Portable Electrical Signs - Maintain and use the required ~~portable changeable message signs~~PCMS and sequential arrow signs according to the manufacturer's recommendations, ~~traffic control plans~~TCP, and as ~~required. Do not display or alter any sign message before it is approved~~directed.

While portable changeable message signs and sequential arrow signs are in use, have repair equipment and parts on the Project site, as recommended by the manufacturer.

When directed, repair or replace sequential arrow signs and portable changeable message signs that are damaged or destroyed before continuing work that requires use of the signs.

00225.67 Flagger Station Lighting - Maintain and use the required flagger station lighting according to the manufacturer's recommendation and as required.

When flagger station lighting is in use, have on the Project site, the following:

- Repair equipment and electronic components recommended by the manufacturer.
- At the beginning of each shift, have approved backup flagger station lighting available for immediate use in event of failure.
- Sufficient fuel to maintain continuous operation of the ~~diesel~~ generator.

Measurement

00225.80 Measurement - Work covered under this Section will be measured by one of the following methods:

- **Method "A" - Unit Basis** - Under this method, work zone traffic control measures will be measured according to 00225.80(a) through 00225.89.

- **Method "B" - Lump Sum Basis** - Under this method, no measurement of quantities will be made.

- **Method "C" - Incidental Basis** - Under this method, no measurement of quantities will be made.

(a) Quantity Limitations - The quantities for work zone traffic control measures (TCM) will be limited to the following, unless otherwise specified:

- The initial installation of quantities necessary to complete the Project based on the Contract Schedule of Items.
- The initial installation of additional TCD and TCM that the Engineer and Contractor agree are necessary to ensure a safe work zone.
- The replacement of TCD and TCM, except temporary signing, temporary electrical signs, and portable temporary traffic signals, damaged by public traffic and replaced by the Contractor.

Temporary signing, temporary electrical signs, and portable temporary traffic signals damaged by public traffic and replaced or repaired by the Contractor will not be measured.

(b) Temporary Protection and Direction of Traffic - No measurement of quantities will be made for this work.

00225.81 Temporary Signing - The quantities of temporary ~~signing and flashers will be determined as follows:~~

~~**(a) Signs** - Temporary~~ signs will be measured on the area basis, upon delivery to the Project. The quantities will be limited to those in the approved TCP including speed zone signage. The sign area will be the nominal area determined by multiplying the width times the length. No deductions will be made for corners or irregular shapes.

Route markers on separate substrate riders and other signs fastened to the face of larger signs will be measured as separate signs.

~~**(b) Amber Flashers** - Amber flashers~~Sign covers will not be measured ~~on the unit basis.~~.

00225.82 Temporary Barricades, Guardrail, Barrier, ~~and~~ Attenuators, and Channelizing Devices - The quantities of barricades, attenuators, guardrail, and concrete barrier will be determined as follows:

(a) Barricades and Attenuators - Barricades, temporary impact attenuators, and moving temporary impact attenuators will be measured on the unit basis.

(b) Guardrail and Concrete Barrier:

(1) Guardrail - Temporary guardrail will be measured on the length basis, of each type complete and in place, determined by one of the following methods:

a. Count Method - The number of standard sections will be counted and multiplied by 12 1/2 feet. For purposes of this subsection, a "standard section" is defined as 12 1/2 feet of complete guardrail, without regard to the number of posts or rail elements used. Non-standard sections will be measured from center of post to center of post and added to the total calculated length of the standard sections for each run.

b. Length Method - Measurement will be from center to center of end posts, along the line and grade of each run of each type.

(2) Guardrail Terminals, Transitions, and Bridge Connections - Temporary guardrail terminals, temporary guardrail transitions, and temporary bridge connections will be measured on the unit basis.

(3) Concrete Barrier - Temporary concrete barrier~~ and moving~~, moving temporary concrete barrier, and pinning or restraining temporary concrete barrier will be measured on the length basis, determined by one of the following methods:

a. Count Method - The laying length of a standard section, as shown on the applicable Standard Drawing, multiplied by the number of standard sections installed in each separate run. Non-standard sections, terminal sections, and transition sections will be measured and added to the total length of standard sections.

b. Length Method - Measurement will be from end to end of the barrier along the line and grade of each run.

(c) Glare Shields - Glare shields and moving glare shields will be measured on the length basis, from center to center of the glare shield blades, as installed on concrete barrier for each run.

(d) Reflective Barrier Panels - Reflective barrier panels will be measured on the unit basis.

(e) Temporary Impact Attenuator Repair - Temporary impact attenuator repair will be measured on the unit basis as follows:

- Sand barrel systems will be the replacement of damaged sand modules.
- All other systems will be the repair or complete replacement of the attenuator system.

(f) Pedestrian Channelizing Devices - The quantities of pedestrian channelizing devices will be measured on the length basis, determined by measuring from end to end of the devices along the line and grade of each run.

00225.83 Temporary Traffic Delineation - The quantities of temporary traffic delineation will be determined as follows:

(a) Surface Mounted Tubular Markers, Plastic Drums, Delineators, and Pavement Markers - Surface mounted tubular markers, replacing surface mounted tubular markers, plastic drums, temporary delineators, reflective pavement markers, and flexible pavement markers will be measured on the unit basis.

Flexible pavement markers ~~includes~~include flexible oiling markers and flexible overlay markers.

(b) Temporary Tape - Temporary tape will be measured on the length basis, ~~to the nearest foot,~~ as follows:

(1) Removable Tape - Removable tape will be determined by measuring the actual length of the 4 inch wide tape complete and in place.

(2) Non-Removable Tape - Non-Removable tape will be determined by measuring the actual length of the 4 inch wide tape complete and in place.

(3) Non-Reflective Tape - Non-Reflective tape will be determined by measuring the actual length of the 6 inch wide tape complete and in place.

(c) Striping, Legends, and Pavement Bars - Temporary striping, legends, and pavement bars will be measured as follows:

(1) Striping - Painted temporary striping ~~on pavement base courses~~ will be measured on the length basis~~, to the nearest foot,~~ determined by ~~measuring~~one of the following methods:

a. Count Method - The number of 4 inch wide skip stripes will be counted and multiplied by the "standard length". For purposes of this subsection a "standard length" for a skip stripe (10.0 feet) is defined in 00225.43(g-1).

b. Length Method - Measurement will be the actual length of 4 inch wide stripe complete and in place. When measuring the actual length of 4 inch wide skip stripe, the skip interval will not be included in the measurement. The length of skip stripe may be determined by dividing the total length by 4.0.

Temporary striping required for durable permanent pavement marking installation will be included in the measurement.

~~Skip intervals will not be included in the measurement.~~

Temporary striping will be measured on the length basis, of lines based on a nominal width of 4 inches. If the plans call for, or the Engineer requires, stripes other than nominal 4 inch width, the measurement will be adjusted by converting to an equivalent length of a nominal 4 inch ~~width~~wide stripe.

(2) Legends - Temporary pavement legends will be measured on the unit basis, by actual count.

(3) Pavement Bars - Temporary pavement bars will be measured on the area basis, for each stop bar and crosswalk bar.

(d) Stripe Removal ~~and~~, Legend Removal, and Bar Removal - Stripe removal ~~and~~, legend removal, and bar removal will be measured as follows:

(1) Stripe Removal - Stripe removal for stage construction will be measured on the length basis, ~~to the nearest foot,~~ determined by measuring the overall length of 4 inch line removed.

The quantity of stripe removal will be the computed length of lines removed based on a nominal width of 4 inches. For computation purposes, the following apply:

- The width of a line is the normal standard line width applied during original placement of solid no-passing lines, broken (skip) lines, edge lines, and any other lines normally 4 inches wide.
- The length of continuous lines is length of the line.
- The length of broken (skip) stripes is the standard length of a skip line normally painted during original placement of the lines 10.0 feet of paint per 40 feet of roadway length. Skip stripes may be counted.

The length of standard 8 inch or 12 inch wide stripes will be adjusted by converting to equivalent length of 4 inch width line. No conversion or adjustment will be allowed for lines that are wider or longer due to improper placement or retracing deviations.

(2) Legend and Bar Removal - Pavement legend removal and bar removal for stage construction will be measured on the area basis, of each legend and bar removed and will be the nominal area determined by multiplying the width times the length of the legend or bar. No deductions will be made for corners or irregular shapes.

00225.84 Temporary Illumination - No measurement of quantities will be made for temporary illumination.

00225.85 Traffic Signals - The quantities of traffic signals will be measured as follows:

(a) Temporary Traffic Signals - No measurement of quantities will be made for temporary traffic signals.

(b) Portable Traffic Signals - Portable traffic signals will be measured on the unit basis, for each complete system. A complete system consists of two portable temporary traffic signals and hardwire interconnect between them.

00225.86 Temporary Electrical Signs - The quantities of temporary electrical signs will be measured as follows:

(a) Sequential Arrow Signs - Sequential arrow signs will be measured on the unit basis, where the devices are initially installed on the Project.

(b) Portable Changeable Message Signs - Portable changeable message signs will be measured on the unit basis, where the devices are initially installed on the Project.

00225.87 Flaggers and Flagger Station Lighting - The quantities of flaggers and flagger station lighting will be measured as follows:

(a) Flaggers - Flaggers will be measured on the time basis, of the actual number of hours flagging stations are staffed.

Flagging performed by a TCS will not be measured, except as specified in 00225.32.

(b) Flagger Station Lighting - Flagger station lighting will be measured on the unit basis, where the devices are initially installed on the Project or on the time basis, of the actual number of hours the flagger stations are staffed and flagger station lighting is required.

No additional measurement will be made for the backup unit in event it is used or not.

00225.88 Traffic Control Supervisor ~~(TCS)~~ - The quantities of the TCS will be measured on the unit basis, and will be determined by a TCS construction work shift.

For the purpose of determining a TCS construction shift, a TCS construction work shift will be any work shift or portion of a work shift where any of the following operations occur:

- Full lane closures or lane shifts implemented on a daily basis on a freeway or highway with an ADT greater than 10,000.
- When TCS is called to respond to a traffic-related issue during non-work hours.
- Other construction operations as requested by the Engineer.

A maximum quantity of two TCS construction work shifts will be allowed for each 24 hour period. One TCS will be allowed for a construction work shift unless otherwise approved.

00225.89 Pilot Cars - The quantity for pilot cars will be measured on the time basis, of the actual number of hours pilot cars are operated.

Payment

00225.90 Payment - Work covered under this Section will be paid for by one of the following methods:

(a) Method "A" - Unit Basis:

(1) Pay Quantities - The accepted quantities, measured according to 00225.80(a) through 00225.89, will be paid for at the Contract lump sum amount or Contract unit price, per unit of measurement, for each of the pay quantities listed in the Contract Schedule of Items and in approved change orders.

Payment will be payment in full for furnishing, installing, moving, operating, maintaining, inspecting, and removing the materials and TCD, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified, except as covered in 00225.90(a-2).

All TCD damaged by public traffic and replaced by the Contractor, except temporary signing, temporary electrical signs, and portable temporary traffic signals, will be paid for at the Contract price for the pay items listed in the Contract Schedule of Items or in approved Contract change orders, unless otherwise specified. ~~Replacement temporary impact attenuator component(s) will be paid for according to Section 00196.~~ Payment for replacing damaged TCD will only be made when:

- The Engineer orders it.
- The replacement devices are used on the Project.
- The damaged devices are disposed of to the Engineer's satisfaction.

No separate or additional payment will be made for:

- Moving and reinstalling signs, barricades, PCD, plastic drums, delineators, sequential arrow signs, and portable changeable message signs required by stage construction.
- Providing TCM, including flaggers, used at material sources and disposal sites that are outside the Contract limits unless specifically called for on the plans or in the Special Provisions.
- Providing portable signs, unless shown or specified or when ~~only~~used for minor work ~~is required~~ as indicated in 00225.41(~~f~~e).

- TCD damaged or destroyed by Contractor's equipment or operations.

(2) Temporary Protection and Direction of Traffic - Temporary protection and direction of traffic will be paid for at the Contract lump sum amount for the item "Temporary Protection and Direction of Traffic" and will be for:

- Positioning all traffic control devices in proper locations at all times.
- Providing and furnishing electrical power.
- Cleaning up and removing devices destroyed or damaged by public traffic.
- Furnishing, placing, maintaining and removing temporary sign covers.
- Moving temporary concrete barrier to and from Contractor's stockpile areas.
- Moving temporary impact attenuators of any type to and from Contractor's stockpile areas.
- Furnishing, placing, replacing, maintaining, moving and removing tubular and conical markers.
- Removing existing raised and recessed pavement markers.
- Furnishing, placing, replacing, maintaining, moving and removing tubular and conical markers used to delineate the pavement edge because of edge line obliteration.
- Furnishing, installing, maintaining, moving, and removing ~~pedestrian~~ work zone ~~delineation~~ fencing.
- Moving and removing existing signs, specific service signs (business logos) and tourist-oriented directional signs (TODS) from their existing locations and reinstalling them on any type of support at new locations required by stage construction, as shown or directed.
- Moving, reinstalling, and removing existing post-mounted signs required by stage construction.
- Providing, surfacing, maintaining, removing, and restoring the alternate pedestrian route.
- Providing, moving, reinstalling, and removing guardrail end pieces and guardrail anchors as required by stage construction.
- Performing routine inspections of the TCD ~~by the TCS~~.
- When the bid schedule does not include an item for a TCS, preparing and signing the daily "Traffic Control Inspection Report".

(b) Method "B" - Lump Sum Basis - Work zone traffic control will be paid for at the Contract lump sum amount for the item "Temporary Work Zone Traffic Control, Complete".

Payment will be payment in full for furnishing, installing, moving, operating, maintaining, inspecting, and removing materials and TCD, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

(c) Method "C" - Incidental Basis - When the Contract Schedule of Items does not indicate payment for work zone traffic control, all work zone traffic control will be considered Incidental and no separate payment will be made.

00225.91 Temporary Signing - The accepted quantities of temporary ~~signing and appurtenances~~signs, regardless of type, will be paid for at the Contract unit price, per ~~unit of measurement~~square foot, for the ~~following items:~~item "Temporary Signs".

~~**Pay Item** **Unit of Measurement**~~

~~(a) Temporary Signs.....Square Foot~~
~~(b) Amber Flashers.....Each~~

~~Item (a) includes all signs, regardless of type.~~

No separate or additional payment will be made for sign flags, sign flag boards, ~~or~~ posts and other supports, or sign covers.

00225.92 Temporary Barricades, Guardrail, Barrier, ~~and~~ Attenuators, and Channelizing Devices ~~–~~ The accepted quantities of temporary barricades, guardrail, barrier, attenuators, and appurtenances will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Temporary Barricades, Type ___	Each
(b)	Temporary Guardrail, Type ___ Reflectorized	Foot
(c)	Temporary Guardrail Terminals, _____	Each
(d)	Temporary Guardrail Transition	Each
(e)	Temporary Bridge Connections	Each
(f)	Temporary Concrete Barrier, Reflectorized	Foot
(g)	Temporary Concrete Barrier, Tall, Reflectorized	Foot
(h)	Moving Temporary Concrete Barrier	Foot
(i)	Securing Temporary Concrete Barrier	Foot
(j)	Temporary Impact Attenuator, _____	Each
(~~j~~k)	Moving Temporary Impact Attenuators, _____	Each
(~~k~~)(l)	Repair Temporary Impact Attenuator, _____	Each
(m)	Temporary Glare Shields	Foot
(~~l~~n)	Moving Temporary Glare Shields	Foot
(~~m~~o)	Reflective Barrier Panels	Each
(p)	Pedestrian Channelizing Devices	Foot

In item (a), the type of barricade will be inserted in the blank.

In items (b) and (c), the type of guardrail or terminal will be inserted in the blank.

Items (d) and (e) ~~includes~~include each device, regardless of size or type.

Items (f) and (g) ~~includes~~include Type 5 delineators. ~~No separate or additional payment will be made for pinning or restraining barrier.~~

Item (h) includes moving temporary concrete barriers, regardless of size or type, from one location of actual use to another, and for removing and replacing Type 5 delineators on the barriers, as necessary.

Item (i) includes pinning temporary concrete barrier by securing it to the pavement surface or restraining temporary concrete barrier by securing it to the bridge deck.

In items (~~i~~j) and (~~j~~k), the type of attenuator, if applicable, will be inserted in the blank.

Item (~~j~~k) includes each move of the device from one location of actual use to another.

~~Item~~In item (l), the words "Sand Module" or the type of attenuator, if applicable, will be inserted in the blank.

Item (l) includes replacement of sand modules damaged by public traffic or includes repair or complete replacement of impact attenuators damaged by public traffic.

Item (n) includes moving the devices from one location on the concrete barrier to another.

Item (~~m~~o) includes panels installed on the concrete barrier and replacing damaged panels.

No separate or additional payment will be made for temporary impact attenuator replacements, replacement modules, cartridges, components, or replacement parts that are required to be on-site according to 00225.62(b) or for cleaning and removing debris from impacts.

00225.93 Temporary Traffic Delineation - The accepted quantities of temporary traffic delineation will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Surface Mounted Tubular Markers	Each
(b)	Replace Surface Mounted Tubular Markers	Each
(c)	Temporary Plastic Drums	Each
(d)	Temporary Delineators	Each
(e)	Temporary Reflective Pavement Markers	Each
(f)	Temporary Flexible Pavement Markers	Each
(g)	Temporary Removable Tape	Foot
(h)	Temporary Non-Removable Tape	Foot
(i)	Temporary Non-Reflective Tape	Foot
(j)	Temporary Striping	Foot
(k)	Temporary Pavement Legends	Each
(l)	Temporary Pavement Bars	Square Foot
(m)	Stripe Removal	Foot
(~~l~~n)	Legend Removal	Square Foot
(o)	Bar Removal	Square Foot

Item (a) includes furnishing and installing the complete assembly of each device in its initial location and for removing the device from the surface.

Item (b) includes furnishing new or refurbished devices to replace damaged or missing devices.

Item (e) includes temporary pavement markers having either one or two reflective faces.

Item (f) includes removing flexible pavement marker covers.

Item (~~k~~m) includes removal of painted and durable stripes required for stage construction.

Item (~~l~~n) includes removal of durable and non-durable legends required for stage construction.

Item (o) includes removal of durable and non-durable bars required for stage construction.

Payment for items (g), (h), (i), (j), (l), and (~~j~~o) performed beyond the quantity shown in the Contract Schedule of Items will be made at the Contract unit price if the Engineer determines that the Contract unit price does not exceed the value of the work as determined ~~on the basis of rates given~~

~~in~~according to Section 00197. If the Engineer determines that the Contract unit price exceeds the value of the work, payment for the additional work will be made according to ~~Section 00196~~00195.20.

No separate or additional payment will be made for mobilization to perform striping, stripe removal, legend removal, or for mobilization to place or remove temporary flexible pavement markers.

00225.94 Temporary Illumination - The accepted quantities of temporary illumination will be paid for at the Contract lump sum amount for the item "Temporary Illumination".

00225.95 Traffic Signals - The accepted quantities of traffic signals will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Temporary Traffic Signal	Lump Sum
(b) Portable Traffic Signal	Each

Item (a) includes all required materials called for by the plans and Specifications.

Item (b) includes furnishing, operating, moving, and removing the signals and all required earthwork, bases, surfacings, and hardwire interconnects.

No separate or additional payment will be made for removing and replacing damaged portable traffic signals.

Flagging for initial turn-on and 2 hour standby time will be paid for under the flagger pay item.

00225.96 Temporary Electrical Signs - The accepted quantities of temporary electrical signs will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Sequential Arrow Signs	Each
(b) Portable Changeable Message Signs	Each

Items (a) and (b) includes furnishing, operating, moving, and removing the signs and supports.

No separate or additional payment will be made for removing and replacing damaged signs.

00225.97 Flaggers and Flagger Station Lighting - The accepted quantities of flaggers and flagger station lighting will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Flaggers	Hour
(b) Flagger Station Lighting	Each or Hour

Item (a) includes all necessary equipment, special apparel, flagging equipment, and two-way radios.

Workers performing flagging duties who are not properly equipped or attired will not be considered to be flaggers and will not be eligible for payment under this item.

Flaggers performing work other than flagging will not be considered flaggers and will not be eligible for payment under this item.

Payment for item (a) performed beyond the quantity shown in the Contract Schedule of Items will be made at the Contract unit price if the Engineer determines that the Contract unit price does not exceed the value of the work as determined ~~on the basis of rates given in~~according to Section 00197. If the Engineer determines that the Contract unit price exceeds the value of the work, payment for the additional work will be made according to ~~Section 00196.~~00195.20.

Item (b) includes furnishing, operating, moving, and removing the flagger station lighting.

No separate or additional payment will be made for back-up unit in event it is used or not.

00225.98 Traffic Control Supervisor - The accepted quantities of traffic control supervisor will be paid for at the Contract unit price, per each for the item "Traffic Control Supervisor".

Payment includes vehicle and equipment.

Payment for item "Traffic Control Supervisor" performed beyond the quantity shown in the Contract Schedule of Items will be made at the Contract unit price if the Engineer determines that the Contract unit price does not exceed the value of the work as determined ~~on the basis of rates given in~~according to Section 00197. If the Engineer determines that the Contract unit price exceeds the value of the work, payment for the additional work will be made according to ~~Section 00196~~00195.20.

00225.99 Pilot Cars - The accepted quantities of pilot cars will be paid for at the Contract unit price, per hour for the item "Pilot Cars".

Payment will be payment in full for fully operated pilot cars, two-way radios, the "PILOT CAR FOLLOW ME" sign, and the rotating amber light or strobe light mounted on the pilot car.

Payment for item "Pilot Cars" performed beyond the quantity shown in the Contract Schedule of Items will be made at the Contract unit price if the Engineer determines that the Contract unit price does not exceed the value of the work as determined ~~on the basis of rates given in~~according to Section 00197. If the Engineer determines that the Contract unit price exceeds the value of the work, payment for the additional work will be made according to ~~Section 00196~~00195.20.

Section 00240 - Temporary Drainage Facilities

Description

00240.00 Scope - This work consists of furnishing, installing, and removing temporary drainage facilities.

Construction

00240.40 ~~General~~Construction - Furnish and install temporary drainage facilities of sufficient capacity and strength to carry traffic over the facility, and water flow in or under the facility. Determine the actual size, strength and type of facility needed. The sizes of facilities shown on the plans are minimum only. Submit this determination and its basis to the Engineer for review. Do not install until approved.

Remove temporary drainage facilities when they are no longer needed. The facilities remain the property of the Contractor.

Measurement

00240.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00240.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract lump sum amount for the item "Temporary Drainage Facilities".

Payment will be payment in full for furnishing, placing, maintaining, and removing temporary drainage facilities, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00270 - Temporary Fences

Description

00270.00 Scope - This work consists of constructing, maintaining, and removing temporary fences, gates, and gateways as shown or directed.

Materials

00270.10 Material - Provide new material meeting the requirements of 01050.10.

Provide concrete barrier meeting the requirements of 00225.12(c).

Construction

00270.40 Construction - Construct temporary fences, gates, and gateways according to the applicable parts of Section 01050.

00270.42 Rock Protection Fence - Construct concrete barrier according to Section 00820. Attach fence to barrier as shown.

Maintenance

00270.60 Maintenance - Maintain temporary fences and appurtenances in good condition. Keep the fences in place until they are no longer needed.

Finishing and Cleaning Up

00270.70 General - When temporary fences and appurtenances are no longer needed remove and dispose of them according to the applicable parts of Section 00310 except fence fabric, fence wire, posts, and braces may be used in permanent fence installations if the following conditions are met:

- The material was new when installed for temporary purposes.
- The material has not been used on previous projects.
- The material meets the requirements of 01050.10.
- The material is undamaged.
- The material is acceptable to the Engineer.

Measurement

00270.80 Measurement - The quantities of temporary fence will be measured on the length basis of each type of temporary fence. Gateways will be considered as fence of the type which adjoins them and will be measured as a continuing part of that type of fence. Measurement will be from center to center of posts, measured along the line and grade of each separate continuous run of fence as constructed exclusive of gates.

The quantities of temporary gates will be measured on a unit basis regardless of size or type.

The quantities of barrier mounted rock protection fence will be measured on the length basis. Measurement will be from center to center of posts, measured along the line and grade of each separate continuous run.

Payment

00270.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Temporary Type ____ Fence	Foot
(b) Temporary Gates	Each
(c) Temporary Rock Protection Fence, Barrier Mounted	Foot

In item (a) the type of fence will be inserted in the blank.

Payment will be payment in full for furnishing, placing, maintaining, and removing all materials, including the concrete barrier, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00280 - Erosion and Sediment Control

Description

00280.00 Scope - This work consists of controlling soil erosion by wind, water, or other means and preventing eroded sediments and other construction-generated pollutants from moving off the project, Agency controlled material sources, disposal sites, and off-site mitigation areas in order to comply with Federal, State, and local laws, rules and regulations, and the Agency's National Pollutant Discharge Elimination System (NPDES) 1200 Permit or Permits applicable to the Project.

This work also consists of providing temporary erosion and sediment control (ESC) measures and furnishing, installing, moving, operating, maintaining, inspecting, and removing ESC throughout the Project area according to the standard drawings, the erosion and sediment control plan (ESCP) for the Project, these Specifications, or as directed, until the site is permanently stabilized.

The work described in these Specifications and shown on the plans are part of the project ESCP and represent the minimum requirements for all project construction sites and conditions.

~~This work consists of implementing structural and non-structural Best Management Practices (BMP) for the purpose of controlling soil erosion by wind or water and keeping eroded sediments and other construction-generated pollutants from moving off project sites.~~

~~Requirements described in these Specifications and shown on the plans are part of the project Erosion and Sediment Control Plan (ESCP) and are the minimum for all project construction sites and conditions. These Specifications cover all project activities performed under the authority and jurisdiction of the Agency, including material sources, disposal sites, and off-site mitigation areas unless specific project activities are excluded elsewhere in these Specifications or in other Agency approved documents controlling the work.~~

~~**00280.01 National Pollutant Discharge Elimination System** - Comply with Federal, State, and local laws, rules and regulations, and the National Pollutant Discharge Elimination System (NPDES) 1200 Permit or Permits applicable to the project. A copy of the Agency's General Construction 1200 CA Permit, if applicable to the project, is available from the Agency. A local government 1200 CA Permit may also apply and some local agency requirements may be more stringent than these Specifications.~~

00280.01 Abbreviations:

ESC - Erosion and Sediment Controls

ESCP - Erosion and Sediment Control Plan

ESCM - Erosion and Sediment Control Manager

00280.02 Definitions:

Effective Functioning - Preventing erosion, controlling runoff, or controlling sediment in each location where a ESC is needed so erosion-related impacts of site construction are mitigated as required.

Erosion - The wearing away of the land surface by water, wind, ice, gravity or other geological agents.

Perimeter Controls - Perimeter controls include sediment fences, ditches, filter berms in flatter areas, and other methods for preventing sediment and other construction-generated pollutants from leaving the construction site.

Permanent Stabilization - Maintenance free measures or methods necessary to prevent erosion or sediments from leaving the project site.

Runoff - That portion of precipitation that flows from drainage area on the land surface, in open channels or in storm water conveyance systems.

Sediment - Fragmented material originated from weathering and erosion of rock and unconsolidated deposits. Sediment also includes fragmented materials from man-made materials. The material is transported by, suspended in, or deposited by water.

Temporary Stabilization - Measures or methods necessary to prevent erosion or sediments from leaving the project site until permanent stabilization measures are in place and established.

Wet Season Work - Wet season work is defined as work between October 1 and May 31.

00280.03 Standards - When designing, applying, installing maintaining, inspecting, and removing erosion and sediment control devices, use and follow the version in effect on the date the project is advertised, of the ODOT "Erosion and Sediment Control" manual.

00280.04 Erosion and Sediment Control Plan on Agency Controlled Lands - For work on Agency-controlled lands~~, submit signed copies~~ use either the Agency's ESCP, a Contractor modified version of the Agency's ESCP, or a Contractor developed ESCP. Submit the following for ~~review and~~ approval ~~ten~~10 calendar days before the preconstruction conference:

- ~~A Contractor-developed, "construction" ESCP that incorporates the Agency's ESCP and all proposed modifications to it that fully complies with NPDES 1200 Permits applicable to the project.~~
- ~~A narrative as described in the NPDES 1200 Permit and the Agency Erosion Control Manual.~~
- When using the Agency's ESCP without modification, a written notification indicating the Agency's ESCP will be used without modification.
- When using a Contractor modified version of the Agency's ESCP or when using a Contractor developed ESCP, include the following:
  - Proposed ESCP showing all ESC work and quantities of all work.
  - Implementation schedules for the ESCP based on each phase of the contractor's ~~construction~~work.

Do not begin any site activities that have potential to cause erosion or sediment movement until the ESCP and implementation schedules are approved by the Engineer.

Update the ESCP and schedule as needed to ensure that sediment does not leave the construction site.

~~An Agency-developed ESCP is typically furnished as part of a conventional contract plan set, which helps fulfill part of the ESCP requirement of the Permit. This initial ESCP, when adopted by the Contractor, may be used as the basis of the construction ESCP.~~ Additional or revised erosion and sediment control features, not shown on the initial ESCP, may be required depending on the Contractor's methods of operation and schedule to provide effective functioning of ESC.

~~For each phase of the scheduled work, indicate on the ESCP all the BMP proposed and installed for erosion and sediment control to minimize clearing, stabilize exposed soil, divert or temporarily store flows, limit runoff from exposed areas, and filter transported sediment. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original contract plans. For assistance in preparing or modifying the ESCP, refer to the current Agency Erosion Control Manual.~~

~~Some ESCP required elements typically required by NPDES 1200 Permits:~~

~~(a) Narrative Site Description:~~

- ~~Nature of the construction activity planned for the site~~
- ~~Estimates of total site area and the areas of the site expected to be disturbed~~
- ~~Soil types found on the site and their erosion potential~~
- ~~The types of fill materials to be used~~
- ~~Timetable for sequence of major construction events~~

~~(b) Site Map:~~

- ~~All areas of development~~
- ~~Drainage patterns~~
- ~~Areas of soil disturbance, including pre-development and post-development elevation contours~~
- ~~Areas used for storage of soils or wastes~~
- ~~Areas where vegetative practices are to be implemented~~
- ~~Location of all erosion and sediment control BMP or structures~~
- ~~Location of all impervious structures and surfaces after project is completed~~
- ~~Springs, wetlands, and other surface waters located on-site~~
- ~~Boundaries of the 100 year floodplain, if determined~~
- ~~Ordinary High Water line, if determined~~
- ~~Location of storm drainage outfalls to receiving waters, if applicable~~
- ~~Details of sediment and erosion controls~~
- ~~Details of detention ponds, storm drain piping, inflow and outflow details~~

~~(c) Required BMP and Procedures for Erosion Prevention, Runoff Control, and Sediment Control:~~

- ~~Construction entrances and parking areas~~
- ~~Unpaved site roads such as haul roads~~
- ~~Hauling saturated soils from the site~~
- ~~Water washed from concrete trucks~~
- ~~Correct installation of erosion and sediment control BMP (contract documents and agency references such as these Specifications may be cited as installation standards if applicable)~~
- ~~Prompt maintenance and repair of BMP~~
- ~~Clearing and grading practices to minimize area of exposed soil throughout the life of the project~~
- ~~Schedule of phased clearing operations to limit soils to what can be stabilized~~
- ~~Vegetative practices including preservation of existing vegetation, seeding, mulching, and buffer strips~~
- ~~Preventing erosion of exposed areas~~

- ~~Diverting flows from exposed slopes~~
- ~~Limiting runoff from exposed areas~~
- ~~Limiting sediment transport within work sites and keeping it from moving off of project areas~~
- ~~Perimeter controls for all clearing and grubbing, both planned and installed~~
- ~~Additional controls for wet season work and temporary work suspensions~~
- ~~Sensitive areas such as wetlands~~
- ~~Off site material source and waste areas~~
- ~~Dust~~
- ~~Emergency materials stockpiled on-site~~
- ~~Storing flows, and filtering sediment~~
- ~~Stockpiles~~

Ensure that the Contractor's construction ESCP and implementation schedules are prepared by an individual who meets qualifications of 00280.30. Furnish a signed copy of the ESCP with individual's name, title, state certifications, and employing firm if different than Contractor's firm.

~~Do not begin any site activities that have potential to cause erosion or sediment movement until the ESCP and implementation schedules are approved by the Engineer.~~

Keep a copy of the approved ESCP with updated changes on-site during all construction activities. If there are approved changes, add them to the ESCP no later than 24 hours after implementation.

During inactive periods longer than 7 calendar days, keep the ESCP on-site or provide a copy to the Engineer to retain.

~~Continually update the ESCP and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. If there are approved changes, add them to the ESCP no later than 24 hours after implementation.~~

00280.~~03~~ 05 Erosion and Sediment Control Plan on Non-Agency Controlled Lands ~~ESCP~~ - For work on non-Agency controlled lands, in addition to the requirements of 00280.~~02~~04, submit the following for review ~~ten~~ 10 days before the preconstruction conference:

- A Contractor-developed ESCP for each unique site covered under ~~project~~a Non-Agency NPDES 1200 ~~Permits~~Permit.
- A description of how the ESCP will be implemented and monitored on these sites.
- A complete list of other applicable permits controlling work on these lands, whether the Agency is one of the permittees or not, and copies of the applicable permits~~.~~
- ~~Proof~~ or proof that permits are not required from all pertinent federal, State, county, city, and local agencies.
- Signed letter from the property owner that allows the Contractor access to the property. Include a statement in the letter that holds the Agency harmless for all consequences related to the Contractor's use of the property.
- Signed agreement with the property owner detailing the Contractor's operation, use of the property, and stating that Contractor will abide by permits, if any.

If the Contractor's operations require work on non-Agency controlled lands not presented ~~at~~10 days before the preconstruction conference, or if changes to the Contractor's submitted ESCP are necessary, ~~submit~~obtain approval of a new or revised ESCP ~~to~~from the ~~Agency for approval~~ Engineer before beginning work.

00280.~~04~~06 Erosion and Sediment Control Manager~~ –~~ - Designate and provide a representative as the Erosion and Sediment Control Manager (ESCM) who meets the qualifications of 00280.30.

Materials

00280.14 Erosion Prevention Materials~~:~~

~~**(a) Plastic Sheeting –**~~ **:**

(a) Plastic Sheeting - Furnish plastic sheeting slope protection, anchoring system, and toe protection meeting the following requirements:

- **Plastic Sheeting** - Minimum 6 mil thick polyethylene plastic sheeting.

- ~~**Anchoring System** - Minimum 65 pounds, non-puncture type anchor weights with cords or ropes of adequate strength to support the weights on the slope or new or used chain link fence conforming to 03010.30.~~

- ~~**Stakes** - Commercial grade metal posts with a weight of at least 1.35 pounds per foot.~~

- **Rock** - Class 50 riprap conforming to Section 00390.

- **Sand Bags** - Sand bags meeting the requirements of 00280.15(a). Sand bags may also be filled with sand.

- **Sediment Barrier** - Fiber rolls and compost filter sock meeting the requirements of 00280.15(a).

- **Staples** - 1/8 inch diameter steel wire staples. 2 inch "U" width with a length of 6 inches minimum.

(b) Chemical Controls:

(1) Chemical Soil Binder - Furnish a liquid ~~stabilizing~~stabilizer emulsion meeting the requirements of ~~00280.14(c).~~ 01030.16.

(~~c~~2) Chemical Dust Control - Furnish ~~non-toxic materials with no adverse effect on soil structure or establishment and growth of vegetation. Furnish one of the following materials and apply as directed by the manufacturer's instructions:~~

~~**(1) Liquid Stabilizer Emulsion** - A~~ tackifier ~~of liquid and polyvinyl acetate polymers with emulsion resins containing not less than 55% total solids by weight. Do not use tackifiers containing polyacrylates or polyvinyl acrylics~~meeting the requirements of 01030.16.

~~**(2) Dry Powder Tackifier** - A tackifier consisting of one or more active hydrocolloids from natural plant sources which hydrates in water and blends with other slurry materials, and upon application and drying tacks the slurry particles to the soil surface, and exhibits no growth or germination inhibiting factors. Provide stabilizing emulsion in a dry powder form that may be re-emulsifiable and consists of a processed organic adhesive derivative of one of the following:~~

- ~~Gumbinder derived from guar (Cyamopsis tetragonoloba)~~
- ~~Gumbinder derived from plantain (Plantago insularis)~~

(c) Non-Chemical Control - Furnish water meeting the requirements of Section 00340.

(d) ~~**Temporary**~~ **Mulching** ~~-~~ **and Seeding** - Furnish temporary and permanent seeding, fertilizing, and mulching meeting the requirements of Section 01030.

(e) Slope and Channel Liner Matting - ~~Matting is organized according to categories from the Texas DOT/TTI Hydraulics and Erosion Control Laboratory.~~ Furnish matting from the QPL that meets the following performance criteria categories:

- **Type A** - Slope protection mat for clay soil slopes 1V:3H or flatter.
- **Type B** - Slope protection mat for sandy soil slopes 1V:3H or flatter.
- **Type C** - Slope protection mat for clay soil slopes steeper than 1V:3H.
- **Type D** - Slope protection mat for sandy soil slopes steeper than 1V:3H.
- **Type E** - Flexible channel liner for shear stress from 0 to 2 pounds per square foot.
- **Type F** - Flexible channel liner for shear stress from 0 to 4 pounds per square foot.
- **Type G** - Flexible channel liner for shear stress from 0 to 6 pounds per square foot.
- **Type H** - Flexible channel liner for shear stress from 0 to 8 pounds per square foot.

Where shown, furnish rolled slope protection matting or hydraulically applied bonded fiber matrix slope protection matting that consists of fully biodegradable long fiber strands held together by a water resistant bonding agent.

Furnish check slot and anchor trench material and fasteners for matting meeting the following requirements:

(1) Check Slot and Anchor Trench:

- ~~**Channel Application** - Compacted~~ **Class 50 Riprap** - Class 50 riprap meeting the requirements of Section 00390.
- ~~**Slope Application** - Compacted suitable native embankment material.~~
- **Soil** - Soil meeting the requirements of 00330.13.

(2) Fasteners - U-shaped wire staples or ~~heavy duty~~ pins as follows:

- **Staples** - ~~14 gauge~~1/8 inch diameter steel wire staples. 1 inch "U" width with a length of ~~6~~ 9 inches minimum for cohesive soils ~~and 8~~, and 1/2 inch "U" width with a length of 12 inches minimum for non-cohesive soils.
- **Pins** - 3/16 inch diameter steel pin with a 2 inch diameter steel washer secured at the head of the pin with a length of 18 inches minimum for cohesive soils and 24 inches minimum for non-cohesive soils.

(f) Compost Erosion Blanket - Furnish commercially manufactured medium compost material meeting the requirements of Section 03020.

When shown, add tackifier. Apply tackifier at the rates shown or as recommended by the manufacturer.

00280.15 Runoff Control Materials~~:~~

~~**(a) Check Dams** -~~**:**

(a) Check Dams - Furnish check dam material meeting the following requirements:

- **Type 1: Aggregate** - Aggregate ~~with maximum size~~sized between ~~6~~ 4 inches maximum and ~~3 inches~~1 inch minimum meeting the requirements of 00330.16.

- **Type** ~~**2: Straw Bales** - Standard rectangular~~ **2: Fiber Rolls** - Fiber rolls or wattles made of straw ~~bales~~ meeting the requirements of 01030.15~~.~~(b). Wrap the straw to a minimum density of 2.75 pounds per cubic foot in tubular plastic netting meeting the following requirements:

  - 8 inch to 10 inch diameter size
  - Minimum strand thickness of 0.003 inch
  - Knot thickness of 1/16 inch
  - Weight of 0.35 ounces per foot ±10 percent
  - Made from 85 percent high density polyethylene, 14 percent ethyl vinyl acetate, and 1 percent color for UV inhibition

- **Type 3: Biofilter Bags** - Minimum size 18 inch x 6 inch x 30 inch plastic mesh bags with 1/2 inch openings filled with approximately 45 pounds of clean, non-toxic 100~~%~~ percent recycled wood product waste containing no fine materials or sediments, or as shown on the standard drawings for this device.

- **Type 4: Sand Bags** - Durable, weather-resistant bags woven tightly enough to prevent leakage of filler material. Fill bags with at least 75 pounds of firmly-packed fine PCC 3/8" - 0 aggregate, or round 3/8" - 3/16" pea gravel.

- **Type 5: Prefabricated System** - Prefabricated check dam system conforming to the manufacturer's recommendations and on the QPL. Field fabricated systems are not acceptable.

- ~~**Check Dam Stakes** - Stakes~~**Type 6: Compost Filter Sock** - Sock material, compost, and stakes meeting the following requirements:

  - **Filter Sock Material** - 5 mil thick woven tubular mesh netting consisting of ~~00280.14(a).~~continuous HDPE filament or polypropylene material with 3/8 inch openings or 100 percent biodegradable burlap or coir as shown.

  - **Compost** - Commercially manufactured coarse compost material meeting the requirements of Section 03020.

(b) ~~**Diversion**~~**Interceptor Dikes and Swales** - Furnish ~~diversion~~interceptor dike and swale materials meeting the following requirements:

- ~~**Aggregate** - Aggregate with maximum size between 4 inches and 1 inch meeting the requirements of 00330.16.~~

- **Seeding, Fertilizing and Mulching** - Permanent or temporary seeding, fertilizing and mulching meeting the requirements of Section 01030.

- **Dike material** - Soil meeting the requirements of 00330.13.

(c) Temporary Drainage Curbs - Furnish temporary drainage curb material meeting the following requirements:

- **Type 1** ~~**Curb**~~ - Concrete drainage curb meeting the requirements of 00480.10.

- **Type 2** ~~**Curb**~~ - Asphalt concrete drainage curb meeting the requirements of 00480.10.

- **Type 3** ~~**Curb**~~ - Sand bags meeting the requirements of 00280.15(a).

(d) Temporary Slope Drains - Furnish either plastic pipe and flared end sections meeting the requirements of Section 02410 or metal pipe and flared end sections meeting the requirements of Section 02420. ~~If the runoff contributing area is not established, use 12 inch diameter.~~

(e) Flow Spreader - Furnish aggregate for flow spreaders with a maximum size between ~~6 inches~~ 6 inches and 3 inches meeting the requirements of 00330.16.

(f) Compost Filter Sock - Furnish filter sock material and ~~3 inches~~compost meeting the following requirements ~~of 00330.16.~~:

- **Filter Sock Material** - Provide material meeting the requirements of 00280.15(a).

- **Compost** - Commercially manufactured coarse compost material meeting the requirements of Section 03020.

(g) Compost Filter Berm - Furnish commercially manufactured coarse compost material meeting the requirements of Section 03020.

00280.16 Sediment Control Materials:

(a) Construction Entrances - Furnish materials meeting the following requirements:

- **Aggregate** - ~~Aggregate with a maximum size~~Clean, durable, open graded angular aggregate sized between ~~6~~4 inches maximum and ~~3 inches meeting~~ 1 inch minimum with less than 5 percent of the ~~requirements of 00330.16~~material, by weight, passing the No. 4 sieve.

- **Geotextile** - Subgrade geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

(b) Tire Wash Facility - Furnish tire wash facility materials meeting the following requirements:

- **Aggregate** - ~~1 1/2" - 0, 1" - 0, or 3/4" - 0 aggregate base material~~ Aggregate meeting the requirements of ~~Section 00641.~~00280.16(a).

- ~~**Reinforcing Steel** - Reinforcing steel meeting the requirements of 02510.10.~~

- **Geotextile** - Subgrade geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- ~~**Concrete** - Commercial grade concrete meeting the requirements of Section 00440.~~

- **Corrugated Steel Panels** - Corrugated steel panels with flexural strength adequate to bear the weight of the vehicles accessing the construction site without deformation.

(c) Sediment Fence - Furnish sediment fence materials meeting the following requirements:

- **Geotextile** - Geotextile meeting requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- **Posts** - ~~Furnish the following posts for the types of fence shown:~~

  - ~~**Sediment Fence, Supported** - Commercial grade metal posts with a weight of at least 1.35 pounds per foot.~~

- ~~**Sediment Fence, Unsupported** - Minimum 1 1/2 inch x 1 1/2 inch x 48 inch untreated~~Untreated wood posts (wood stain is acceptable).

- ~~**Wire Mesh** - For supported sediment fence, furnish galvanized wire mesh with 2 inch x 2 inch openings, horizontally and vertically self-supporting prior to fastening to posts, a minimum tensile strength of 70 ksi, and meeting the requirements of ASTM A 82.~~

(d) Inlet Protection - Furnish inlet protection materials meeting the following requirements:

- **Type 2:**

- **Wire Mesh** ~~- Wire mesh materials as follows:~~

  - ~~**Type 1 Inlet Protection** - Wire mesh meeting the requirements of 00280.16(c).~~

  - ~~**Type 2 Inlet Protection**~~ - 19 gauge steel-wire mesh with 3/8 ~~inch~~ x 3/8 inch openings.

  - **Geotextile** - Type~~ 1 sediment fence~~ 1 geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

  - **Aggregate** - ~~Aggregate with maximum size between 4 inches and 1 inch~~Open-graded aggregate meeting the requirements of ~~00330.16~~02630.11.

- ~~**Stakes** - Stakes meeting the following requirements:~~

  - ~~**Type 1 Inlet Protection** - Commercial grade metal posts with a weight of at least 1.35 pounds per foot.~~

  - ~~**Type 4 Inlet Protection** - Minimum 1 inch x 2 inch x 18 inch wooden posts.~~

- ~~**Biofilter Bags** - Biofilter bags meeting the requirements of 00280.15(a).~~

- Type 3: **Prefabricated Filter Inserts** - Prefabricated filter inserts manufactured specifically for collecting sediment in drainage inlets and listed on the QPL. Include handles and fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet.

- ~~**Concrete Masonry Units** - Nominal 8 inch x 8 inch x 16 inch, 29 pound concrete masonry units (CMU).~~

- **Type 4:**

  - **Biofilter Bags** - Biofilter bags meeting the requirements of 00280.15(a).

  - **Reinforcing Steel** - Commercial grade reinforcing steel meeting the requirement of 02510.

- ~~**Type 6:** **Sod** - Grass sod meeting the requirements of 01040.19(h).~~

- ~~**Reinforcing Steel** - No. 4 rebar commercial grade reinforcing steel.~~

- **Type 7:**

  - **Filter Sock Material** - Provide material meeting the requirements of 00280.15(a).

  - **Compost** - Commercially manufactured coarse compost material meeting the requirements of Section 03020.

(e) Sediment Barriers - Furnish sediment barriers and sediment barrier stakes meeting the following requirements~~:~~:

- ~~**Type 1: Straw Bales** - Standard 45 to 65 pound rectangular straw bales that are wire-bound or string-tied meeting the requirements of 01030.15(b).~~

- **Type 2: Biofilter Bags** - Biofilter bags meeting the requirements of 00280.15(a).

- **Type 3: Fiber Rolls** ~~**(Wattles)**~~ - Fiber rolls ~~made of straw~~or wattles meeting the requirements of ~~0103~~00280.15(~~b), except use only rice or coconut straw material. Wrap the straw to~~ a ~~minimum density of 2.75 pounds per cubic foot in tubular plastic netting meeting the following requirements:~~).

  - ~~8 inch to 10 inch diameter size~~
  - ~~Minimum strand thickness of 0.003 inch~~
  - ~~Knot thickness of 1/16 inch~~
  - ~~Weight of 0.35 ounces per foot ±10%~~
  - ~~Made from 85% high density polyethylene, 14% ethyl vinyl acetate, and 1% color for UV inhibition~~

- **Type 4: Sand Bags** - Sand bags meeting the requirements of 00280.15(a).

- **Type 5: Brush Barrier** - Maximum 6 inch diameter woody debris brush or topsoil strippings for brush barriers. Provide ~~type~~ Type 1 sediment fence geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- **Type 6:** ~~**Filter Berm** -~~ **Aggregate Barrier** – Clean well graded angular aggregate with maximum size between 4 inches and 1 inch meeting the requirements of 00330.16~~. Provide subgrade geotextile meeting~~ , except no more than 5 percent of the ~~requirements~~

~~of Section 02320. Provide "Level B" geotextile documentation according to 02320.10(c).~~material by weight shall pass the No. 40 sieve.

- **Type 7: Prefabricated Barrier System** - Prefabricated barriers manufactured specifically for temporarily obstructing the flow of sediment-laden water and listed on the QPL.
- ~~**Stakes** - Sediment barrier stakes as follows:~~

  - ~~**Biofilter Bags** - Use minimum 1 inch x 2 inch x 18 inch wood stakes.~~

  - ~~**Brush Barrier** - Use minimum 1 inch x 2 inch x 18 inch wood stakes.~~

  - ~~**Straw Bales** - Use minimum 1 1/2 inch x 1 1/2 inch x 36 inch wood stakes.~~

  - ~~**Fiber Rolls** - Use minimum 1 inch x 1 inch x 24 inch wood stakes.~~

- **Type 8: Compost Filter Sock** - Sock material and compost meeting the following requirements:

  - **Filter Sock Material** - Provide material meeting the requirements of 00280.15(a).

  - **Compost** - Commercially manufactured coarse compost material meeting the requirements of Section 03020.

- **Type 9: Compost Filter Berm** - Commercially manufactured coarse compost material meeting the requirements of Section 03020.

(f) Sediment Mat - Furnish sediment mat from the QPL.

(g) Temporary ~~**Scour Basin** -~~ **Energy Dissipater** - Furnish ~~class 100 riprap for~~ temporary ~~scour basins~~energy dissipater material meeting the following requirements:

- **Geotextile** - Type 1 riprap geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- **Class 100 Riprap** - Class 100 riprap meeting the requirements of Section 00390.

(h) Temporary Sediment Trap - Furnish sediment trap materials meeting the following requirements:

- **Geotextile** - Type 2 drainage geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- **Aggregate Base** - ~~1 1/2" - 0, 1" - 0, or 3/4" - 0 aggregate for aggregate~~Aggregate base meeting the requirements of Section ~~00641~~ 00640.

- **Aggregate** - Aggregate ~~with maximum size between 6 inches and 3 inches~~ meeting the requirements of ~~0033~~00280.16(a).

(i) Concrete Washout - Furnish concrete washout materials meeting the following requirements:

- **Geotextile** - Type 2 drainage geotextile and subgrade geotextile meeting the requirements of Section 02320. Provide "Level B" documentation according to 02320.10(c).

- **Straw Bales** - Standard rectangular straw bales, with straw material meeting the requirements of 01030.15, except no certification is required.

- **Plastic Sheeting** - Minimum 10 mil thick polyethylene plastic sheeting.

- **Staples** - 1/8 inch diameter steel wire staples. 2 inch "U" width with a length of 6 inches minimum.

(j) Floating Turbidity Barrier - Furnish floating turbidity barriers shown and as directed.

Labor

00280.30 Erosion and Sediment Control Manager - Designate and provide an ESCM ~~with the following minimum qualifications:~~

- ~~Experience in all major disciplines of highway construction.~~
- ~~Knowledgeable in principles of and practice of erosion and sediment controls.~~
- ~~Skilled in assessing site conditions and effectiveness of erosion control BMP used.~~
- ~~Successful completion of erosion control formal training sponsored by the Agency or acceptable to the Engineer.~~
- ~~Responsible participation in construction of at least one Agency project with erosion control.~~
- ~~Authority to immediately mobilize necessary personnel to correct and modify erosion control BMP as required.~~

~~Duties typically required of~~that possesses a valid ODOT ESCM certificate.

The ESCM duties include:

- Manage and ensure proper implementation of the ESCP.
- Accompany the Engineer during field review of the ESCP prior to construction activities.
- Monitor rainfall on and in the vicinity of the Project site.
- Monitor water quality in receiving streams in the vicinity of the Project site.
- Inspect ~~erosion and sediment control~~ESC on active construction sites weekly for effective functioning.
- Inspect ~~erosion and sediment control~~ESC on inactive sites every ~~two~~ 2 weeks for effective functioning.
- Inspect ~~erosion control BMP~~ESC on all active and inactive sites at least daily during rainy periods when ~~5/8~~ 1/2 inch or more of rain has fallen within a 24 hour period for effective functioning.
- Ensure that ESC are regularly cleaned and maintained.
- Mobilize crews to make immediate repairs to ~~BMP~~ESC or install additional ~~BMP~~ESC during working and non-working hours when ESC is not effectively functioning.
- Record actions taken to clean up significant amounts of sediment.
- Report potential permit violations to the Agency in a timely manner.
- Regularly update the approved ~~Erosion Control~~ESC Monitoring form.
- Update the ESCP monthly and within 24 hours after changes or major ~~BMP~~ESC modifications are implemented.

- Prepare a contingency plan in preparation for emergencies and the rainy season.
- Accompany the Engineer on inspections and, if required, on inspections by representatives of regulating agencies.

Provide the ESCM name, ~~description of experience and training,~~ qualifying certifications, and 24 hour contact phone number ~~ten~~ 10 days before the preconstruction conference. If changes in the appointment of the ESCM occur during the term of the Contract, provide written notice to the Engineer within ~~five~~5 calendar days.

Construction

00280.40 Installation - Install ~~erosion and sediment control BMP~~ESC as shown and according to the ~~most current edition of the ODOT Erosion Control Manual.~~ESCP. Install these ~~BMP~~ESC before performing clearing, grading, or other land~~-~~-altering activities. Ensure effective functioning of ESC such that sediment~~ laden water~~ does not leave the Project boundaries, enter drainage systems or waterways, or violate applicable water quality standards.

~~Included in this work are both non-structural BMP, such as limiting clearing of vegetation, and structural BMP such as various kinds of physical devices or materials like sediment fences. BMP may be temporary or they may be permanent when required to continue functioning after the Contract ends.~~ Coordinate temporary ~~erosion control BMP~~ESC with permanent ~~BMP~~ESC and all related project work.

~~Provide continuous erosion prevention and sediment control throughout the period the Contractor is responsibilities for project sites under the Contract as determined by the Engineer. Take all reasonable steps to minimize or prevent any erosion and transport of sediment. Install and maintain all erosion and sediment control BMP to function as required. If planned or installed BMP are not effective, modify or change them so they are effective. Effective functioning is defined as preventing erosion, controlling runoff, or controlling sediment in each location where a measure is needed so all erosion-related impacts of site construction are fully mitigated as required.~~

If ESC are not effective, modify or change ESC so they become effective.

00280.41 Work Restrictions - The following work restrictions apply:

(a) Disturbance Limits - ~~Flag~~Delineate all construction site-clearing limits with high visibility ~~flagging~~markings and do not disturb areas outside the ~~flagging~~clearing limits. Maintain the ~~flagging~~markings during Project construction.

(b) Perimeter Controls - ~~Perimeter controls include sediment fences, ditches, filter berms in flatter areas, and other methods for channeling flows.~~ Install all appropriate perimeter controls before beginning any ground disturbing activities~~, especially at critical locations such as stream banks, the toe of fill or cut slopes, and sites near the two-year flood elevation.~~ .

(c) Wet Season Work and Temporary Work Suspension - ~~Wet season work is defined as work between October 1 and May 30.~~ Update the ESCP and schedule for work proposed during the wet season to ensure that all appropriate controls, including ESC during work ~~suspension controls~~suspensions , are implemented and maintained. Submit the updated ESCP and schedule to the Agency and receive approval before beginning any work during the wet season. ~~The Agency may not approve work on critical sites with high erosion potential if controls are not properly installed or have a likelihood of failure.~~

During the wet season, limit excavation and bare ground activities to only that required for immediate operations. Stabilize~~ soil~~ stockpiles at the end of each workday by diverting flows, placing covers, or installing sediment barriers~~ at the stockpiles~~.

(d) Disturbance Restrictions - ~~If soil erosion and sediment resulting from construction activities is not effectively controlled, the Agency will limit~~Limit the amount of disturbed areas to that which can be effectively controlled.~~ Implement erosion and sediment control BMP at the earliest practicable time. Install all erosion and sediment control devices according to the approved ESCP and schedule. If the Contractor fails to control erosion, the Agency will stop all construction work according to 00180.70.~~

00280.42 Stabilization~~ Protect exposed soils from erosion by water, wind, or vehicles when required by permits or directed by the Engineer. At a minimum, stabilize~~ - Stabilize soil areas as follows:

(a) Soil Exposure Limitations:

- **Statewide (Entire Year)** - Within ~~seven~~7 days of exposure, stabilize all areas within 100 feet of waterways, wetlands, or other sensitive areas using methods that do not rely solely upon germination to control erosion.
- **West of the Cascades (Entire Year)** - Stabilize all other areas within 14 days of exposure.
- **East of the Cascades (October 1 through April 30)** - Stabilize all other areas within 14 days of exposure.
- **East of the Cascades (May 1 through September 30)** - Stabilize construction areas in stages based on site conditions, weather, and as determined by the Engineer.

(b) Temporary Stabilization - Temporarily stabilize exposed soils:

- Every 14 days or more frequently ~~of~~as needed or directed.
- Upon approval, active work areas scheduled for re-disturbance may be left unstabilized for 14 day periods if erosion ~~by wind, water, or vehicles~~ is not occurring or imminent.
- A minimum of ~~one~~1 day before expected rain events.
- ~~During wet periods and when not actively raining, at~~At the end of each day~~.~~ during wet periods.
- As an emergency measure when rain is falling on unprotected areas.
- When wind or vehicle traffic is visibly causing more than minor dust.
- ~~Soil surfaces at~~At finish grade when working outside the permanent seeding dates.

~~Temporary stabilization includes, but is not limited to, chemical soil binders, mulching and tacking, erosion control matting, plastic sheeting, and temporary seeding or other BMP required to achieve the necessary stabilization.~~

Document all implemented ~~BMP~~ESC on the ESCP. Ensure that permanent slope stabilization is achieved before removing temporary ~~BMP~~ESC.

(c) Permanent Stabilization - Permanently stabilize exposed soil surfaces at finished grade. ~~Permanent stabilization methods include, but are not limited to, seeding, mulching, structural surface coverings such as riprap, and vegetative stabilization. Permanent stabilization includes stabilization of temporary structures such as detours and staged earthwork. Immediately perform~~Perform permanent stabilization at each completed excavation and embankment area except for areas that are scheduled to be redisturbed.

If seeded areas are not sufficiently stabilized by an established stand of vegetation according to 01030.60, or if the soil surface is not sufficiently protected with temporary stabilization ~~BMP~~ESC by ~~November~~ October 1 of each year, do the following:

- Use ~~BMP~~ESC necessary to redirect water flows away from disturbed areas.
- Re-grade disturbed areas to finish grade.
- Apply permanent seeding at the original specified rate.
- Apply temporary mulching or matting.

If areas for temporary stabilization are too steep or lack access for effective straw mulch application, apply, upon approval, another effective measure ~~such as chemical soil binder~~.

Incorporate permanent erosion control features into the Project at the earliest practicable time. ~~Use temporary erosion control features for the following situations:~~

- ~~To correct conditions that occur during construction activities that were not foreseen during the design stage of the Project.~~
- ~~That are needed prior to installing permanent erosion control features.~~
- ~~To temporarily control erosion that develops during normal construction activities.~~

~~Where potential for erosion exists and if construction permits, construct permanent erosion control features immediately after clearing and grubbing and grading operations are complete. If permanent erosion control BMP are not practicable to construct, furnish and install temporary erosion control BMP.~~

00280.43 Area Preparation - Prepare areas according to 01040.48(d) and track walk all fill slopes at finished grade steeper than 1V:3H and flatter than 1V:1.5H so that track impressions run parallel to slope contours. Maintain at least 1 3/8 inch tall track grousers.

00280.44 Erosion Prevention ~~**BMP** - Install erosion prevention BMP~~ - Perform erosion prevention work as shown and according to the following:

(a) Plastic Sheeting - Place plastic sheeting on disturbed, temporary slopes or stockpiles where immediate protection is required and mulching or other methods of soil stabilization are not feasible. ~~Temporary slopes include vertical excavations for retaining walls and other temporary soil excavations and embankments related to structural work.~~

Cover exposed soil with plastic sheeting ~~and secure tightly using an anchoring system of sand bags, chain link fence, or other approved methods. Do not allow the anchoring system to puncture the plastic~~as shown. Keep sheeting~~. Trench plastic sheeting at the top of slope and secure adequately to keep~~ in place during ~~any conditions that can be reasonably expected in the area~~rain events. Direct runoff away from areas above plastic sheeting to prevent undermining. Control runoff from plastic sheeting so water discharges ~~into protected drainage~~without causing further pollution.

~~(b~~(b) Erosion and Sediment Control by Chemical Methods:

(1) Chemical Soil Binder - Hydraulically apply a liquid stabilization emulsion at the following rates unless the manufacturer recommends a ~~greater~~different rate of application:

- **Long Term Control of Exposed Soil Surfaces** - Apply 35 gallons per acre of emulsion. Dilute with water at the rate of one part emulsion to 20 parts water.

- **Steep Slopes with Raveling Small Rock** - Apply 45 gallons per acre of emulsion. Dilute with water at the rate of one part emulsion to 10 parts water.

~~(c~~

(2) **Chemical Dust Control** - Apply ~~appropriate~~ tackifier for dust control for wind or equipment-caused erosion according to the following:

~~• **Water** - Apply water according to Section 00340.~~

- **Liquid Stabilizer Emulsions** - Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at the rate of 865 gallons per acre unless the manufacturer recommends a ~~greater~~different rate of application.

- **Dry Powder Tackifier** - Apply at a rate of 140 pounds per acre unless the manufacturer recommends a greater rate of application.

~~Watering for dust control may also be covered under~~**(c) Erosion and Sediment Control by Non-Chemical Methods** - Apply water according to Section 00340.

(d) Temporary and Permanent Mulching ~~-~~and Seeding:

- **Mulching -** Evenly apply dry mulch and tackifier material ~~to form a cohesive surface cover that is resistant~~according to ~~displacement by wind and water.~~Section 01030.. In areas not accessible to heavy equipment, mulch by hand or by other approved methods. Areas not prepared according to 01040.48(d) will require greater ~~rates~~rate of application to obtain complete coverage at no additional cost to the Agency.

~~**(1) Dry Mulch** - Apply straw mulch on slopes 1V:1.5H or flatter. Spread straw mulch by hand or blower. Place approximately 2 inch deep, in loose condition, at a rate between 2 to 3 tons per acre of dry mulch. Place straw mulch so that it is loose enough for sunlight to penetrate and air to circulate, but dense enough to shade the ground, reduce water evaporation, and materially reduce soil erosion. Anchor using hydraulically applied tackifier, crimping disc, or sheep's foot roller approved by the Agency or methods specified in the Special Provisions.~~

~~Provide blower equipment that uses air pressure with an adjustable spout that uniformly applies dry mulch at constantly measured rates. Apply the materials using a sweeping, horizontal motion of the nozzle.~~

~~**(2) Tacking** - Straw mulch may be tackified using hydraulically applied tacking agents or mechanical methods at the following rates of application:~~

~~**a. Hydraulically Applied Tacking Agents:**~~

~~• **Liquid Stabilizer Emulsions** - Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at the rate of 865 gallons per acre unless the manufacturer recommends a greater rate of application.~~

~~• **Dry Powder Tackifier** - Apply at 80 pounds per acre with 2,000 pounds of hydromulch fiber unless the manufacturer recommends a greater rate of application.~~

~~**b. Mechanical Methods** - Straw mulch may be mechanically tackified using a crimping disk or sheep's foot roller.~~

~~• **Crimping Disc** - A heavy disk with flat, scalloped discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.~~

- ~~**Sheep's-Foot Roller** - Modified sheep's-foot roller equipped with straight studs, made of approximately 3/4 inch steel plate, placed approximately 8 inches apart and staggered. Ensure that the studs are not less than 6 inches long or more than 6 inches wide, and rounded to prevent withdrawing the straw from the soil. Use a roller with enough weight to incorporate the straw sufficiently into the soil providing a uniform surface cover.~~

- **Seeding** - Seed according to Section 01030.

(e) Slope and Channel Liner Matting - ~~Ensure that the matting is installed~~Install matting according to the ~~plans, these Specifications,~~ESCP or the manufacturer's recommendations, whichever is more stringent. ~~Within~~Install fully biodegradable matting within 25 feet of water resources~~ or as indicated, install only matting that is fully biodegradable (photodegradable is not acceptable).~~.

(1) Area Preparation - Remove all materials~~ (vegetation, rocks, wood, etc.)~~ larger than 2 inches in size. Smooth the surface and remove undulations sufficient to allow the matting to be placed in complete contact with the soil.

(2) Seeding - Apply seeding ~~to all disturbed areas, including the area where matting is required,~~ according to ~~one of~~ the following:

a. ~~Seeding Prior to~~Seed Before Matting Installation - Apply ~~according to~~ at the application rate for seed specified in Section 01030.~~ This method is preferred.~~

b. Seeding After Matting Installation - ~~This method is allowed only if specified in the Special Provisions or approved.~~ Apply ~~according to Section 01030~~ at double the application rate for seed specified in Section 01030.

c. Single Application~~ -~~: Matting and Seed:

- **Hydraulically Applied Matting** - Apply seed at double the rate specified in Section 01030.~~ Thoroughly mix seed, fertilizer, and matting material.~~

- **Manually Applied (Pre-seeded) Rolled Matting** - Pre-seed the matting at double the rate specified with the seed mix specified in Section 01030.

(3) Matting Placement - Apply matting loosely so it is in complete contact with the soil~~ to prevent erosion occurring beneath it. Apply mat and fasteners as shown. Construct check slots on all channel applications and on slope applications when shown or specified~~.

(4) Bonded Fiber Matrix Matting Placement - Follow the manufacturer's recommended practices to hydraulically apply bonded fiber matrix at the rates shown on the ESCP or as recommended by the manufacturer, whichever is more stringent.

(f) Compost Erosion Blanket - Apply compost with equipment that propels the material directly at the soil surface and achieves direct contact with the soil. Apply compost at a uniform depth of 2 inches to all exposed soil surfaces.

00280.45 Runoff ~~Control BMP~~Controls - Install runoff ~~control BMP as shown and~~ controls according to the following:

(a) Check Dams - Construct check dams as shown or directed.

- ~~**Type 1: Aggregate** - Place aggregate in the ditch section with the center low point below the outside edge.~~

- ~~**Type 2: Straw Bales** - Straw bales are not acceptable for use as check dams except in emergency situations and when approved at each location. If straw bales are used as check dams, replace with another acceptable check dam as soon as practicable but no longer than seven calendar days.~~

- ~~**Type 3: Biofilter Bags** - Place aggregate in ditch section and extend check dam with biofilter bags sufficient to direct flow over aggregate weir. Aggregate weir may be replaced with additional biofilter bags if approved.~~

- ~~**Type 4: Sand Bags** - Place aggregate in ditch section and extend check dam with sand bags sufficient to direct flow over aggregate weir. Aggregate weir may be replaced with additional sand bags if approved.~~

- ~~**Type 5: Prefabricated System** - Install prefabricated systems according to the plans, Special Provisions, and the manufacturer's recommendations. Field fabricated systems are not acceptable.~~

(b) ~~Diversion~~Interceptor Dikes and Swales - ~~Construct diversion~~Construct interceptor dikes and swales as shown or directed. After construction of interceptor dikes and swales~~ above the cut slope to divert runoff from undisturbed areas away from disturbed slope areas. Convey runoff to an undisturbed area and discharge in a non-erosive manner.~~

~~Construct diversion dikes and swales at the toe of fill slopes to divert and convey sediment laden water to a sediment control facility. Compact dike material according to the Agency Manual of Field Test Procedures.~~

~~Immediately after construction of diversion dikes and swales, place~~, construct temporary ~~seed and mulch~~stabilization according to~~ Section 01030, or place erosion matting and seed as directed.~~ 00280.42(b).

(c) Temporary Drainage Curbs - Construct temporary drainage curbs as shown or directed.

(d) Temporary Slope Drains - ~~Construct watertight slope drains and extend as the embankment height increases.~~ Construct temporary slope ~~berms at the top of embankment slopes to direct water into the drains until permanent drainage structures are completed~~drains as shown or directed.

~~**(e) Flow Spreader** - A flow spreader is a device that receives channeled runoff and uniformly disperses it along the length of the spreader. It may be constructed of clean aggregate in a berm or trench or lumber or similar materials. Place the flow spreader to discharge water into a stabilized area at non-erosive velocities. See the plans for details and locations of this device.~~

(e) Flow Spreader - Construct flow spreaders as shown or directed.

(f) Compost Filter Socks - Construct compost filter socks as shown or directed.

(g) Compost Filter Berm - Construct compost filter berms as shown or directed.

00280.46 Sediment ~~Control BMP~~Controls - Install sediment ~~control BMP~~controls as shown and according to the following:

(a) Construction Entrances - Install construction entrances at every point of access onto paved surfaces.

~~When construction entrances are in use and mud and dirt tracking is still evident, take additional steps to eliminate tracking by hosing off tires before vehicles leave the site, or by modifying construction techniques or work operation. Perform tire washing on gravel pads. Use silt-trapping structures to collect and drain wash water before it leaves the construction site.~~

(b) Tire Wash Facility - ~~Excavate the area for installation of the~~Construct tire wash facility~~. Install subgrade geotextile, aggregate base coarse, reinforced concrete, and water~~ as shown or directed.

(c) Sediment Fence - ~~Construct supported (mesh and metal posts) and unsupported (no mesh) as follows:~~Construct sediment fence as shown or directed.

- ~~When installing geotextile and mesh, or geotextile alone, use a continuous roll of geotextile cut to the length of the barrier to avoid joints.~~
- ~~Manufacturer's factory seams are acceptable. Field sewn seams are not acceptable.~~
- ~~Drive posts into undisturbed soil as shown.~~
- ~~Securely fasten the geotextile (and mesh) to the upslope side of the posts. Securely fasten each end of the geotextile (and mesh) to the end posts.~~
- ~~Use stitched loops over posts for unsupported silt fence.~~
- ~~Excavate a trench on the upslope side of the fence and place geotextile to the bottom of the trench. Backfill the trench with native material and compact.~~
- ~~Attach the supported sediment geotextile to the wire mesh.~~
- ~~Install the manufactured silt fence system according to the plans, Special Provisions, and manufacturer's recommendations. Connect end of rolls as shown.~~

(d) Inlet Protection - ~~Construct inlet protection that directs flows through the control and into the inlet~~Construct inlet protection as shown or directed.

- ~~**Type 1: Sediment Fence** - Install supported sediment fence around the perimeter of the inlet according to 00280.46(c).~~

- ~~**Type 2: Geotextile/Wire Mesh/Aggregate** - Place wire mesh over the inlet grate. Place sediment fence geotextile over the wire mesh and perimeter area near the inlet. Install aggregate over the geotextile fabric.~~

- ~~**Type 3: Prefabricated Filter Inserts** - Install prefabricated filter inserts according to the plans, Special Provisions, and manufacturer's recommendations. Prefabricated inserts with provisions for overflow are allowed only when accompanied by additional BMP to prevent the potential of sediments entering project storm systems. Field fabricated inserts are not allowed.~~

- ~~**Type 4: Biofilter Bags** - Install biofilter bags according to the plans.~~

- ~~**Type 5: Masonry** - Install concrete masonry units around the perimeter of the inlet. Place sediment fence geotextile around the outside perimeter, up the outside face, and on the top of masonry units. Place aggregate over the geotextile fabric and flush with the top of masonry units.~~

- ~~**Type 6: Sod** - Install sod around the perimeter of inlets within 36 hours of harvest of the sod.~~

(e) Sediment Barriers~~:~~ - Construct sediment barriers as shown or directed.

- ~~**Type 1: Straw Bales** - Straw bales are only acceptable for use as short-term emergency containment. Receive approval before each use of straw bales and remove within 30 calendar days of installation unless directed to replace with new bales.~~

- ~~**Type 2: Biofilter Bags** - Place and arrange biofilter bags as shown or directed.~~

- ~~**Type 3: Wattles** - Place and arrange wattles as shown or directed.~~

- ~~**Type 4: Sand Bags** - Place and arrange sand bags as shown or directed.~~

- ~~**Type 5: Brush Barrier** - Place brush barrier as shown or directed. Place woody debris in a linear pile.~~

- ~~**Type 6: Filter Berm** - Place and arrange filter berms as shown or directed. Place rock in an evenly spread, trapezoidal berm.~~

- ~~**Type 7: Prefabricated Barrier System** - Install prefabricated barrier systems according to the plans, Special Provisions, and manufacturer's recommendations. Field fabricated systems are not allowed.~~

(f) Sediment Mat - ~~Place sediment mats a minimum of 20 feet downstream of work areas. Install mats individually or in groups on the stream bottom.~~ Construct sediment matting as shown or directed. Remove the mats not later than 48 hours after stream activities are complete. ~~Remove them from the Project site, or if approved, place them on the stream bank and cover with permanent seeding.~~

(g) Temporary ~~**Scour Basin**~~ - **Energy Dissipater** - Construct temporary ~~scour basins at the outfall ends of temporary slope drains or as shown~~energy dissipaters as shown or directed.

(h) Temporary Sediment Trap - ~~The trap may be formed by constructing a berm~~Construct temporary sediment traps as shown or ~~by partial~~directed.

(i) Concrete Washout - Construct concrete washouts as shown or ~~complete excavation. Direct the discharge flow to a stabilized conveyance outlet or level spreader~~directed.

00280.47 Work Quality ~~- Protect areas according to~~ - Comply with 01030.49.

00280.48 Emergency Materials - Provide, stockpile, and protect emergency materials on-site for unknown weather or erosion conditions. A list of emergency materials will be listed in the Special Provisions. Replenish emergency materials as they are used.

The emergency materials are in addition to the other erosion control materials required to implement and maintain the ESCP.

Remove all unused emergency materials from the Project site at the completion of the Project.

Maintenance

00280.60 General - Maintain installed ~~erosion and sediment control~~ESC devices in good working order and effective functioning at all times. Keep the devices in place until the Agency issues

notification of acceptance of stabilization. All maintenance and repairs are at no additional cost to the Agency.

00280.61 Ineffective Controls - If a ~~control feature~~ESC device does not ~~function effectively, immediately~~meet effective functioning, repair, replace, or provide additional devices. Devices repaired, replaced, or added due to improper installation, insufficient maintenance, or damage from Contractor operations will be made at no additional cost to the Agency.

00280.62 Inspection and Monitoring~~.~~ - Ensure that regular site inspection and monitoring is performed according to the schedule and record keeping requirements of the ~~NPDS~~NPDES permit.

(a) Inspection - Perform general site inspection, complete all applicable parts of the ODOT Erosion Control Monitoring Form, and submit the Form to the Agency as follows:

- Weekly for active sites.
- Every ~~two~~ 2 weeks for inactive sites.
- Within 24 hours after 1/2 inch or more rainfall occurs including weekends and holidays.
- When ~~direct~~directed by the Engineer.

(b) Rainfall - Furnish and install a rain gauge at the Project site. Notify the Agency if 1/2 inch or more of rainfall occurs ~~within a 24 hour period. As soon as practicable, but not later than 24 hours, after 1/2 inch or more of rainfall occurs, including weekends and holidays, inspect the entire Project to determine the condition of all erosion and pollution control devices~~at the Project site within a 24 hour period.

(c) Monitoring Receiving Stream - Observe and record color and turbidity or clarity within 30 feet upstream and downstream of locations where surface waters from the construction site enter the receiving stream. ~~Note whether sheen and floating matter are present or absent.~~ Describe in the report any apparent differences in color and the clarity of the discharge, and any observable difference in comparison with the receiving stream. Note whether sheen and floating matter are present or absent.

If a ~~significant~~ permit noncompliance or serious water quality issues occur ~~which may endanger health or the environment,~~ verbally report to the Engineer within 24 hours and submit a written report within 5 calendar days.

00280.63 Sediment Removal - Remove sediment and upgrade or repair the devices as needed as soon as practicable, but not later than ~~two~~2 days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair operations.

If rainfall continues over a 24 hour period, or other circumstances that preclude equipment operation in the area, hand carry and install additional ~~sediment control devices with best management practices and approved by the Agency~~ESC devices.

(a) Catch Basins - Maintain ~~catch basin inserts and other forms of~~ inlet protection by removing trapped sediment when storage capacity has been reduced by 50~~%.~~ percent. Prevent release of sediments during maintenance or removal work.

(b) Sediment Controls - Remove sediment from sediment fences, sediment barriers, check dams, and sediment traps once it has reached one third of the exposed height of the device or storage depth. ~~Replace aggregate and rock filter material with new aggregate material when the sediment reduces the filtering capacity of the device by one half. Replace biofilter bags with~~

~~clean, washed bags when removing sediment from them. Wash bags in an approved sediment control area.~~

(c) Paved Areas - Keep all paved areas clean for the duration of the Project. Use cleaning methods that do not transport sediment-laden water to receiving streams. Adjust the frequency of cleaning to ensure compliance with the ESCP.

(d) ~~**Construction Entrances** - Add and remove aggregate or other specified material as needed to maintain the proper function of the construction entrances.~~

~~**(e)**~~ **Permanent Stabilization** ~~- Restabilize within two calendar days of disturbance all~~ – Maintain permanent stabilization work by restabilizing areas disturbed by the Contractor's operations or other causes ~~including wind, water, and vandalism~~within 2 calendar days.

~~**(f) Straw Bales** - Replace straw bales when they become non-functional or, at a minimum, on an annual basis or at the beginning of each construction season as appropriate.~~

Finishing and ~~Clean~~Cleaning Up

00280.70 Removal ~~–~~ - All temporary erosion and sediment control features that are not incorporated into the permanent work remain the property of the Contractor. Within 30 days of the notification of acceptance of permanent stabilization, remove temporary erosion and sediment control devices and materials from the area. ~~Remove~~Dispose of accumulated sediment before removing the devices and materials~~. Immediately shape~~ according to 00280.71. Shape and permanently stabilize areas affected by the removal process. ~~All temporary erosion and sediment control features that are not incorporated into the permanent work remain the property of the Contractor.~~ Do not remove temporary erosion and sediment control devices before permanent stabilization is accepted.

If shown or if directed, compost filter material may be dispersed in place. Cut open compost filter socks and dispose of sock material according to 00290.20

00280.71 Sediment Disposal - Regrade removed sediment into slopes or remove and dispose ~~of~~ off-site according to ~~00290.20. Do not flush sediment-laden water into waterways or drainage systems~~ 00290.20.

Measurement

00280.80 Measurement - Quantities of work performed under this Section will be measured according to the following:

(a) Lump Sum Basis - No measurement of quantities will be made for lump sum items.

(b) Unit Basis - Unit basis items will be measured on the unit basis, of each device or location where the device is constructed or placed.

(c) Length Basis - Length basis items will be measured on the length basis along the line and grade of the item or device constructed or placed.

- Flow spreaders and diversion dikes and swales will be measured along the long axis.
- Sediment barrier, when measured on the length basis, will be measured along the long axis of the barrier regardless of type.

- Temporary slope drains will be measured from the beginning of the metal end pieces to the end of the drain. Measurement will be made when each installation is at its maximum length.

(d) Area Basis - Area basis items will be measured on the area basis along the ground surface, and computed to the square ~~foot~~yard or acre as applicable.

(e) Limitations - The quantities of emergency materials listed in 00280.48 of the Special Provisions are included in the items listed in the Contract Schedule of Items.

Payment

00280.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Erosion Control	Lump Sum
	Erosion Prevention	
(b)	Plastic Sheeting	Square Yard
(c)	Chemical Soil Binder	Acre
(d)	Chemical Dust Control	Acre
(e)	Temporary Mulching	Acre
(f)	Matting	Square Yard
(g)	Compost Erosion Blanket	Square Yard
	Runoff Control	
(~~g~~h)	Check Dam	Each
(~~h~~i)	Temporary ~~Diversion~~Interceptor Dike/Swale	Foot
(j)	Temporary Slope Drain	Each or Foot
(~~j~~k)	Flow Spreader	Foot
(l)	Compost Filter Sock	Foot
(m)	Compost Filter Berm	Foot
	Sediment Control	
(~~k~~n)	Construction Entrance	Each
(~~l~~o)	Tire Wash Facility	Each
~~(m)~~(p)	Concrete Washout Facility	Each
(q)	Sediment Fence~~,~~	Foot
(~~n~~r)	Inlet Protection	Each
(~~o~~s)	Sediment Barrier	Each or Foot
(~~p~~t)	Sediment Mat	Square Yard
(~~q~~u)	Temporary ~~Scour Basin~~Energy Dissipater	Each
(~~r~~v)	Temporary Sediment Trap	Each

Item (a) includes:

- providing the Erosion and Sediment Control Manager
- developing, revising, and documenting the ESCP
- mobilization

- monitoring activities to maintain effective functioning
- furnishing, stockpiling, protecting, restocking, and removing emergency materials
- preparing Project for ~~winter shut-down~~a period of extended non-activity
- inspecting, maintaining, and removing erosion control devices
- restoring, mulching, tacking, and seeding all disturbed ground, work, and storage areas not otherwise covered

When only item (a) is listed in the Contract Schedule of Items, no separate or additional payment will be made for modifications or additions to the ~~BMP~~ESCP that become necessary for permit compliance during construction.

Partial payments for item (a) will be made as follows:

- When the initial Contractor developed ESCP, narrative, and schedule are complete and accepted, and the initial erosion control devices are installed..... 25%
- When 50 percent of the Contract is complete, excluding advances on materials 25%
- When 75 percent of the Contract is complete, excluding advances on materials 25%
- ~~At completion of the Contract and all erosion control devices are either~~
- ~~removed from the Project site or are fully functioning as permanent BMP~~work covered by this section 25%

Item (b) includes protecting exposed slopes with plastic sheets, anchoring devices, and providing toe protection~~ maintenance.~~.

Item (f) includes preparing the slope surface and stabilizing exposed soil with erosion matting material and bonded fiber matrix matting application.

Items (~~g), (n~~h), (r), and (~~o~~s) includes the biofilter bags, sand bags, and sediment fence as applicable.

Emergency materials that are incorporated into the Project will be paid for under the appropriate items listed in the Contract Schedule of Items.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- ~~removing and disposing of sediment build-up behind sediment fences and sediment barriers~~
- ~~removing and reinstalling required appurtenances to modify temporary slope drains as the embankment slopes are changed~~
- constructing and removing temporary slope berms
- ~~applying dust control~~
- erosion control for work outside the construction limits including but not limited to borrow pits, haul roads, disposal sites, and equipment storage sites

Water used for non-chemical dust control will be paid according to Section 00340.

Section 00290 - Environmental Protection

Description

00290.00 Scope - This Section describes the Contractor's duties and obligations with respect to protection of the land, waters, air, wildlife, and other environmental resources of the State.

Comply with all applicable federal, State, and local environmental, health, safety, and other laws, acts, statutes, regulations, administrative rules, ordinances, orders, and permits, as they may be amended from time to time (referred to in this Section as "Laws"). Comply with all applicable Laws, whether or not specifically referenced in this Section or elsewhere in the Contract.

Federal, State, and local agencies known to have enacted ordinances and regulations relating to environmental pollution and the preservation of natural resources that may affect the performance of the Contract are listed in 00170.01.

If any provision of these Specifications appears to conflict with one or more Laws, the more stringent requirement shall apply, unless the Engineer directs otherwise in situations where these Specifications are more stringent.

Comply with all additional requirements or Laws imposed by any agency or governmental unit having authority to enforce the Endangered Species Act (ESA) and other Laws.

All penalties assessed against the Agency because of the Contractor's violation of Laws referenced above, or permits applicable to the Project, will be withheld from the progress or final payments according to 00195.50(e).

No condition of the Contract releases the Contractor from any responsibility or requirement under any environmental or other Law.

00290.10 Staging and Disposal Sites - Locate staging areas and disposal sites in previously improved or disturbed sites, including existing roadways, pullouts, turnouts, parking lots, and storage yards that have been compacted, graveled and paved, unless otherwise approved, in writing, by the Engineer.

00290.11 Water Conservation - Minimize use of water by maintaining equipment, immediately fixing water line and container leaks, ensuring water valves are turned off promptly, and using recycled water when feasible.

00290.20 Waste, Hazardous Waste, and Hazardous Substances - Comply with all applicable federal, State, and local Laws as they pertain to the storage, handling, management, transportation, disposal, and documentation of waste, hazardous waste, and hazardous substances.

(a) Hazard Communication - Ensure the following documents are readily available on-site to employees, subcontractors and inspectors:

- Material Safety Data Sheets (MSDS) for all hazardous substances stored or used on-site.
- Written hazard communication program, including employee training documentation.

The Oregon Occupational Safety and Health Division (OR-OSHA) provides guidance to meet these requirements in their publication "Hazard Communication: A Safe-Work-Practice Guide".

(b) Fuel Storage - Store fuel according to the current edition of the International Fire Code and all applicable federal, State, and local Laws.

If total fuel and petroleum storage, in containers 55 gallons or larger, exceeds 1,320 gallons, comply with the applicable spill prevention control and countermeasures (SPCC) requirements of 40 CFR 112. If applicable, submit the professional engineer stamped SPCC plan, 10 days before the preconstruction conference. Comply with the plan and keep a copy on-site and readily available. The SPCC plan may be combined with the Pollution Control Plan required under 00290.30(b).

(c) Waste Management:

(1) General - Prepare a hazardous waste determination for all waste generated on-site to determine whether the waste is classified as hazardous waste, universal waste, excluded waste, waste water, or solid waste. The Agency may provide initial analytical results for some wastes such as lead-based paint and asbestos containing material. Conduct additional testing necessary for waste characterization and disposal using an Oregon Environmental Laboratory Accreditation Program (ORELAP) accredited laboratory, under chain of custody procedures.

Segregate all demolition debris according to its intended end use (reuse, recycle, or dispose). If required, store in designated areas in a manner that prevents contamination to soil and water and prevents fugitive dust emissions. Remove all waste materials recovered from the site unless otherwise approved, in writing. Retain disposal and recycling facility receipts for wastes generated on-site for at least ~~one~~ 1 year after completion of the Project. Provide copies of the receipts to the Engineer within ~~seven~~7 calendar days of the disposal or recycling.

Dispose of noxious weeds and Specified Weeds according to Section 01030.

Do not reuse demolition material, coated or treated materials, or concrete and masonry materials in waters of the State or U.S.

(2) Clean Fill - Clean fill, as defined by OAR 340-093-0030~~(13),~~, becomes the property of the Contractor at the place of origin.

(3) Reuse, Recycle, and Dispose of Materials - Waste materials become the property of the Contractor at the place of origin. Unless prohibited by Law, treat waste materials according to the following priority:

- Reuse demolition debris ~~on-site~~.
- Recycle demolition debris.
- If it is not feasible to reuse or recycle, ("feasible" is defined as a facility that is capable of handling the material, will take the material and the cost of transportation plus the cost to reuse or recycle the material is equal to or less than the costs of disposal) dispose of waste material according to the following:

a. Burnable Materials - Dispose of burnable material, that cannot be reused or recycled, according to 00290.30(c-3).

b. Woody Matter - Woody matter may be burned according to 00290.30(c-3) or may be chipped to a size of no more than 3 inches in any direction then uniformly spread over selected landscape areas, as directed, in loose layers not more than 3 inches thick. Burying wood, stumps, or other woody material is not allowed.

c. Preserved and Coated Wood - Dispose of chemically preserved wood, pressure treated wood, and wood coated with latex paint that does not contain lead according to the following:

- Reused whole.
- Provided to others to reuse.
- Burned as fuel at an energy recovery facility with a DEQ or LRAPA stationary source permit.
- Delivered to a DEQ permitted municipal solid waste landfill or a DEQ permitted construction and demolition landfill.

Dispose of wood coated with lead-containing paint at a DEQ permitted municipal solid waste landfill or a DEQ permitted construction and demolition landfill.

Test wood as required by the receiving facility.

d. Concrete and Masonry - Concrete and masonry, ~~when~~that is not recycled and does not contain hazardous substances, may be reused to fill basements or be buried in embankments on-site, provided that the materials are broken into pieces not exceeding 15 inches in any dimension, and placed so that:

- No part of any piece is within 2 feet of the top, side or end surface of the basement, embankment, or other structures.
- The fill or embankment is constructed and compacted according to 00330.42 and 00330.43.

If the Engineer provides written approval, concrete may be reused as aggregate if it meets the requirements of Section 02610 through Section 02690.

e. Disposal on Agency-Owned Lands - Do not dispose of waste materials on Agency~~-~~-owned or Agency-controlled lands, except when shown, specified, or allowed in writing to be used as fill. If allowed, place waste materials only at specified locations, as directed.

f. Off-Site Disposal - Dispose of waste at an energy recovery facility with a DEQ or LRAPA Stationary Source Permit, at a permitted landfill, or at other waste disposal facilities as required depending on that type of waste.

Subject to local zoning codes and the requirements of 00280.~~03~~05, materials that meet the definition of clean fill may be placed on other properties in a manner consistent with environmental requirements, and with written permission of the property owner. Furnish the Engineer a copy of the signed agreement with the owner before placement of the clean fill material. Do not place the clean fill material at locations that are visible from a public highway, road, or street unless the site is zoned and licensed for landfill.

(d) Hazardous Waste Management - Determine the generator category for the Project, based on the amount and type of hazardous waste generated. Use the following definitions. If they differ from current Laws, use the current Laws.

- **Conditionally Exempt Generator** - A conditionally exempt generator (CEG) generates 220 pounds or less of hazardous waste per month or 2.2 pounds or less of acutely

hazardous waste per month and accumulates up to 2,200 pounds hazardous waste or 2.2 pounds acutely hazardous waste on-site.

- **Small Quantity Generator** - A small quantity generator (SQG) generates 220 pounds to 2,200 pounds hazardous waste per month, can accumulate up to 13,200 pounds hazardous waste on-site (or more with a permit), and ship hazardous waste off-site within 180 days of generation.

- **Large Quantity Generator** - A large quantity generator (LQG) generates more than 2,200 pounds hazardous waste per month or more than 2.2 pounds acutely hazardous waste per month, has no accumulation limit, but ship all hazardous waste off-site within 90 days of generation.

In addition to current Laws, comply with the following:

- If the Project generator category is SQG or LQG, or if it requires a hazardous waste identification number, obtain a Resource Conservation and Recovery Act (RCRA) site identification number from the DEQ. Pay all fees and complete the RCRA application form as follows:
  - List the Contractor as the Site Contact, the Site Operator, the Hazardous Waste Form Contact, and the Hazardous Waste Fee Contact.
  - List ODOT as the Site Location, the Land Owner, and the Legal Owner.
  - Fill in the Comments section with the following statement:

    "[Contractor name] is responsible for the following: All hazardous waste management on site for the duration of this construction project, for delivery of the waste to a permitted recycling or disposal facility, and for all forms and fees associated with the hazardous waste management including cancellation of the RCRA site identification number at the end of the Project. ODOT is the owner of the waste and maintains long term responsibility for the waste as required by RCRA, excluding all wastes generated solely from materials brought to the site by the Contractor, which remain the property of the Contractor."
  - The Contractor may sign hazardous waste manifests for the off-site shipment of hazardous wastes as the "offeror" rather than as the "generator".
- Maintain all required waste management records, including monthly hazardous waste generation records, manifests, recycling and disposal receipts, test results, and annual DEQ reports. Submit monthly records to the Engineer by the fifteenth day of the following month and submit DEQ reports to the Engineer concurrently with DEQ. Keep copies for at least ~~three~~3 years following completion of the Project and resolution of any regulatory violations or citations.
- ~~If the quantity of hazardous waste projected to be generated meets the requirements for a CEG, store hazardous wastes on-site for no more than 180 days.~~
- ~~If the quantity of hazardous waste projected to be generated meets the requirements for a SQG or for a~~ LQG, prepare a full Hazardous Waste Contingency Plan according to 40 CFR 265~~.51.~~ Subpart D. Maintain a copy of the Contingency Plan on~~-~~-site at all times during construction activities, readily available to employees and inspectors.
- If the quantity of hazardous waste projected to be generated meets the requirements for a SQG, prepare a modified Hazardous Waste Contingency Plan according to 40 CFR 262.34(d)(5) and 40 CFR 265 Subpart C. Maintain a copy of the modified Contingency Plan on-site at all times during construction activities, readily available to employees and inspectors.

- If the quantity of hazardous waste projected to be generated meets the requirements for a CEG, follow the contingency planning and storage requirements of the SQG unless the only potentially hazardous waste is aerosol cans smaller than 20 ounces. Limit storage to 180 days and 2,200 pounds. Prepare a modified Hazardous Waste Contingency Plan and keep a copy on-site with emergency response procedures and contact information.
- If the project is SQG or LQG, retain a Certified Hazardous Materials Manager (CHMM) in good standing and with experience managing the hazardous wastes associated with the Project to oversee waste management at the site.
- All employees involved in the handling and management of CEG hazardous waste shall comply with the federal and State Laws for hazardous waste management. All employees involved in the handling of SQG and LQG hazardous waste shall be trained according to federal and State Laws. For LQC hazardous waste projects, keep employee training records on-site and readily available.
- If the quantity of hazardous waste generated in a month changes the generator category, immediately implement the requirements for the new category and comply with them for the remainder of the year. Complete the new documentation and training requirements within 30 calendar days of the change.
- Ensure hazardous waste containers are clearly and visibly labeled with the contents and accumulation start date, compatible with the contents and in good condition. Store them in a designated weather-protected area that is secured from public access, has secondary containment adequate to contain a release, and has sufficient aisle space to safely maneuver containers and respond to spills (minimum 30 inches).
- If hazardous waste will be treated on-site, obtain approval from DEQ and the Engineer for each specific treatment or recycling process, treat wastes within accumulation tanks or closed containers that meet RCRA requirements, conduct treatment within the storage time for the applicable generator category, maintain current copies of all required notifications and waste analysis plans readily available on-site and request DEQ technical assistance prior to starting any on-site recycling or treatment.

(e) Hazardous Substance Transportation - Comply with the following requirements for transportation of hazardous substances and hazardous waste:

- Train all employees involved in transportation and shipping as required by US DOT.
- Use drivers who have a commercial driver's license with a hazardous materials endorsement when required.
- Ship hazardous wastes from SQG and LQG projects using a DEQ registered hazardous waste transporter under a hazardous waste manifest.
- Ensure shipments are appropriately packaged and labeled, and vehicles are appropriately placarded.
- Submit copies of the completed manifests and documentation to the Engineer and retain copies for at least ~~one~~ 1 year.

(f) Unexpected Contamination - If, during construction, unanticipated hazardous substances are discovered that threaten the health and safety of workers, the public, or the environment, do the following:

- Immediately remove all affected employees and secure the area to prevent access.
- Notify the Engineer immediately and provide written notification within 24 hours, setting forth a description of the hazardous substances encountered.

The Engineer will attempt to resolve the unanticipated situation expeditiously according to 00140.40. Delays to work due to the discovery of unexpected contamination shall be considered for exclusion from Contract time according to 00180.50(e).

(g) Spills and Releases - Obtain a response agreement with a professional on-call spill response team. The professional on-call spill response team, identified in the ~~PCP,~~pollution control plan (PCP), agrees to be available and respond to spills that cannot be cleaned up with on-site resources. A professional spill response team is a company or section of a company specifically dedicated to hazardous materials emergency spill response, insured, and bonded for hazardous materials cleanup, and employing experienced personnel certified according to 29 CFR ~~1920~~1910.120.

In the event of a spill or release of a hazardous substance or hazardous waste or the release of any other material that has the potential to harm human health or the environment, do the following:

- Immediately commence response actions to protect human health and the environment. Follow the PCP, SPCC and Contingency Plan, as appropriate. If any of the provisions in these plans conflict, implement the actions providing the greatest protection of public health and safety and the environment.
- If the spill ~~can not~~cannot be safely contained and cleaned up with on-site resources, activate the professional on-call spill response team.
- Immediately notify the Engineer.
- If the quantity released exceeds the State or Federal reportable quantities, or if the release impacts or threatens to impact any surface water body, immediately notify DEQ by the Oregon Emergency Response System (OERS) at 1-800-452-0311 and the EPA and USCG through the National Response Center (NRC) at 1-800-424-8802 (Federal reportable quantities or spills impacting or potentially impacting water only). If the quantity released is unknown, proceed with OERS and NRC notifications. Reportable quantities are listed at 40 CFR 302.4 and OAR 340-142-0040 to OAR 340-142-0050.
- Conduct cleanup of the released material according to all applicable Laws and DEQ requirements. Cleanup to background levels unless otherwise agreed to by the Agency in writing.
- Provide a written report to the Engineer, using the DEQ Spill/Release Report form, within 10 calendar days of completing spill response, but no more than 30 calendar days after the initial event. If the spill was reported to DEQ, submit the report to DEQ concurrently. Include a description of how future releases will be prevented.

00290.29 Health and Safety - Comply with all applicable health and safety Laws as they pertain to the hazardous substances and wastes used, stored and generated on-site. If any of these requirements are in conflict, the more stringent requirements apply.

00290.30 Pollution Control - Prevent, control, and abate pollution of the environment. Comply with new or amended environmental pollution Laws, not contemplated at the time of bid preparation, according to 00140.50 and ORS 279C.525.

(a) Pollution Control Measures - Comply with the following requirements:

(1) General:

- Allow no pollutant of any kind (e.g., petroleum products or fresh "green" concrete) to come in contact with an active flowing stream or waters of the State and U.S.

- Comply with the erosion prevention and sediment control requirements of Section 00280 and all applicable DEQ NPDES 1200 Permit requirements.
- Do not cause turbidity to waters of the State and U.S. outside of regulated levels.

(2) Materials and Waste Management:

- Store construction equipment, materials and debris in a manner that prevents contamination of water and soil and prevents fugitive dust.
- Store hazardous substances in the original containers or labeled compatible containers according to State Fire Marshal's regulations, International Fire Code and product MSDS.
- Locate areas for storing fuels and other potentially hazardous materials at least 150 feet away from any waters of the State and U.S. or storm inlet, unless otherwise approved by the Engineer.
- Dispose of material waste according to 00290.20.
- Do not use treated timbers within any waters of the State and U.S.

(3) Equipment Fueling, Repair and Maintenance:

- Promptly correct or repair operational procedures, leaks, or equipment problems that may cause pollution at the Project Site. If soils or other media become contaminated as a result of operational procedures or equipment problems, remove and dispose of them according to applicable Laws and 00290.20(g).
- Locate areas for parking, refueling and servicing mobile equipment and vehicles at least 150 feet away from any waters of the State and U.S. or storm inlet, unless otherwise approved by the Engineer.
- For large equipment that is not easily moved, prevent fuel and operating fluids from reaching any waters of the State and U.S. or storm inlet by, at a minimum, using spill containment systems designed to completely contain potential spills during all refueling and equipment repair operations.

(4) Equipment Cleaning and Washouts:

- Inspect and clean all equipment prior to operating it within 150 feet of any waters of the State and U.S. or storm inlet. Check for fluid leaks and remove all external oil, grease, weed seed, and dirt.
- Do not discharge untreated wash and rinse water into the any waters of the State and U.S. or storm inlet.
- Establish wash areas that contain all fluids and debris, at least 150 feet from any waters of the State and U.S. or storm inlet, such that untreated waste water does not impact those systems.
- Clean concrete equipment in washout areas that contain all fluids and debris. Recycle washout materials into fresh mixes or dispose of according to applicable permits.

(5) Off Site Tracking:

- Limit water leakage from trucks carrying saturated soils to less than 1 gallon per hour before allowing them to leave the Project Site.
- Remove all loose dirt and debris from trucks prior to leaving the Project Site.

(6) Other Spill Prevention and Response Measures:

- Inspect heavy equipment, storage containers, staging areas and other potential sources of hazardous substances daily to identify and prevent potential releases.
- If flooding of the Project site is expected to occur within 24 hours, evacuate areas used for staging, access roads, or storage and remove materials, equipment, and fuel.
- Immediately contain and repair leaking equipment or containers and cleanup any releases according to 00290.20(g).
- Maintain hazardous material containment kits and spill containment kits on-site to facilitate the cleanup of hazardous material spills on dry-land and/or waters of the State and U.S.

(b) Pollution Control Plan ~~(PCP)~~ - Develop and submit a ~~PCP~~pollution control plan to prevent pollution related to Contractor operations for approval 10 calendar days before the preconstruction conference. Maintain a copy of the PCP on-site at all times during construction activities, readily available to employees and inspectors. Ensure that all employees comply with the provisions of the PCP.

Include the following information in the PCP:

- Identify a professional on-call spill response team.
- Identify all contractor activities, hazardous substances used and wastes generated.
- Describe how hazardous substances and wastes will be stored, used, contained, monitored, disposed of and documented. Include pollution prevention, spill response, waste reduction, dust prevention, off site tracking prevention, washout facility design, vehicle and equipment fueling and maintenance procedures, employee training and emergency contact information.
- Include the waste determination results from 00290.20(c-1). Provide reuse, recycle, and disposal options, the reason for selecting that alternative, and estimated quantities for each reuse, recycle, and disposal option.
- Include or refer to the SPCC plan and the hazardous waste contingency plan, if required.
- Include scaled site plans showing locations for hazardous substance storage, spill response equipment, communications equipment and fire suppression equipment.

A "Pollution Control Plan Contractor Packet" is available from the Agency.

(c) Air Pollution Control Measures - Comply with ORS 468, ORS 468A, OAR 340-014, OAR 340-200 through OAR 340-268, and all other applicable Laws.

(1) Vehicle and Equipment Idling - Establish truck staging areas for diesel-powered vehicles located where truck emissions have a minimum impact on sensitive populations, such as residences, schools, hospitals and nursing homes.

Limit idling of trucks and other diesel powered equipment to ~~five~~ 5 minutes, when the equipment is not in use or in motion, except as follows:

- When traffic conditions or mechanical difficulties, over which the operator has no control, force the equipment to remain motionless.
- When operating the equipment's heating, cooling or auxiliary systems is necessary to accomplish the equipment's intended use.
- To bring the equipment to the manufacturer's recommended operating temperature.
- When the outdoor temperature is below 20 °F.

- When needed to repair equipment.
- Under other circumstances specifically authorized by the Engineer.

(2) Dust Control and Permitting - Prevent airborne dust and fugitive dust emissions from construction activities including rock, concrete, and asphalt crushing operations and obtain permits according to 00160.70. Do not use oil, waste, waste water, or other illegal materials as dust suppressants.

(3) Burn Restrictions - Burn wastes only if open burning is allowed by State, LRAPA, and local burning Laws. Obtain and comply with all required permits including DEQ permits required by OAR 340-264-0010 through OAR 340-264-0020, LRAPA permits, and local fire district permits. Provide copies of all permits to the Engineer prior to burning. Do not conduct burning within riparian areas. Conduct burning at locations where existing structures will not be damaged and where smoke will not impact traffic. Do not burn the following materials on-site:

- Rubber products
- Tires
- Plastic
- Wet garbage
- Petroleum and petroleum treated materials
- Asphalt or industrial waste
- Any material that creates dense or noxious odors
- Painted materials
- Asbestos, mercury or PCB containing materials or equipment
- Hazardous wastes
- Scrap wiring or electrical equipment
- Painted or treated wood

Buildings intended for demolition may be burned by the local fire department for training purposes~~.~~ provided that all hazardous substances have been removed from the building before burning. Contact the local fire department for applicable restrictions.

00290.32 Noise Control - Comply with ORS 467, OAR 340-035, all other applicable Laws, and the following construction noise abatement measures:

- Do not perform construction within 1,000 feet of an occupied dwelling on Sundays, legal holidays, or between the hours of 10:00 p.m. and 6:00 a.m. on other days, without the approval of the Engineer.
- Use equipment with sound control devices no less effective than those provided on the original equipment. Equipment with un-muffled exhausts is prohibited.
- Use equipment complying with pertinent equipment noise standards of the EPA.
- Do not drive piling or perform blasting operations within 3,000 feet of an occupied dwelling on Sundays, legal holidays, or between the hours of 8:00 p.m. and 8:00 a.m. on other days, without the approval of the Engineer.
- Mitigate the noise from rock crushing or screening operations performed within 3,000 feet of all occupied dwellings by placing material stockpiles between the operation and the affected dwellings, or by other means approved by the Engineer.

If a specific noise impact complaint occurs during the construction of the Project, one or more of the following noise mitigation measures may be required, at no additional cost to the Agency, as directed by the Engineer:

- Locate stationary construction equipment as far from nearby noise sensitive properties as feasible.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residents whenever extremely noisy work will be occurring.
- Install temporary or portable acoustic barriers around stationary construction noise sources.
- Operate electric-powered equipment using line voltage power or solar power.

00290.34 Protection of Fish and Fish Habitat - Comply with the Laws of the Oregon Department of Fish and Wildlife, National Marine Fisheries Service, and U.S. Fish and Wildlife Service, and the rules and practices developed through the Oregon Plan for Salmon and Watersheds. Conduct operations to avoid any hazards to the safety and propagation of fish and shellfish in waters of the State and U.S.

(a) Regulated Work Areas - Perform work within regulated work areas only within the regulated in-water work periods. Do not allow equipment to enter any waters of the State or U.S. or the regulated work area except as allowed in permits issued for the Project.

The regulated work area, if any, will be identified in the Special Provisions.

(b) Prohibited Operations - Except where allowed by the Contract or by permit, do not:

- Blast underwater
- Use water jetting
- Release petroleum products or chemicals in the water
- Disturb spawning beds
- Obstruct stream channels
- Cause silting or sedimentation of waters of the State and U.S.
- Use treated timbers within the regulated work area
- Impede adult and juvenile fish passage, including intermittent streams

00290.36 Protection of Wildlife and Wildlife Habitat - Comply with the Laws of the Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service. Conduct operations to avoid any hazards to the safety and propagation of wildlife.

(a) Migratory Birds - Comply with the Migratory Bird Treaty Act (16 U.S.C. 703-712) which protects most species of birds in Oregon and prohibits the removal of nests containing eggs and dependent young. Migratory birds include most birds in Oregon, except pigeons, house sparrows, and starlings. Except where allowed by the Contract and by permit, do not disturb a migratory bird nest containing eggs or dependent young, or the surface the nest is built on.

If migratory bird nests are encountered that contain eggs or dependent young, stop all actions that may disrupt the nest and contact the Engineer. Do not resume work, that may disrupt nesting, until approved by the Engineer.

(b) Bats - Avoid destruction of bat colonies as shown.

00290.38 Protection of Plants - Plant habitats to be protected will be shown with the plant habitat boundaries flagged by the Engineer . Avoid destruction of plant habitats by ensuring construction personnel, equipment, and associated pollutants, including sediment, chemical contaminants, discharge water, non-native grass and weed seed, do not enter the habitat.

00290.40 Protection of Forests - - Obtain necessary permits according to ORS 477.625 and ORS 527.670, and comply with the Laws of any authority having jurisdiction for protection of forests.

00290.41 Protection of Wetlands - Comply with and require that all the Contractor's employees, agents, and subcontractors on the Project Site comply with the following:

- Clean Water Act Section 404 (33 U.S.C. 1344); Federal Rivers and Harbors Act of 1899, Section 10 (33 U.S.C. 403 et seq.).
- ORS 196.800 to ORS 196.990 (Oregon Removal-Fill law).
- ORS 390.805 to ORS 390.925 (Oregon Removal and Filling in Scenic Waterways law).
- All other applicable Laws governing preservation of wetland resources.

For the purposes of this Section, "wetland" or "wetlands" shall be understood to include wetlands as defined in 00110.20, as well as other jurisdictional waters of the State and U.S.

Willful violation of permit conditions and applicable laws exposes the offending Contractor and other violators to criminal and civil sanctions. Civil sanctions include, but are not limited to, the offender's sole liability for all costs associated with site restoration, maintenance and additional mitigation work required by federal or State authorities.

(a) Identifying Wetlands - Wetlands known to be on the Project Site will be shown and identified either as "permanently filled or excavated" or as "temporarily impacted". Wetlands to be protected will be shown as "no work zones".

(b) Disturbing Wetlands - If wetlands are shown, meet with the Agency Wetland Specialist, the Engineer, and inspector on-site prior to moving equipment onto the site or beginning any work, to ensure that all parties understand the locations of wetlands and the measures that shall be taken to protect them.

Ensure protection of no work zones as follows:

- Fence off no work zones using pedestrian safety fence or approved equivalent.
- Except as authorized by the Engineer for the purpose of installing or maintaining approved wetland protective measures, keep all persons, equipment and materials off no work zones.
- The Engineer has the authority to bar from the Project any person entering a protected site other than for the purpose of installing or maintaining protective measures.

Install all site protection for wetlands required by the Plans and Special Provisions prior to staging equipment or starting work near the ~~site(s).~~sites.

The Engineer may suspend work until the Contractor, Engineer, Agency Wetland Specialist, and other required federal and State personnel, if any, meet to determine damage to the site and the nature and scope of necessary site restoration and maintenance. The Engineer may require the Contractor to submit a written plan for protection of other sites for the duration of the Project before work resumes.

00290.50 Protection of Cultural Resources - Comply with all Laws governing preservation of cultural resources. Cultural resources may include, but are not limited to, dwellings, bridges, trails, fossils, and artifacts.

If cultural resources are encountered on the Project area or in material sources, and their disposition is not addressed in the Special Provisions, do the following:

- Immediately discontinue operations or move to another area of the Project Site or material source.
- Protect the cultural resource from disturbance or damage.
- Notify the Engineer.

The Engineer will do the following:

- ~~Contact the Agency Archaeologist, to arrange~~Arrange immediate investigations.
- Arrange for disposition of the cultural resources. The Engineer may direct the Contractor to perform salvage operations ~~as Extra Work~~according to 00140.30 or 00140.60.
- Notify the Contractor when to begin or resume construction operations in the affected area.

00290.51 Protection of Sensitive Cultural Sites - Comply with and require that all the Contractor's employees, agents, and subcontractors on the Project Site comply with all Laws applicable to the preservation and protection of sensitive cultural sites. The existence of any sensitive cultural sites affecting the Project, and the mandatory preservation and protection measures applicable to the sites, are determined according to the Laws including, but not limited to the following:

- National Historic Preservation Act (NHPA) of 1966, Section 106, codified in 36 CFR Part 800 (Protection of Historic Properties).
- ORS 97.740 to ORS 97.760, ORS 97.990(5), and ORS 97.990(6) (Indian Graves and Protected Objects).
- ORS 358.905 to ORS 358.955 (Archaeological Objects and Sites).
- ORS 390.235 to ORS 390.240 (Archaeological Sites and Historical Material).

Ensure protection for sensitive cultural sites according to the following:

- Except as authorized by the Engineer for the purpose of installing or maintaining approved sensitive cultural site protective measures, keep all persons, equipment, and materials off known sensitive cultural sites.
- Install all sensitive cultural site protection required by the plans and Special Provisions prior to staging equipment or starting work near the ~~site(s).~~sites.
- Instruct all Contractor and subcontractor personnel to regard the locations of these sites and their contents as confidential.

The Engineer has the authority to bar from the Project any person entering a protected site other than for the purpose of installing or maintaining protective measures.

If sensitive cultural sites are known to be on the Project, additional information will be provided in the Special Provisions.

(a) Disturbing Known Sensitive Cultural Sites - Willful violation of Laws exposes the offending Contractor and other violators to criminal and civil sanctions. Civil sanctions include,

but are not limited to the offender's sole liability for all costs associated with monitoring, recovery, site restoration or other archaeological work required by Tribal, federal, and State authorities. Costs can exceed $100,000.

The Engineer may suspend work until the Contractor and the Engineer meet to determine damage to the site and the nature and scope of necessary site restoration and maintenance. The Engineer may require the Contractor to submit a written plan for protection of other sites for the duration of the Project before work resumes.

(b) Disturbing Unknown Sensitive Cultural Sites - If the Contractor finds a previously undiscovered sensitive cultural site, immediately cease all activities at that site, follow procedures listed in 00290.50, and notify the Engineer. If the Contractor inadvertently disturbs unknown sensitive cultural sites, but immediately ceases all activities and follows the procedures listed in 00290.50, the Agency, to the extent permitted by Article XI, section 7 of the Oregon Constitution and by the Oregon Tort Claims Act, will indemnify, within the limits of the Tort Claims Act, the Contractor for costs associated with monitoring, recovery, site restoration or other required archaeological work, provided neither the Agency nor the State shall be required to indemnify the Contractor for such costs resulting from, arising out of or relating to the willful misconduct, negligence or other wrongful acts attributable to the Contractor or other persons on the Project site.

Delays to work due to new cultural resource finds will be considered for exclusion from Contract time according to 00180.50(e).

Work required for monitoring and site restoration for newly discovered sensitive cultural sites encountered by the Contractor will be paid according to ~~Section 00197~~00195.20.

Measurement

00290.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00290.90 Payment - The accepted quantities for work performed under this Section will be paid for at the Contract lump sum amount for the item "Pollution Control Plan".

Partial payments will be made as follows:

- When the initial PCP is approved 20%
- When 30 percent of the Contract is complete, excluding advances on materials 20%
- When 60 percent of the Contract is complete, excluding advances on materials 20%
- When 90 percent of the Contract is complete, excluding advances on materials 20%
- At completion of the Contract and all waste is removed from the Project site and all reports, receipts, and documents have been submitted 20%

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment includes, but is not limited to, the following:

- Contractor's Pollution Control plan ~~(PCP)~~
- Spill Prevention Control and Countermeasures ~~(SPCC)~~ plan
- Hazardous Waste Contingency plan
- ~~Hazardous~~hazardous waste determination

- ~~Determination~~determination of generator category
- ~~The~~the Certified Hazardous Materials Manager
- ~~The~~the Professional on-call Spill Response Team

PART 00300 - ROADWORK

Section 00310 - Removal of Structures and Obstructions

Description

00310.00 Scope - This work consists of removing and disposing of man-made materials and cleaning up areas they occupy. See Section 00501 for removal of bridges..

00310.01 Areas of Work - Perform removal work in the same areas as specified in 00320.01.

If a building to be removed lies partly within the right-of-way, remove the entire building unless otherwise shown or directed.

00310.02 Exclusions - Removal work does not include removal or disposal of materials which are:

- Designated to remain.
- Included in earthwork as given in 00330.41.
- Specifically indicated by the Specifications, plans, or Special Provisions to be removed incidental to other items of work under the Contract.
- Owned or controlled by third parties.

Construction

00310.40 Restrictions on Removal Work:

(a) Guardrail, Median Rail, and Concrete Barrier - In those areas where guardrail, median rail, or concrete barrier are to be removed and replaced with new or salvaged rail or barrier, do one of the following:

- Install the new or salvaged units the same working shift the existing unit is removed.
- Protect the area with temporary, precast concrete barrier units with appropriate end treatment satisfactory to the Engineer, until the new or salvaged unit is installed.

(b) Milepost Markers - Throughout construction, protect and maintain all milepost markers affected by the work at locations visible to the traveling public. This may require removing and relocating the milepost markers to maintain visibility throughout construction. When construction is completed, reinstall the milepost markers in their original location in a manner satisfactory to the Engineer, unless new milepost markers are to be installed according to Section 00840.

00310.41 Removal Work:

(a) General - Where an abutting structure or ~~a~~ part of a structure is to be left in place, make clean, smooth, vertical cuts with a saw or other approved cutting device. Avoid operations that ~~protect~~may damage any portion of the remaining ~~structures and allow for specified connections~~structure.

(b) ~~Guard Rail~~Guardrail Posts - Remove posts completely and backfill holes with selected granular backfill material meeting the requirements of 00330.14.

(c) Drainage Structures - Remove drainage structures, such as box culverts, down to a depth 2 feet below ground, slope or waterway bed. Remove culverts, sewers, siphons, and other conduits according to 00330.41(a-7).

(d) Materials Within Construction Areas:

(1) General - Remove materials within construction areas entirely or break down the materials to an elevation at least 2 feet below subgrade or slope surface as allowed below.

(2) Bituminous Treated Surfaces - Scarify and break up existing bituminous treated surface when it lies under subgrade and is not salvaged. Incorporate the scarified material into the embankment. Pieces of existing pavement shall not exceed 15 inches in any dimension.

(3) Concrete Floors, Slabs and Walls - Before placing material in basements or over concrete slabs, remove or break through the floors, slabs, and walls so no fragments of the floors, slabs, and walls have a dimension in excess of 15 inches and there is no protruding reinforcement.

(e) Materials Outside of Construction Areas - Remove materials which lie outside of construction areas to an elevation at least 2 feet below the surface elevation to which the affected area is to be finished.

00310.42 Salvaging Drainage Structure Fittings - Metal grates, frames, rings, covers, and other metal fixtures or fittings for drainage structures may be salvaged and used on new structures if the Engineer determines they are reusable.

00310.43 Disposal of Material - Dispose of materials according to 00290.20(c).

00310.44 Earthwork in Connection with Removal - Excavation required to perform removal of structures and obstructions will be considered Incidental to the removal work, unless it is within the measurement limits for an excavation Contract pay item.

Backfill holes according to 00330.45. The backfill will be measured for payment according to 00330.82, when there is an embankment measure basis pay item for earthwork and that material is used for backfilling, otherwise no separate payment will be made for this work.

Maintenance

00310.60 Repair of Damages - Repair promptly any breakage or damage to materials or items not intended to be removed. Complete replacement of the affected materials may be required if the Engineer determines it is necessary. Make all repairs and replacements at no additional cost to the Agency.

Measurement

00310.80 Measurement - The quantities of removal of structures and obstructions work performed under this Section will be measured according to the following:

- **Lump Sum Basis** - Under this method, no measurement of quantities will be made.

- **Separate Item Basis** - Under this method, the quantities of work performed on a separate item basis will be measured as follows:

- **Length and Area** - The length or area of the structure or item actually removed, will be measured along the line and grade of the structure or item for each continuous structure or item removed. Measurement will be ~~by~~on the ~~foot and be~~length or area basis, limited to the neat lines shown or directed~~. Area will be calculated to the square yard~~.

- **Each** - Items will be measured on a unit basis of units removed.

Payment

00310.90 Payment - The accepted quantities of work done under this Section will be paid for at the lump sum basis or separate item basis according to 00310.91 and 00310.92 as applicable.

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for barriers used for temporary protection where guardrail, median rail, or concrete barriers have been removed.

No separate or additional payment will be made for protecting and maintaining milepost markers and reinstall them at their original location.

When the Contract Schedule of Items does not indicate payment for work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

00310.91 Lump Sum Basis - The accepted quantities of removal work done on a lump sum basis will be paid at the Contract lump sum amount for the following items:

Pay Item	Unit of Measurement
(a) Removal of Structures and Obstructions	Lump Sum
(b) Removal of _____	Lump Sum

Item (a) includes all removal work done on a lump sum basis, except as covered under pay items given in the form of (b).

In item (b), the specific kind or description of removal work will be inserted in the blank.

00310.92 Separate Item Basis - The accepted quantities of removal work done on a separate item basis will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Removal of Pipes	Foot
(b) Removal of Curbs	Foot
(c) Removal of Walks and Driveways	Square Yard
(d) Removal of Surfacings	Square Yard
(e) Removal of Inlets	Each
(f) Removal of Manholes	Each

Item (d) includes the removal of all surfacings, except for walks and driveways, as defined in 00110.20 under "Existing Surfacings".

Section 00320 - Clearing and Grubbing

Description

00320.00 Scope - This work consists of removing and disposing of vegetation and buried matter within a specified area or as directed. The work also includes preserving vegetation and objects designated to remain in place and cleanup of the work area.

00320.01 Areas of Work - The areas to be cleared and grubbed are shown on the plans, or if not shown on the plans, the clearing lines are 10 feet outside the following:

- Top of side slopes of ditches and channel changes.
- Top of cut slope.
- Top of cutbank rounding if rounded.
- Toe of fill slope.
- Outside edge of structure.
- Other work areas shown on the plans, such as material sources, borrow areas and road connections.
- Tree, plant, or natural areas to be preserved.

00320.02 Definitions:

(a) Clearing - Clearing consists of:

- Preserving trees and other vegetation designated to remain in place.
- Salvaging marketable timber, when required by the Special Provisions.
- Cutting and removing vegetation, such as weeds, grasses, crops, brush, and trees.
- Removing down timber and other vegetative debris.

(b) Grubbing - Grubbing consists of removing:

- Brush stems remaining above the ground surface after the clearing work.
- Tree stumps.
- Roots and other vegetation found below ground surface.
- Partially buried natural objects.

(c) Clear Zone - The clear zone is the roadside border area, starting at the edge of the traveled way, available for safe use by an errant vehicle. The minimum clear zone line, for purposes of this Section, is 30 feet from the edge of the traveled way, but this distance may vary depending on design speed, horizontal alignment and side slope requirements.

Construction

00320.40 Clearing Operations:

(a) Clearing Trees and Other Vegetation - Remove and dispose of noxious weeds and Specified Weeds according to Section 01030 prior to beginning clearing of trees and other vegetation.

Cut trees and brush so they fall into the areas specified to be cleared.

Cut off tree stumps, not required to be grubbed under 00320.41 as follows:

- Flush with the ground surface if within the clear zone.
- No higher than 4 inches above the ground surface if between the clear zone and the clearing line.

Remove all evidence of clearing matter and debris. This work includes removal of:

- Sod, weeds and dead vegetation.
- Down timber, brush and other vegetation.
- Sticks and branches with diameters greater than 1/2 inch.
- Dead trees, down timber, stumps, and specified trimmings from areas where live trees and other vegetation are designated to remain.

(b) Preserving and Trimming Vegetation:

(1) Within the Work Areas - Avoid injuring vegetation designated to remain in place. Preservation of this vegetation includes protection and special care.

(2) Outside the Work Areas - Avoid injuring any vegetation. Confine operations which may injure vegetation to areas that have no vegetation or to the work areas.

Remove hazardous, dead and damaged trees outside the clearing limit as directed.

(3) Tree Trimming - Trim trees according to good tree surgery practices and as directed to remove safety hazards such as:

- Unsound branches of trees to remain in place.
- Branches over roadways and bridges to provide at least 20 feet of clearance above the roadway surface.
- Branches over walks to provide at least 8 feet of clearance above the walk surface.
- Branches obstructing sight distance at intersections or impairing visibility of signs.

Preserving vegetation includes keeping equipment and materials off of the critical root zone as directed.

(4) Trees To Be Saved - When trees are to be saved, the Engineer will identify and mark them. Provide and place orange plastic mesh fencing, from the QPL, around critical root zones of marked trees or tree groups as directed. Do not begin construction activity or move equipment into existing tree areas until the plastic mesh fencing is in place.

Do not work within the critical root zone of marked trees unless written approval is obtained from the Engineer. Be responsible for all damage to or for removal of marked trees. Tree damage will be determined by a certified arborist selected by the Engineer.

00320.41 Grubbing Operations - Within excavation limits, remove tree stumps, roots, and other vegetation to a depth of at least 6 inches below excavation subgrade or sloped surfaces.

Within embankment limits, remove tree stumps, roots, and other vegetation.

00320.42 ~~Ownership and~~ Disposal of Matter - ~~All matter and debris accumulated from clearing and grubbing operations become the Contractor's property at the place of origin.~~ Dispose of ~~this~~all matter and debris according to 00290.20~~(c).~~.

00320.43 Backfilling Holes - Except in areas to be excavated, backfill holes remaining after grubbing operations with clean fill (see 00290.20(c-2)) according to 00330.45.

Measurement

00320.80 Measurement - The quantities of clearing and grubbing work performed under this Section will be measured according to the following:

- **Lump Sum Basis** - Under this method, no measurement will be made.
- **Area Basis** - Under this method, measurement will be the ground surface, limited to the areas shown or directed.

Payment

00320.90 Payment - The accepted quantities of clearing, grubbing, disposal, and cleanup work will be paid for at the Contract lump sum amount or the Contract unit price, per acre, for the item "Clearing and Grubbing".

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for plastic mesh fencing.

When the Contract Schedule of Items does not indicate payment for work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00330 - Earthwork

Description

00330.00 Scope - This work consists of excavation, ditching, backfilling, embankment construction, grading, leveling, borrow, and other earth-moving work required in the construction of the Project, excepting such work specifically included and provided for as:

- A pay item elsewhere in the Contract Specifications.
- Incidental work in the detailed Specifications for other Contract pay items.

The term "earthwork" will be used as a general term to designate the work included within the scope of this Section.

00330.01 Lines, Grades, and Cross Sections - All earthwork shall conform to the lines, grades and cross sections established.

Roadbed cross sections shall be subject to variation from the typical sections shown on the plans, if directed, to:

- Provide superelevation on curves.
- Take care of special conditions at intersections and elsewhere.
- Balance earthwork quantities.

00330.02 Definitions:

Abandoned Pipes and Miscellaneous Matter - Sewers, pipes, conduits, logs, timbers, concrete and other structures, materials, objects, and matter encountered in the work, excepting only items identified for removal or preservation.

General Excavation - All excavation covered by this Section, except foundation, toe trench, and borrow excavation.

Overbreak - Material beyond and outside of the slope limits established by the Engineer, which becomes displaced or loosened during excavation and is excavated.

Selected Materials - Those materials with pertinent characteristics that are preserved and sorted as directed from specified excavations and handled for specific uses.

Stone Embankment Material - Rock used in specific embankment applications including buttresses, inlays, shear keys, and erosion control applications.

00330.03 Basis of Performance:

(a) General - Except as provided in 00330.00, all earthwork shall be performed on either an excavation basis or on an embankment basis. The basis of performance for each earthwork pay item will be indicated in the Special Provisions and the Contract Schedule of Items.

(b) Excavation Basis - Earthwork performed under this provision including excavation, haul, and embankment construction, unless otherwise specified, will be paid for by excavation measurement. (see 00330.80 and 00330.81)

(c) Embankment Basis - Earthwork performed under this provision, including excavation, haul and embankment construction, unless otherwise specified, will be paid for by embankment measurement. (see 00330.80 and 00330.82)

00330.04 Sources of Borrow:

(a) Agency Furnished Borrow - Use materials obtained from Agency furnished sources lying outside of, separated from and independent of planned roadbed excavations, or other required excavations within the Project limits, only when called for by the Contract or when specifically directed. (see 00330.41(d))

(b) Contractor Furnished Borrow - Unless otherwise specified or directed, all borrow shall be furnished by the Contractor. Sources shall lie wholly outside of and beyond the limits of Agency-controlled lands. Acquire at Contractor's own expense. The provisions of 00160.60 and 00160.80 shall apply.

Materials

00330.10 Selected Materials - When the Contract contains a pay item "Extra for Selected _____ Material", furnish the material from required excavations. The Specifications for the selected materials will be in the Special Provisions, if different than specified in these Specifications. If other provisions of this Section call for selecting or sorting material for various parts of the work, select and sort the materials to meet the directed requirements.

00330.11 Selected Topsoil - Furnish topsoil selected for use according to 00330.10 meeting the requirements of 01040.14.

00330.12 Borrow Material - Furnish borrow materials for general embankment construction with soil that is free of unsuitable materials or other characteristics detrimental to the construction of firm, dense and sound embankments. Furnish borrow materials for other uses meeting the specified requirements for the use intended.

00330.13 Selected General Backfill - Soil, selected as directed from specified excavations, and containing no particle with any dimension greater than 3 inches, or other unsuitable material.

00330.14 Selected Granular Backfill - Durable sand, gravel or combinations of these, selected as directed from specified excavations, and containing no particle with any dimension greater than 3 inches or other unsuitable material. Reclaimed glass meeting the requirements of Section 02695 may be substituted for selected granular backfill.

00330.15 Selected Stone Backfill - A combination of durable sand, gravel and cobbles, selected as directed from specified excavations, which contains no particle with any dimension greater than 6 inches, and no unsuitable material. Reclaimed glass meeting the requirements of Section 02695 may be substituted for selected stone backfill.

00330.16 Stone Embankment Material:

(a) Requirements - An unweathered, hard, angular, durable, free draining material, visibly well graded from coarse to fine with the maximum size between 15 inches and 3 inches. Rock fragments larger than 15 inches but not larger than 36 inches may be included if placed as directed in 00330.42(c-2).

If the 1" - 0 portion exceeds 10~~%~~ percent of the total volume by the Engineer's visual examination, the 1" - 0 material will be randomly sampled for testing. The wet sieve test,

according to AASHTO T 11, will be performed on the sampled material. The amount of material passing the No. 200 sieve shall not exceed 5.0~~%~~ percent by weight.

(b) Control Sample - Provide, at a location acceptable to the Engineer, in close proximity to the Project, at least a 5 cubic yards sample of stone embankment meeting the gradation specified. This sample will be used as a frequent reference for judging the gradation of the material supplied.

(c) Sampling and Testing Assistance - If the Engineer visibly determines the material furnished justifies sampling and testing, dump and check the gradation of two random loads of stone embankment material. Provide a sorting site, mechanical equipment and labor to assist in checking gradation at no additional cost to the Agency.

00330.17 Quality Control - Provide quality control according to Section 00165.

Equipment

00330.20 Tamping Foot Rollers - If specified, use tamping-foot rollers with a weight of at least ~~115~~15 tons, with each tamping-foot protruding from the drum at least 4 inches.

00330.21 Vibratory Rollers - If specified, use vibratory rollers having a smooth drum, exerting a dynamic force of at least 30,000 pounds per impact and operating at a frequency of at least 1,000 vibrations per minute. Limit roller speed to no more than 1 1/2 mph.

Labor

00330.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT and CDT technical certifications.

~~• CEBT~~
~~• CDT~~

Construction

00330.40 General:

(a) Quantities - Quantities and locations of earthwork materials indicated on the plans are approximate only. Make sure there is enough suitable material available to complete embankments and other required fillings before disposing of any excavated materials. Make up any shortage of materials caused by premature disposal at no additional cost to the Agency.

The Agency makes no guarantee or representation by implication or otherwise, that any material available on the Project site is suitable for incorporation into any portion of the Project. No material will be considered unsuitable on the sole basis that special or additional processing or handling is required to make it suitable for incorporation into the Project.

(b) Preservation of Existing Surfacings - In addition to the cautions in Section 00150 and Section 00170, protect existing surfacings of all types which are to remain in place from being damaged or fouled with undesirable material. Repair or replace damaged or fouled surfaces as directed at no additional cost to the Agency.

(c) Avoidance and Correction of Detrimental Operations - Perform all operations involved in excavating, hauling and placing of earthwork materials so no damage or detriment to the completed or partially completed work results. At all times provide sufficient drainage of completed or partially completed earthwork to prevent damage or loss due to rainfall, surface

water or any other cause. In all cases, take proper precautions to ensure that embankment construction and filling does not move, endanger or cause undue strain or stress to any structure or adjacent ground. Temporary and final embankment slopes within any cross section shall not be constructed steeper than the slope staked for that cross section.

Recondition or remove unstable materials resulting from improper operations, inadequate drainage or over watering, and restore or replace with stable material at no additional cost to the Agency.

00330.41 Excavations - Perform excavation of earthwork as indicated on the plans, as directed and according to the following:

(a) General:

(1) Selection and Sorting of Excavated Materials - All materials available from excavations, including borrow materials, are subject to selection and separate handling for their best utilization in various parts of the work. Select the types of materials to be used according to 00330.42, 00330.44, 00330.45, 00330.47, the Special Provisions, and as directed. Select and sort excavated materials, as necessary, to meet Contract requirements.

(2) Selected Topsoil - Stockpile and place selected topsoil according to 01040.43.

(3) Unsuitable Materials - Unsuitable materials encountered in required excavations shall be classed as waste material and disposed of according to 00330.41(a-5).

(4) Excess Materials - If the quantities of excavated materials are greater than required to construct embankments and to do all filling and backfilling, the remaining materials shall be classed as waste materials and be disposed of according to 00330.41(a-5).

(5) Waste Materials - ~~Waste materials under 00330.41(a-3) and 00330.41(a-4) become the property of the Contractor at the point of origin.~~ Unless otherwise specifically allowed and subject to the requirements of 00280.~~03~~05, dispose of materials, classed as waste materials in 00330.41(a-3) and 00330.41(a-4), outside and beyond the limits of the Project and Agency controlled property according to 00290.20~~(c).~~. Do not dispose of ~~any~~ materials on ~~any wetland~~wetlands, either public or private~~,~~ or within 300 feet of ~~any river~~rivers or ~~stream~~streams.

(6) Excavation of Existing Surfaces - Unless otherwise specified, earthwork includes excavating, hauling and depositing of existing surfacings which are within the limits of the excavation work.

If an abutting roadway or structure, or part of a roadway or structure, is to be left in place, make cuts according to 00310.41(a).

(7) Abandoned Pipes and Miscellaneous Matter - Remove and dispose of abandoned pipes and miscellaneous matter encountered in the work as a part of the earthwork, unless otherwise specified.

Remove ends of remaining abandoned pipe or portions of other miscellaneous matter remaining exposed in slopes or at subgrade after excavation work to at least 2 feet back of the finished slope or below subgrade.

Place a watertight cap or plug in the inlet ends of remaining abandoned pipes. Leave outlet ends open. Place free draining cover material and/or take other measures as directed to

allow for free passage of drainage at remaining outlet ends. Shape and finish the affected area so no evidence of their existence is apparent upon completion of the work.

(8) Ditches, Channel Changes, Approaches, Connection, Etc. - Perform excavations to construct ditches, channel changes, approach roadways, road connections, and other items, as required.

(9) Excavation Below Grade:

a. Rock - If directed, excavate rock found in roadbed excavation to a depth of 12 inches below subgrade or as directed. Backfill to subgrade elevation with selected granular backfill material as directed.

b. Selected Material - Where the plans indicate the placement of a selected material below subgrade in excavation areas, excavate to the depth necessary to place the material to its specified compacted thickness.

c. Unstable Subgrade Material - Where unstable material is encountered below subgrade in roadbed excavations, excavate such material below subgrade as directed. Dispose of these unstable materials according to 00330.41(a-5). Backfill with selected general backfill, or selected granular backfill material to provide a firm roadbed as directed. A geotextile may be required before backfilling.

(10) Protection of Excavation Side Slopes - Use methods in making roadbed excavations that will not shatter or loosen excavation slopes, avoid overbreaks, and leave slopes accurately and smoothly trimmed. As far as practical, excavate materials without previous loosening and in limited layers or thickness to avoid breaking the material back of the established slope line. Overbreak is Incidental to the work except in cases where the Engineer determines that such overbreak was unavoidable.

After the main excavation in rock or rocky cuts is completed, thoroughly test the slopes with bars or by other approved means and remove all loose, detached, broken, or otherwise unstable material. Remove jutting points and bring the entire cut slope area to a safe, trim, neat and stable condition. Dispose of the materials removed under this provision in the same manner as other excavated material. Remove all exposed roots, debris and all stones more than 3 inches in size which are loose or could become loosened.

(11) Rounding of Cutbanks - As part of the earthwork, blend the tops of cutbanks with the adjacent ground by rounding as called for by the plans. Rounding will not be required when rock requiring blasting to excavate extends to the top of cutbanks, and makes rounding impractical.

(12) Outside Earthwork Limits - Outside earthwork limits but within the clear zone, (see 00320.02(c)), remove partially buried natural objects, such as boulders, which the Engineer determines would be dangerous to an errant vehicle. Place them within embankments as specified or dispose of them as directed.

(b) Foundation Excavation - Excavate unsuitable materials in embankment foundations and elsewhere as designated. This work will be classed as "Foundation Excavation". Dispose of these materials according to 00330.41(a-5) and replace with selected general backfill, selected granular backfill or other suitable materials as directed.

(c) Toe Trench Excavation - Excavate trenches at the toe of slopes that are to be protected with stone embankment, riprap or other protective material, as shown or directed, to provide a

suitable foundation. Maintain the toe trenches until the geotextile or filter blanket, if any, and stone embankment, riprap or other protective materials are placed.

(d) Borrow Excavation - Whenever the Specifications or Contract plans call for an Agency furnished borrow source for earthwork materials, the material excavated from such source and used in the work as earthwork materials will be classed as "Borrow Excavation". Excavate and use these materials according to the Contract provisions, or as directed.

(e) Blasting - Avoid the use of explosives as far as practical. If blasting is necessary and is not included in the Contact Schedule of Items, perform blasting according to following:

(1) General - Use blasting methods that do not shatter or loosen backslopes, that produces smooth and uniform excavation slopes at the specified slope angles, and satisfactorily loosens the rock for excavation. Do not use tunnel blasting methods.

(2) Methods - Follow the requirements of 00335.40(b) through 00335.40(h) and 00335.43.

00330.42 Embankment, Fills, and Backfills - Consider the nature, characteristics, and qualities of the materials to be selected before performing embankment, fill, and backfill work. Select and use excavated materials in various parts of the work according to 00330.41(a). Use all materials originating from required excavations, as far as practical, in the formation of embankments and subgrade, and for bedding, backfilling and other purposes shown on the plans, as directed, and according to the following:

(a) Embankment Foundation Preparation - In addition to the excavation and replacement of unsuitable materials as provided in 00330.41(b), and before constructing embankments, prepare the areas on which embankments are to be constructed as follows:

(1) Unstable Areas - Where the embankment foundation will not support hauling or compaction equipment and only if directed, place an initial layer of selected materials. Place the initial layer by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the equipment and not greater than 3 feet, unless otherwise authorized. Do not place the initial layer higher than 3 feet below subgrade. Commence consolidation of the initial layer by routing construction equipment uniformly over the entire layer. The initial layer shall meet the compaction requirements of 00330.43 except for layer thickness. Subsequent layers shall meet all requirements of 00330.43.

(2) Ends of Abandoned Pipe - Place a watertight cap or plug in the inlet ends of remaining abandoned pipes. Place a screen over the outlet ends of remaining abandoned pipes, and if directed, place free draining cover material and/or take other measures as directed to allow for free passage of drainage.

(3) Drainage - Provide drainage and drainage structures as called for by the plans or as directed.

(4) Backfilling Inside Roadbed Limits - Break up concrete or asphalt floors, slabs, or walls, as specified in 00310.41(d), before backfilling or placing embankment. Backfill basements, trenches and holes within embankment limits with selected stone backfill material. Backfill material placed in basements may include pieces of broken concrete and masonry not exceeding 15 inches in any dimension provided they are placed and compacted according to 00330.42(c). The broken concrete and masonry shall not have protruding reinforcement.

(5) Existing Surfacings - Scarify and break up existing surfacings according to 00310.41(d) before placing embankment material.

(6) Roughen Ground Surface - Break up, roughen or scarify the ground surface if the slope is 1V:5H, or less, to positively bond embankment materials with the existing ground with benching allowed as a supplement.

(7) Foundation Benching - If existing ground surfaces or existing embankment surfaces are steeper than 1V:5H, bench the existing ground or embankment.

Make the bottom bench at least 10 feet wide. Each succeeding bench shall penetrate the slope at least 3 feet horizontally beyond the vertical side of the previous bench, and be wide enough to operate placing and compaction equipment. Each bench and embankment layer surface shall be brought to a slope flatter than 1V:10H. The benching, placing and compaction operation shall be performed simultaneously from the bottom up.

Place and compact the bench excavation material combined with new embankment material in layers to the thickness and compaction required in 00330.43.

(8) Compact Existing Ground - After roughening the existing ground surface and/or benching, compact the top 1 foot of existing ground and embankment in place to the density specified and with compaction equipment specified, according to 00330.43.

(b) Excess Moisture - Do not place material in final position in embankments or as backfill until excess moisture has been removed to within minus 4~~%~~ percent to plus 2~~%~~ percent of optimum moisture as required in 00330.43. Remove excess moisture by manipulation, aeration, drainage, rehandling or other means, at no additional cost to the Agency.

(c) Embankment Construction:

(1) General - Except as provided in 00330.42(a-1), do not construct embankments or fillings when the embankment material, the foundation or the embankment on which it would be placed is frozen, not stable or not compacted, unless otherwise directed.

Make roadbed embankment slopes as smooth, safe, and sightly as practical with the materials used to construct the embankments.

Route hauling equipment over the full width of embankments. Traveling over the same areas repeatedly will not be allowed unless approved by the Engineer as unavoidable.

Place embankments and all fillings in nearly horizontal layers not more than 8 inches thick, except as provided in 00330.42(c-2). Compact each layer separately and to the density required in 00330.43.

Place slope berms, if required, according to 00280.

(2) Rock in Embankment Construction:

a. General - Retrieve cobbles and boulders that fall or roll outside embankment limits and place them within embankments as specified, or dispose of them as directed.

b. Limited Quantities of Rock - If embankment materials contain up to 50~~%~~ percent rock, sort the materials until they can either be placed in 8 inches layers, or meet the requirements of and be placed according to 00330.42(c-2-c).

c. Oversize Durable Rock Fragments - Placing isolated individual durable rock fragments having dimensions greater than the specified layer thickness will be allowed if:

- Clearance between adjacent fragments provides adequate space for placement and compaction equipment between rock fragments to place materials in horizontal layers as specified and for compaction according to 00330.43.
- No part of the fragment comes within 36 inches of subgrade.

d. Durable Rock - If embankment materials contain more than 50~~%~~ percent durable rock, distribute and manipulate the rock so that the voids between the larger pieces are filled with smaller pieces forming a dense and compact mass. Durable rock is defined in 00110.20. In the absence of two cycle slake durability test results, the rock durability will be visually evaluated.

When such embankments cannot be placed in 8 inches horizontal layers, place the embankment in nearly horizontal layers of the thickness directed, but not more than 15 inches.

If the visible quantity of silt and clay materials passing the No. 200 screen is less than 20~~%~~ percent by volume, as determined by the Engineer, the maximum rock fragment size and layer thickness may be increased to 36 inches, but the layer thickness shall not exceed the average maximum size of the rock fragments.

e. Nondurable Rock - In the absence of two cycle slake durability test results, the Engineer will visually evaluate if the rock is potentially degradable. If embankment materials contain more than 50~~%~~ percent nondurable rock, as defined in 00110.20, process the material as follows:

- Pulverize nondurable rock to 12" - 0 size and place in nearly horizontal layers not more than 12 inches thick.
- Water to promote slaking and breakdown of the nondurable material according to Section 00340.
- The moisture content of the material at the time of compaction shall be within the requirements of 00330.43.
- Compact the material to density/deflection requirements specified in 00330.43 with a tamping-foot roller that meets the requirements of 00330.20. Each embankment layer shall receive a minimum of three coverages with the tamping-foot roller. Operate the roller at a uniform speed not exceeding 3 mph. No additional compensation will be made for additional roller coverages to meet the requirements of 00330.43.

(3) Embankment Slope Protection - Construct outer portions of embankments exposed to erosion by stream flow or other erosive action with rock fragments, or other desirable materials, if directed, and such are available in the excavations. Also, if directed, place similar material as a protective layer on the outside of the regular embankment slopes as embankment widening. Placement shall closely follow construction of the embankment when directed. Protective materials placed as embankment widening need not be compacted but shall present a reasonably smooth surface, resistant to washout or slippage.

(4) Embankments for Approaches, Connections, ~~Etc.~~Etcetera - Construct embankments as required and as directed to provide a complete Project. Construct according to 00330.42(c) and 00330.42(d).

(5) Embankment Construction Around Minor Structures - Backfill prior excavations in the vicinity of curbs, walks, driveways, inlets, manholes and other such minor structures with selected general backfill, or selected granular backfill material as directed with no particles larger than 1 inch and that is compatible with the adjacent material, unless otherwise

specified. The material shall have a moisture content as specified in 00330.43, be placed in layers according to 00330.42(c-1), and compacted according to 00330.43.

(6) Embankment Construction at Pipes - Before installing any pipes with 72 inch or smaller, inside nominal diameter that will protrude above the existing ground surface:

- Provide temporary drainage at no additional cost to the Agency, unless provided for in Section 00240.
- Construct specification embankments at least five pipe diameters each direction from the pipe centerline and to a height equal to the following:
  - 12 inches minimum above the outside top of pipe elevation.
  - A higher height if called for on the plans or directed.
- Then trench, bed, and install the pipe, and backfill around all pipes according to 00445.45.

(7) Embankment Construction at Bridge Ends - At the ends of bridges and for a distance of at least 100 feet from the bridge, place and compact the embankments before beginning bridge construction, unless otherwise directed. Unless the embankment is constructed according to 00330.42(c-8), provide and place selected stone backfill material, meeting the requirements of 00330.15 when such is available from excavations, in all embankments within 100 feet of bridges, or as directed.

(8) Engineered Fills - In areas designated on the plans as "Engineered Fills", place selected stone backfill material in maximum 8 inch lifts from the existing ground up to the base of granular structure backfill. Compact to 95~~%~~ percent maximum density according to 00330.43.

If the existing ground line is within the limits of the granular structure backfill, subexcavate the area beneath the footing in order to place the full depth of granular structure backfill shown or specified.

Place the granular structure backfill, meeting the requirements of 00510.13, in maximum 6 inch lifts and compact to 100~~%~~ percent maximum density from the top of the selected stone backfill to the footing elevation shown. The thickness and extent of these materials shall be according to the details shown or as directed.

The foundation compaction requirements in 00330.43 shall be subject to the higher requirements of this provision. Compact according to the percentages required above.

(d) Stone Embankment - If the Contract plans or Specifications require embankments, or parts of embankments, to be constructed of stone embankment material, furnish and place the stone embankment material according to this provision and as directed. Furnish materials from Contractor provided sources which conform to the requirements of 00330.16, unless otherwise specified.

Construct these embankments according to the other provisions of 00330.42, unless otherwise specified or directed, and as follows:

- Material placed in the upper 1 foot of embankments or within 1 foot of a culvert or other structure, shall not be more than 3 inches in size.
- If placement in water is allowed, construct the first layer of embankment to an elevation 2 feet above water. Continue thereafter as specified or directed.
- Some rock fragments larger than 15 inches, but not larger than 36 inches may be placed provided they are placed and compacted according to 00330.42(c-2-c).

00330.43 Earthwork Compaction Requirements:

(a) General - Compact natural ground, embankment foundations, foundations for structures, each layer of embankment, fills, and backfills, the upper 1 foot of roadbeds in cuts and other earthwork which is to support any part of the roadbed prism according to this subsection.

Unless otherwise specified, compact in place the entire surface of each layer of all specified materials with a minimum of three coverages, using equipment made specifically for compaction. Select compaction equipment based on the type of material being compacted and the layer thickness. Normal compaction equipment consists of sheeps-foot rollers, tamping-foot rollers, grid rollers, pneumatic-tired rollers, and vibratory rollers. Routing of hauling and grading equipment will not be accepted as adequate to achieve compaction, except as provided in 00330.42(a-1).

In the immediate vicinity of minor structures as provided in 00330.42(c-5), in holes, around and under isolated individual rock fragments, and elsewhere where embankment and filling materials can or cannot be reached by normal compaction equipment, compact with machine-operated pneumatic or mechanical tampers, or by hand methods if allowed, as required to ensure intimate contact between the backfill material and the structure or fragment and provide thorough compaction.

(b) Moisture-Density Testable Materials:

(1) Test in-place materials for compaction according to the MFTP.

(2) In-place materials shall meet the following moisture content, density, and deflection requirements, each of which has equal weight and each of which shall be satisfied:

a. Moisture Content - Moisture content at the time of compacting the materials shall be prepared to within minus 4~~%~~ percent to plus 2~~%~~ percent of optimum moisture content. Material which does not contain sufficient moisture to obtain proper compaction shall be wetted and thoroughly mixed as directed. Material containing an excess of moisture shall be dried by manipulation, aeration, drainage or other means before being compacted.

b. Density - After compaction of each layer the density shall be at least:

- 95~~%~~ percent of maximum density in roadbed cuts, to a depth of 1 foot below established subgrade elevation.
- 95~~%~~ percent of maximum density in embankments, fills, backfills, and specified portions of existing ground.

c. Deflection Requirement - In addition to moisture-density testing, conduct at least one deflection test according to ODOT TM 158 for each 3 feet, or portion of 3 feet, of embankment placed. If the layer being tested exhibits any yielding, deflection, reaction or pumping, rework the area to provide acceptable test results prior to placement of any additional material.

Conduct deflection tests, witnessed by the Engineer, on the finish grade of all subgrades. During placement of subbase~~ or~~, base aggregates, or ~~HMAC~~ACP, if deflection is observed, remove the ~~HMAC~~ACP, base, and subbase aggregates and correct the deflecting areas at no additional cost to the Agency.

Provide a signed test report to the Engineer at the end of each shift after completing the required testing. At no additional cost to the Agency, remove and replace embankment constructed thicker than 3 feet that was not deflection tested.

(c) Non-Moisture-Density Testable Materials - When material is not moisture-density testable because rock fragments in the material prevent moisture-density testing, place and compact the material as follows:

- Place non-moisture density testable material in nearly horizontal layers with thickness not exceeding 12 inches.
- Water or aerate the material to ensure each layer can be compacted to form a dense mass, free of pumping.
- Compact each layer uniformly with a minimum of four full coverages using a smooth drum vibratory roller.
- Conduct at least one deflection test according to ODOT TM 158 for each layer of embankment placed. If the layer being tested exhibits any yielding, deflection, reaction or pumping, rework the area to provide acceptable test results prior to placement of any additional material.

(d) Small, Irregular Fill Areas - The density requirements of 00330.43 do not apply to irregular fill areas that have a total volume of no more than 150 cubic yards outside of the travel lanes. Construct these areas according to the following:

- Place embankment material in nearly horizontal layers with thickness not exceeding 8 inches.
- Water or aerate the material to ensure each layer does not deflect under the action of the roller used for compaction.
- Compact each layer using a roller appropriate to the material being placed and as directed. Use a smooth drum vibratory roller for sands and gravels; use a sheepsfoot or tamping foot roller for silts and clays. The Engineer will determine the classification of the embankment soil
- Compact each layer uniformly with a minimum of five full coverages of the specified roller.
- In areas not accessible to rollers, use compaction equipment suitable for the area and compact each layer with sufficient coverages to produce a firm unyielding surface.

00330.44 Buttress, Inlay, or Shear Key - Remove the designated materials and construct the buttress, inlay or shear key as follows:

(a) Preparation - Do not start excavation for each segment until a stockpile of stone embankment material is immediately available at or near the site. Locate the stockpile at a site approved by the Engineer. The size of the stockpile shall be sufficient to fill one excavated segment.

(b) Sequence of Construction - Excavate the area according to 00330.40 and 00330.41 to provide a backslope to the lines, slopes and details indicated on the plans or as directed. Excavate and backfill in segments to minimize aggravating stability conditions. Each segment shall not exceed 75 feet in length as measured across the top of each open excavation segment, unless otherwise specified or directed.

(c) Unsuitable Materials - Sort and dispose of unsuitable materials as waste material according to 00330.41(a-5).

(d) Foundation - Excavate to a depth of at least 5 feet into firm, stable, undisturbed materials as shown on the plans or as directed. Remove soft or loose materials. The Engineer will verify sufficient excavation into firm, stable, undisturbed materials in each segment before allowing the backfill. Where called for in the plans or as directed, place riprap geotextile against the excavated backslope. Remove water from the excavation before placing stone embankment material.

(e) Drainage - Provide drainage as shown or as directed.

(f) Placement of Stone Embankment - After excavation of each segment according to 00330.44(b) and 00330.44(d), place the stone embankment material to fill the excavated segment before excavating the next segment. Backfill all segments on the same day they are excavated. Place and manipulate the stone embankment material in the buttress, inlay or shear key to provide a dense and well-filled mass to the lines, slopes and cross-sections indicated on the plans or as directed.

00330.45 Filling of Holes - Backfill holes outside the limits of required excavation or embankment construction that result from grubbing and removal work, basements, trenches and other such holes as directed. Smooth and shape to blend with the surrounding area. If the basis of performance is the excavation basis, no separate payment for this work will be made. If the basis of performance is the embankment basis, payment for this work will be made according to 00330.94.

00330.46 Watering of Materials - Water materials as directed to provide compaction and required density to embankments and backfills and to alleviate dust nuisance according to Section 00340.

00330.47 Specified Selected Courses or Layers of Materials - In addition to the requirements of 00330.42, select, sort, and place courses or layers of materials if included in the Contract Schedule of Items. Select and sort the materials obtained from required excavations and place in locations and thicknesses specified or as directed.

Place and construct selected courses or layers to conform to the requirements of 00330.42 and 00330.43, unless otherwise specified.

The work covered by this provision may include, but is not limited to:

- Selected Embankment Material
- Selected Subgrade Material
- Selected Stone Embankment Material
- Selected Topsoil

00330.49 Construction Slide Removal and Repair - Remove construction slide materials and repair construction slide damages to the work according to Specifications, or as directed, and as follows:

(a) Definition - For the purposes of this provision:

(1) Slide - A slide is a lateral movement of earth materials.

(2) Construction Slide - A slide outside the designated limits of excavations, or below the foundation within designed limits of embankments or within embankments, which occur after excavation or embankment construction starts and before final acceptance of the Contract.

(3) Slide Materials - Materials displaced as the result of a slide.

(b) Remove Construction Slide Materials - Within the limits of established or reestablished lines, grades and slopes, do the following:

- Excavate and remove construction slide materials.
- Sort and dispose of unsuitable materials.
- Use excavated slide materials, to the extent practical, in embankments, fills, backfills, widenings, and for flattening slopes within the Project limits.
- Dispose of excess material according to 00330.41(a-4~~)~~).

(c) Construction Slide Repair - Reconstruct or restore subgrade and slopes to the established or reestablished lines, grades and slopes. Reconstruct or repair damaged structures or facilities within construction slide areas.

(d) Responsibility For Construction Slide Removal and Repair:

(1) Contractor Responsibility - Perform construction slide removal and repair work at no additional cost to the Agency when caused by any of the following:

- Embankment foundation conditions or pre-existing subsurface conditions that were reasonably anticipated in the Contract.
- Contractor's method and manner of operations.
- Contractor's failure to perform or to protect the work according to plans and Specifications.

(2) Agency Responsibility - Slide removal and repair work will be paid for according to 00330.90 when all of the following apply:

- Caused by embankment foundation conditions or pre-existing subsurface conditions that were not reasonably anticipated in the Contract.
- Not caused by Contractor's method and manner of operation.
- Not caused by Contractor's failure to perform or to protect the work according to plans and Specifications.

Finishing and Cleaning Up

00330.70 General - Immediately before completing the earthwork:

- Blend the tops of cutbanks with the adjacent terrain.
- Trim and finish all roadbeds, ditches, waterway channels, and other excavations and embankments to the lines, grades, and cross sections established.
- Clean up debris and foreign matter of all kinds on the entire right-of-way area. Dispose of materials as directed.
- Finish the subgrade to be within a tolerance of plus or minus 3/4 inch and to be free of ruts, depressions and irregularities.
- In planting and seeding areas, remove all rocks, boulders, and vegetative matter.
- Remove all litter, debris and obstructions.

~~**00330.71 Daily Progress Reports** - For projects that have more then 2,500 cubic yards of embankment material, regardless of the basis of performance, (excavation or embankment), provide daily progress reports documenting the quantities of materials placed and a summary of~~

~~tests performed. Use report forms approved by the Agency. Submit the reports to the Engineer at least weekly.~~

Measurement

00330.80 Measurement - The quantities of earthwork will be measured ~~as follows~~according to one or more of the following:

- Volume basis, based on the Agency's digital terrain model (DTM) calculated by Triangular Volume, Average End Area Volume, or by other methods of equivalent accuracy.
- Volume basis, computed by the average end area method from cross section measurements, or by other methods of equivalent accuracy. When ~~the Special Provisions so state~~specified, corrections for curvature will be made.
- ~~Volume basis, of materials handled and placed in the work as required and as directed.~~

Measurement will only be for those items listed in 00330.93 and 00330.94 that are actually included as an item in the Contract Schedule of Items.

Structure excavation will be measured according to 00510.80(b).

Materials subexcavated from beneath footings as required by 00330.42(c-8) will be measured according to 00510.80(b).

Granular structure backfill will be measured according to 00510.80(d).

Watering of materials required by 00330.46 will be measured according to 00340.80.

00330.81 Excavation Basis Measurement - When measurement of earthwork is on the excavation basis, the materials will be measured in their original positions before excavation. Measurement will be limited to the lines, grades, and slopes as established.

The quantities of excavation measured for payment will include the volumes of:

- Abandoned pipe and miscellaneous matter within excavation limits.
- Materials removed below subgrade in roadbed excavations according to 00330.41(a-9) and 00330.91(d).
- Overbreak determined to be unavoidable according to 00330.41(a-10).

The following earthwork items will be measured on the excavation basis:

- Borrow Excavation
- Ditch Excavation
- Foundation Excavation
- General Excavation
- Toe Trench Excavation

Embankments required or necessary to perform earthwork on the excavation basis will not be measured separately.

00330.82 Embankment Basis Measurement - When measurement of earthwork is on the embankment basis, the materials will be measured in their final embankment position. Measurement will be limited to the lines, grades, and slopes of the original ground contours ~~after~~

~~clearing and grubbing and compaction is performed according to 00330.43(a)~~established before ~~embankment construction~~the Contractor begins any Work on the Project.

The quantities of embankment measured for payment will include the volumes of materials used to backfill excavations below subgrade and holes when shown or directed.

The quantities of embankment measured for payment will not include the volumes of:

- Any additional quantities required due to subsidence, settlement of the ground or base, settlement within embankments, or to shrinkage, settlement, washout, slippage, or loss regardless of cause, subject to 00170.80 or 00170.82.
- Any additional quantities required due to compaction efforts that are required in 00330.43.
- Any additional quantities required due to clearing and grubbing operations.
- Slide materials paid for ~~as Extra Work~~according to 00195.20.
- Any materials for which payment is made for completed embankments or backfills under other Contract provisions.

The following earthwork items will be measured on the embankment basis:

- Embankment In Place
- Stone Embankment
- Extra For Selected _____ Material

Excavations, including cutbank rounding, overbreak whether avoidable or not, and foundation benching, required or necessary to perform earthwork on the embankment basis, and retrieval or removal of cobbles and boulders according to 00330.42(c-2-a) will not be measured separately.

When an excavation basis item is included in the Contract Schedule of Items and selected materials are obtained from the excavation for use as "Extra for Selected _____ Material", measurement will be made for both items.

Payment

00330.90 Payment - The accepted quantities of earthwork performed under this Section will be paid for at the Contract unit price, per unit of measurement, for each item that appears in the Contract Schedule of Items.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Structure excavation will be paid for according to 00510.90(b).

Materials subexcavated from beneath footings as required by 00330.42(c-8) will be paid for according to 00510.90(b).

Granular structure backfill will be paid for according to 00510.90(d).

Watering of materials required by 00330.46 will be paid for according to 00340.90.

Slide removal and repair work determined under 00330.49(d-2) to be Agency responsibility will be paid for ~~as Extra Work under Section 00196~~according to 00195.20.

No separate or additional payment will be made for work that is required to be done under these Specifications that does not appear as a separately listed item in the Contract Schedule of Items.

No separate or additional payment will be made for blasting done according 00330.41(e) unless a blasting item is listed in the Contract Schedule of Items.

00330.91 Kinds of Pay Excavation - The kinds of pay excavation on the Project will be indicated by the items listed in the Contract Schedule of Items and are defined as follows:

(a) Ditch Excavation:

- Limited to the lines, grades, and cross sections shown or established with bottom widths of 8 feet and less that lie outside of and separate from roadbed cross sections.
- Includes canals, channels, and inlet, outlet, diversion, drain, and other open ditches to carry water.

(b) Foundation Excavation:

- Limited to the lines, grades, and cross sections shown or established.
- To remove soft materials for preparation and stabilization of areas below embankments.

(c) Toe Trench Excavation:

- At the toe of riprap slopes as shown and elsewhere as directed to provide a suitable foundation toe trench on which to place riprap geotextile or filter blanket, and riprap material.

(d) General Excavation:

- Other than ditch, trench, structure, foundation, toe trench, and borrow excavation.
- Includes cut ditches, borrow ditches, and roadside ditches in the roadway section as staked or established, or shown as being a part of the typical roadway cross sections.
- Includes other ditches with bottom widths greater than 8 feet.
- Includes unsuitable material excavated below subgrade in roadbed excavations according to 00330.41(a-9), when determined that such excavation is neither more nor less difficult to remove than the material above subgrade in the whole of the cut. When determined that such excavation is either more or less difficult to remove than the material above subgrade in the whole of the cut, payment will be according to ~~Section 00196~~00195.20.

(e) Borrow Excavation:

- Obtained from specifically designated and authorized sources lying outside of, separated from, independent of, and beyond the roadway cross sections, unless otherwise directed.

00330.92 Kinds of Incidental Earthwork - No separate or additional payment will be made for the following:

- Removal of overburden from pits and quarries.
- Excavation of rock and other material for use in surfacings or structures.
- Excavation for haul roads.
- Other excavation (borrow excavation excepted) which is not directly a part of the finished work.

- Blend tops of cutbanks with adjacent ground according to 00330.41(a-11).
- ~~If shown on the plans.~~
- Overbreak, except on excavation basis earthwork and the Engineer determines that overbreak was unavoidable.
- Foundation benching performed according to 00330.42(a-7).
- Rock excavated below the excavation plane established by 00330.41(a-9) and the specified backfill required to fill up to the excavation plane, to the satisfaction of the Engineer.
- Smooth and maintain foundations, roadbeds, and haul roads.
- Material handled, removed, placed, or used contrary to Specifications or directions.
- Rehandling and reshaping of materials previously excavated, except where called for in the Specifications, Plans, or Contract change orders.
- Excavation for forms to construct curbs, gutters, walks and other similar structures unless specified.
- The volume of any free water or liquid.
- Hauling, moving, or transporting earthwork materials.
- Removal of excess moisture according to 00330.42(b).
- Retrieval or removal of cobbles and boulders according to 00330.42(c-2-a).
- Constructing outer portions of embankment with suitable material for slope stabilization.
- Additional quantities of materials required due to clearing and grubbing operations and compaction requirements within embankment limits.

00330.93 Excavation Basis Payment - When listed in the Contract Schedule of Items, the following items will be paid for on the excavation basis:

	Pay Item	Unit of Measurement
(a)	Ditch Excavation	Cubic Yard
(b)	Foundation Excavation	Cubic Yard
(c)	Toe Trench Excavation	Cubic Yard
(d)	General Excavation	Cubic Yard
(e)	Borrow Excavation	Cubic Yard

These items include excavating, selecting, handling, hauling, placing, and compacting the materials as specified.

00330.94 Embankment Basis Payment - When listed in the Contract Schedule of Items, the following items will be paid for on the embankment basis:

	Pay Item	Unit of Measurement
(a)	Embankment In Place	Cubic Yard
(b)	Stone Embankment	Cubic Yard
(c)	Extra For Selected _____ Material	Cubic Yard

Item (a) includes excavating, selecting, handling, hauling, placing, and compacting of the materials as specified and all other costs incurred in furnishing required embankment materials.

Item (b) includes furnishing, selecting, handling, hauling, placing, and compacting the material as specified.

In item (c), the type of material will be inserted in the blank.

Item (c) includes preserving, sorting, stockpiling, and handling of the specified selected materials as described in 00330.41(a-1) and 00330.41(a-2), selected and placed according to 00330.42, 00330.47, and the Special Provisions.

Unless a specific pay item in the form of item (c) appears in the Contract Schedule of Items, no separate or additional payment will be made for preserving, sorting and handling selected materials. However, earthwork materials obtained from excavations and incorporated into specified embankments will be paid for at the applicable item, if listed in the Contract Schedule of Items.

Excavation of unstable material that is below subgrade in roadbed excavation areas, according to 00330.41(a-9), will be paid for according to 00195.20.

Section 00331 - Subgrade Stabilization

Description

00331.00 Scope - This work consists of excavating and disposing of unstable materials in excavation areas only and placing subgrade ~~geotextiles~~geosynthetic, stone embankment, and aggregate backfill to the lines and grades as shown or directed.

Materials

00331.10 Materials - Furnish materials meeting the following requirements:

Aggregate Base 02630
Aggregate Subbase..... 00641.10(b)
Stone Embankment.....00330.16
Subgrade Geotextile, Certification Level B.....02320
Subgrade Reinforced Geogrid, Certification Level B.....02320
Water.....00340

00331.16 Acceptance of Backfill - The backfill material will be accepted based on visual inspection. The Engineer may perform tests if deemed necessary.

Equipment

00331.20 General - Provide all equipment necessary to perform the work according to Sections 00330, 00340, 00350, and 00641.

Construction

00331.40 Excavation - Excavate unstable material to the lines and grades as shown or directed. Dispose of the excavated material according to 00330.41(a-5).

00331.41 Geosynthetic:

(a) Geotextile - Place geotextile as shown.

(b) Subgrade Reinforcement Geogrid:

(1) Placement - Prepare the surface receiving geogrid to a smooth, uncompacted condition to the depth shown and as follows:

- Orient the geogrid rolls parallel to the roadway centerline.
- Unroll the geogrid in the same direction as aggregate base placement. If the geogrid shifts or becomes misaligned, realign it and anchor it according to the manufacturer's recommendations.

(2) Overlaps - Overlap the geogrid a minimum of 24 inches. Overlap the geogrid in the same direction as aggregate base placement with the preceding layer lapped on top of the following layer.

(3) Protection of Geogrid - Drive rubber tired equipment on the geogrid at no more than 5 mph. Drive tracked equipment on the geogrid only after placing a minimum of 6 inches of aggregate base on top of the geogrid. Do not turn or make sudden stops or starts on the geogrid or the aggregate base.

During installation cover the geogrid with the aggregate base as soon as possible. Do not leave uncovered for more than 5 calendar days.

(4) Repair - Repair or replace damaged or torn geogrid according to manufacturer's recommendations at no cost to the Agency.

00331.42 Backfill - Place the backfill material to lines and grades as shown or directed, to provide a homogeneous mixture. Compact the backfill until there is no reaction or yielding under the compactor.

Measurement

00331.80 Measurement - The quantities of subgrade stabilization will be measured on the area basis of subgrade surface area stabilized to the full depth as shown. The surface area will be determined by horizontal measurements. In areas where directed to stabilize to a depth other than shown, the areas will be adjusted by converting to an equivalent number of square yards on a proportionate volume basis.

Payment

00331.90 Payment - The accepted quantities of subgrade stabilization will be paid for at the Contract unit price, per square yard, for the item "_____ inch Subgrade Stabilization".

The depth of stabilization will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavation, ~~geotextile~~geosynthetic, stone embankment or aggregate backfill material, or water.

Section 00335 - Blasting Methods and Protection of Excavation Backslopes

Description

00335.00 Scope - This work consists of excavating in rock using controlled blasting methods to achieve smooth, uniform and unfractured backslopes, and produce a free surface or shear plane in the rock along the specified excavation backslope, and production blasting to facilitate excavation.

00335.01 Definitions:

Buffer Row - In multiple row blasts in which perimeter control blasting techniques are used, the first row of production holes immediately adjacent to and drilled along a plane parallel to the perimeter control blast line. The buffer row is located between the production holes and the perimeter controlled blast line.

Perimeter Controlled Blasting - The use of explosives and blasting accessories in carefully spaced and aligned drill holes. Perimeter controlled blasting techniques include presplitting and trim (cushion) blasting.

Presplitting - A perimeter control blasting method in which the perimeter row of blast holes are drilled along the plane of the specified final excavation backslope and which utilizes reduced drill hole spacing and reduced diameter explosives decoupled from the drill hole wall, and whose initiation precedes the initiation of the adjacent production holes by a minimum of 25 milliseconds.

Production Blasting - Fragmentation blasting in the main excavation area, usually using more widely spaced drill holes than controlled blast holes

Trim (Cushion) Blasting - A perimeter control blasting method in which the initiation of the perimeter row of blast holes drilled along the plane of the specified final excavation backslope follows the initiation of the adjacent production holes within 25 to 75 milliseconds, if production holes are being employed in the blast.

Materials

00335.10 Materials - Furnish all explosives and blasting caps that are no more than ~~one~~ 1 year old. Each blasting cap period shall come from one lot number.

Construction

00335.40 Blasting Methods:

(a) General - Use methods in making excavations that do not shatter or loosen the backslopes and that produce smooth and uniform excavation slopes at the specified slope angles. These include:

- **Perimeter Controlled Blasting** - Use on the entire length of cut section in rock or cemented materials which have backslopes of 1V:0.75H or steeper, even if the main excavation can be ripped.

- **Production Blasting** - Blasting in the mass of rock to be excavated shall be designed to control flyrock, minimize ground vibration and air blast, and result in loosened and fragmented in-place rock of a size that can be removed, transported, or crushed to produce specified products. Lay out production blast holes in a consistent pattern that does not affect the perimeter control blast holes. Where production blast holes are made adjacent to highways with specified closure restrictions, the volume of material blasted shall not

exceed the Contractor's ability to remove the blasted material from the adjacent highway within the specified closure time.

(b) Safety and Flyrock Control - Use techniques that effectively limit and control flyrock. Clear the site of all boulders or other material as directed prior to beginning blasting work. Following every blast, observe the entire blast area for a minimum of ~~five~~ 5 minutes before reentering or commencing work in the area.

Be responsible for the storage, transportation, and handling of explosives, their use, and the results of all blasting operations according to 00170.94.

Cover all blast areas that are within 200 feet of residences, facilities or above ground utilities using appropriate blast containment mats or an approved equivalent method.

Discontinue blasting operations, as directed, if it is apparent that the methods employed are not producing acceptable results or the safety of the public, the Contractor's employees or adjacent property is being jeopardized.

(c) Preblast Survey - Offer, in writing, to perform a preblast survey for owners and occupants of all buildings, structures, and utilities within the distance of the blast specified in 00335.40(~~d~~e). If the offer is accepted, use an Agency approved survey form, signed and completed by an independent third party, and submitted to the Engineer and Contractor at least 72 hours before blasting begins. Deliver a copy of the survey form and copies of any photos taken to the owners and occupants.

~~**(d) Blasting Notification** - Notify all owners and occupants of buildings, structures, and utilities that are within the following distances of the blasting areas:~~

- ~~300 feet for shots using less than 50 pounds of explosives per time delay of 15 milliseconds.~~
- ~~600 feet for shots using between 50 and 250 pounds of explosives per time delay of 15 milliseconds.~~
- ~~1,250 feet for shots using more than 250 pounds of explosives per time delay of 15 milliseconds.~~

~~Provide notification, in writing, once, at least 48 hours before blasting begins, and again on the day the blasting operations occurrence.~~

(~~e~~(d) Blasting Plan - Provide a separate blasting plan for each cut that requires blasting, prepared by a person qualified and experienced in blasting work. Each plan shall cover individual major rock cut areas or rock production from a material source. Similar minor rock cut areas of less than 50 cubic yards, as well as utility and culvert trenches, may be covered as a group in one generalized blasting plan.

Submit the blasting plans for the Engineer's review at least ~~seven~~7 calendar days before beginning drilling and blasting work for excavations of 3,000 cubic yards or smaller, and 14 calendar days for drilling and blasting work requiring any perimeter controlled blasting and or excavations of more than 3,000 cubic yards.

The blasting plans will be reviewed for conformance with the Specifications and any concerns will be discussed with the Contractor. Submit any proposed changes to the blasting plans in writing to the Engineer for review before implementation. Submittal of blasting plans is for quality control and record keeping purposes.

Review of blasting plans by the Engineer does not relieve the Contractor of full responsibility for the accuracy and adequacy of the plans and the resulting safety when implemented in the field.

Each blasting plan shall contain the full details of the drilling and blasting patterns, vibration, flyrock, and noise reduction methods, blast area security measures and traffic control that the Contractor proposes to use, and the following information:

- Station limits of proposed shot.
- Removal of overburden.
- Plan and cross section diagrams of proposed drill pattern for controlled and production blast holes including buffer rows, free face, burden, blast hole spacing, blast hole diameters, blast hole angles, lift height and sub drill depth. Accurately draw to scale and show each cut area to be blasted.
- Loading diagram showing the type, amount and specific gravity of explosives, primers, and initiators, and location depth, and type of stemming.
- Initiation sequence of production and controlled blast holes including delay times and delay system.
- Manufacturer's product data sheets for all explosives, primers and initiators to be used in the work.

(e) Blasting Notification - Notify all owners and occupants of buildings, structures, and utilities that are within the following distances of the blasting areas:

- 300 feet for shots using less than 50 pounds of explosives per time delay of 15 milliseconds.
- 600 feet for shots using between 50 and 250 pounds of explosives per time delay of 15 milliseconds.
- 1,250 feet for shots using more than 250 pounds of explosives per time delay of 15 milliseconds.

Provide notification, in writing, once, at least 48 hours before blasting begins, and again on the day the blasting operations occurrence

Do not begin detonation of the blast until the Agency representative is ready to videotape the blast, or until the Engineer is prepared to witness the blast.

(f) Blasting Test Sections - Demonstrate the adequacy of each proposed blasting plan by means of test shots in each cut or excavation before beginning full scale blasting. Do not proceed with remaining drilling and blasting until acceptable test blast results have been demonstrated to the satisfaction of the Engineer.

In areas where perimeter controlled blasting techniques are being employed, drill and blast short representative test sections not exceeding 100 feet in length. Excavate a section not less than 20 feet wide exposing the full height of the lift for examination. In areas where no perimeter controlled blasting techniques are being employed, determine effectiveness of the test section based on the material placement, cut slope stability, fragmentation and control of ground vibration, air blast and fly rock.

Do not drill ahead of the test blast area, except as provided in 00335.41(a-6), until the test section has been evaluated. The Contractor may be directed to use test section lengths less than 100 feet.

If the results of the test shots are unacceptable revise the methods, techniques and procedures, at no additional cost to the Agency, so that the results achieved will be acceptable. No further drilling and blasting will be allowed until the revised methods are reviewed according to 00335.40(~~e~~d) and verified by additional test shots.

If, during the progress of the work, the methods of drilling and blasting do not produce acceptable results within the tolerances specified, drill, blast and excavate additional test sections until a technique is determined that will produce acceptable results.

(g) Blasting According to Plan - After the Engineer has reviewed the blasting plan and determined that test sections have demonstrated acceptable results, perform all perimeter controlled and production blasting according to the plan that produced acceptable results. Notify the Engineer when any changes in conditions or results are observed. On the day of each blasting occurrence and before detonation of the blast, the supervisor or blasting specialist in charge shall certify, in writing, that the shots being carried out are consistent with the reviewed blasting plan.

(h) Blasting Report - Submit a blasting report detailing the blast outcome within 48 hours of making each blast. Include in the report the following:

- Drill logs, drilling remarks, loading, and timing variables used in the blast.
- All blast monitoring documentation.
- A comment section that includes the Contractor's evaluation of the blast performance.
- All damage incurred and details of all neighbor's complaints or comments.

00335.41 Controlled Blasting Methods:

(a) Presplitting:

(1) Attach mechanical devices to all drilling equipment used to drill the presplit holes to determine, within an accuracy of 1°, the angle at which the drill steel enters the rock.

(2) Do not drill presplit holes more than 3 inches in diameter.

(3) Start presplit drill holes along the presplit line within 3 inches of the dimensions shown on the blasting plan. Holes located beyond this tolerance will be rejected. Completely fill the rejected holes with stemming material at no additional cost to the Agency. Drill new presplit holes with the proper spacing. Rejected holes will not be measured for payment.

(4) Control the drilling operations to ensure that presplit hole alignment does not vary from the plane of the planned slope by more than 9 inches either parallel or normal to the slope. Presplit holes exceeding these limits will not be paid for unless, in the Engineer's opinion, satisfactory slopes are being obtained.

(5) The length of presplit holes for any individual lift shall not exceed 30 feet unless the Contractor can demonstrate to the Engineer's satisfaction that hole alignment can be maintained within the above tolerances. Upon satisfactory demonstration, and with written permission of the Engineer, the length of holes may be increased to a maximum of 60 feet. If more than 5~~%~~ percent of the presplit holes are misaligned in any one lift, reduce the height of the lifts until the 9 inch alignment tolerance is met.

(6) Drill presplit holes a minimum of 30 feet longitudinally beyond the limits of the production holes to be detonated or to the end of the cut. Unless otherwise allowed by the Engineer in

writing, remove all overburden, including any loose or decomposed rock, before drilling the presplitting holes.

(7) When the cut height will require more than one lift, a maximum offset of 18 inches between lifts will be allowed to allow for drill equipment clearance. Adjust the slope angle of lower lifts to compensate for drill offsets and any drift which may have occurred in upper lifts.

(8) Use only explosives manufactured specifically made for presplitting in the presplit holes. The maximum diameter of explosives used in presplit holes shall not be greater than half the diameter of the presplit hole. Bulk ammonium nitrate and fuel oil (ANFO) will not be allowed in the presplit holes.

(9) Determine that the presplit hole is free of obstructions for its entire depth before placing charges. Exercise all necessary precautions so the placing of the charges will not cause caving of material from the walls of the holes.

(10) Detonation of explosives in each hole in a presplit shot may be delayed, providing the hole-to-hole delay is no more than 25 milliseconds.

(b) Trim (Cushion) Blasting - When the horizontal distance from the new proposed slope face to the existing rock face is less than 15 feet, the Contractor may trim blast instead of presplitting. The requirements in 00335.41(a) for presplitting also apply to trim blasting, by changing the words presplit and presplitting to trim blasting. If trim blasting burdens are less than 6 feet or zones of weakness in the rock are observed, submit a hole loading diagram that reflects the site conditions.

(c) Buffer Row - Locate the buffer hole line a minimum of 3 feet away from the perimeter control blast line, or 1 foot for every inch of buffer hole diameter, whichever is greater. Space buffer row holes 3 to 5 feet center to center. The explosive load in buffer holes shall not exceed 50~~%~~ percent of the full explosive load that could be placed in a 3 inch production hole. Initiation of the buffer holes shall be on a delayed sequence toward a free face.

00335.42 Production Blasting - Do not drill any row of production blast holes closer than 6 feet to the perimeter controlled blast line. Where necessary to minimize damage to the rock backslope, a row of buffer holes may be drilled between the perimeter controlled blast line and the production blast holes. Except for the bottom lift, do not extend production holes below the bottom of the controlled blast holes. Do not exceed 6 inch diameter for production holes. Detonate production holes on a delay sequence documented in the blasting plan.

00335.43 Scaling - Remove all loose, hanging, or potentially dangerous rock on the excavated surface by scaling during the completion of the excavation of each lift. Do not begin drilling the next lift until this work has been completed, as directed.

Scale the slopes throughout the Contract at the frequency required to remove loose or overhanging material.

Use a suitable standard steel mine scaling rod to hand scale the slopes. Other methods such as machine scaling, hydraulic splitters or light blasting may be used instead of, or to supplement, hand scaling, if allowed.

Measurement

00335.80 Measurement - The quantities of perimeter controlled blast holes will be measured on the length basis and will be determined by dividing the cut slope surface area by the perimeter

controlled blast hole spacing. The cut slope surface area will be determined by cross section measurement from the top of the blasted rock to the finished ditch bottom elevation.

The quantities shown in the Contract Schedule of Items have been computed from a theoretical plan length using 30 inch hole spacing. The actual quantities will depend on field conditions and results from blasting test sections.

Payment

00335.90 Payment - The accepted quantities of perimeter controlled blast holes will be paid for at the Contract unit price, per foot, for the item "Perimeter Controlled Blast Holes".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for blasting, scaling, or loosening materials for excavation.

When the Contract Schedule of Items does not indicate payment for work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00340 - Watering

Description

00340.00 Scope - This work consists of furnishing and applying water or combinations of water and additives for:

- Compacting and preparing roadbed excavations, roadbed embankments, backfills, subgrades, subbases, bases and surfacings.
- Preventing or alleviating dust nuisance originating within the highway right-of-way and the Project limits, which is not caused by Contractor operations at the Contractor's plants or plant setups.
- Other watering when ordered~~, except for Extra Work~~.

00340.01 Definitions:

Additives - Emulsified asphalt, magnesium chloride or other materials added to water for the purpose of aggregate binder or dust control.

00340.02 Exclusions - Watering which is specified as Incidental and included in payment for other items or parts of work is excluded from measurement under this Section.

Materials

00340.10 Water - Furnish water free of silts and other matter harmful to the quality of the material to which it is applied or with which it is mixed.

Comply with Chapter 537 of the "Oregon Water Laws", which is administered by the Water Resources Department, covering the appropriation of water.

Most adjudicated water may be limited to agricultural uses, so it should not be assumed that there will be any water sources in the immediate area of the Project available for the Contractor's use.

00340.11 Water Mixtures:

(a) Use of Additives - When called for by the Special Provisions, or ordered, perform watering with a mixture of water and additives. Use an additive from the QPL and mix according to the manufacturer's recommendations.

(b) Magnesium Chloride - When required, furnish Magnesium Chloride ($MgCl_2$) in brine solution at 28 ~~%~~ to 35~~%~~ percent concentration by weight.

Equipment

00340.20 Watering Equipment - Perform uniform and controlled application of watering by one or more of the following methods:

- Tank trucks equipped with spray bars
- Hose and nozzle
- Wetting materials in stockpile or in excavation areas before excavating
- Other means, as directed

The use of splash boards will not be allowed without prior approval. When required, provide a metering device for water measurement.

Construction

00340.40 Watering:

(a) General - Make all necessary arrangements to obtain water and pay all costs involved in its procurement. Maintain an adequate supply of water at all times.

Perform watering only when and where directed at an approved rate and manner of application. Water at any hour of the day, and on any day of the week, as directed, for proper performance or protection of the work and for alleviation of dust nuisance.

(b) Use of Additives - If an additive is combined with water in the watering work, mix it in the proportions and manner specified, and use in the work as directed.

Maintenance

00340.60 Avoidance of Detrimental Operations - Avoid wasting water or watering detrimental to other work. Cease such operations until corrective measures are directed.

Measurement

00340.80 Measurement - The quantities of water will be determined by the following methods:

- Weight or volume, or both
- In tanks or tank trucks of predetermined capacity
- By approved meters

Measurement will be M-gallons (1,000 gallons = 1 M-gallon) not including the additives used in the watering as specified or ordered. For conversion purposes, water weighs 8.34 pounds per gallon or 62.4 pounds per cubic foot. Only quantities acceptably used in the work, as specified, will be measured.

Quantities of additives combined with water for watering purposes will be determined separately from the water and will be measured on the volume basis in gallons.

Payment

00340.90 Payment - The accepted quantities of water and additives will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Watering	M-Gallon
(b)	_____ in Watering	Gallon

Item (a) includes furnishing and developing the water supply, hauling and applying the water.

In item (b), the name of the additive will be inserted in the blank.

Item (b) includes furnishing the specified additive, for combining and mixing it with the water, and for all extra costs involved in the use of the additive in the watering work not included in item (a).

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for obtaining permits, water rights, or any other costs related to complying with the "Oregon Water Laws".

When the Contract Schedule of Items does not indicate payment for work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

00340.91 Quantity Variations - Payment for watering items performed beyond 25~~%~~ percent of the quantity shown in the Contract Schedule of Items will be made at the Contract unit price if the Engineer determines that the Contract unit price does not exceed the value of the work ~~as determined on the basis of rates given in~~according to Section 00197. If the Engineer determines that the Contract unit price exceeds the value of the work, payment for the additional work will be made according to ~~Section 00196~~00195.20.

Section 00344 - Treated Subgrade

Description

00344.00 Scope - This work consists of treating the upper layer of subgrade with water and either lime, chloride, or portland cement to form a stabilized course of material at the locations and to the lines, grades, thicknesses, and cross section shown or directed.

00344.01 Definitions:

Treated Subgrade - Subgrade which is improved by the addition of soil stabilizing materials.

Materials

00344.10 Soil Stabilizing Materials - Furnish soil stabilizing materials meeting the following requirements:

Material	Type	~~Grade~~Requirements
Hydrated Lime	AASHTO M 216, Type 1	Grade A
Granular Quicklime (~~CAO~~CaO)	AASHTO T 27 and AASHTO T 219	100% passing 3/8" sieve ~~for 3/8"~~ (grading and hydroxide ~~sieve; max. 15%~~ content~~, with minimum 85%~~) 15% max. passing No. 100 sieve min. 85% Calcium Hydroxide
Calcium Chloride	AASHTO M 144~~,~~ (sampling ~~–~~) ~~–~~ AASHTO ~~T143,~~ T 143 (testing)	
Sodium Chloride	AASHTO M 143	–
Portland Cement	AASHTO M 85	~~Conform to Portland Cement in~~ Section ~~2010~~02010

Store materials according to 00165.75.

00344.11 Water - Furnish water meeting the requirements of Section 00340.

Construction

00344.40 Preparation - Before starting subgrade work, including backfill, complete all underground work contemplated in the area of the subgrade. This requirement includes work by the Contractor, by the owner or by others. Drain all depressions or ruts which contain water.

00344.41 Addition of Stabilizing Material - Apply stabilizing materials at a uniform rate as specified using equipment and methods that will ensure uniformity of distribution. The use of blade graders to distribute lime will not be allowed. Allow only equipment that is used for watering, applying and mixing the stabilizing material to pass over the material until after it is mixed into the soil. Add water, if necessary, during mixing operations to provide optimum moisture content.

00344.42 Mixing - Perform mixing operations until the treated subgrade material is uniform and free of streaks or pockets and all material, other than stones, will pass a 1 inch sieve. Do not allow the content of stabilizing material to vary by more than plus or minus 1~~%~~ percent from the amount specified.

00344.43 Finishing - Immediately after mixing the treated subgrade, grade the mixture to specified line, grade and cross section and compact the mixture to the specified density. Compact and finish within 12 hours after compaction begins. If the Contractor has not compacted and finished the material within 12 hours, loosen the mixture and add stabilizing material and water as directed. Remix the freshened material, regrade and recompact, at no additional cost to the Agency. During compaction, maintain the mixture at proper grade and cross section and at optimum moisture content.

00344.44 Curing - Limit traffic over treated subgrade to equipment which do not cause any damage to the subgrade and which do not visibly deflect, ravel or wear the surface. Keep the finished surface moist and protect from rutting, spalling, displacement and disfiguration for a period of ~~seven~~7 days, or until a subsequent course of material is placed which will prevent drying of the mixture by evaporation or absorption.

00344.45 Compaction:

(a) Achieve the required density of treated subgrade materials as specified in 00330.43(b).

(b) Compact the subgrade until it is firm and unyielding. Unyielding means no more than 1/4 inch deflection of the subgrade when proof-rolled with a fully loaded 10 to 12 cubic yard dump truck. Test and proof-roll within 24 hours prior to placing base material on the subgrade.

(c) Over-excavate areas of visible deflection to a depth of 12 inches or more below subgrade, as directed. Place fabric, backfill the over-excavated subbase area up to the subgrade elevation with a single lift of 1 1/2" - 0 crushed rock and compact. Apply the compactive effort until the density of the top 6 inches of the subbase rock is as specified in 00641.44(a). In addition, proof-roll these areas to verify they are firm and unyielding as specified above.

(d) Notify the Engineer if the specified compaction is not attained. The Contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications cannot be compacted to the required density regardless of compactive effort or method, the engineer may reduce the required density or direct that alternative material be used. Do not proceed with finishing or compaction of the subgrade until the Contractor is able to compact the material to the satisfaction of the Engineer.

00344.46 Tolerances:

(a) Rework areas found to be deficient in thickness by more than 1/2 inch, and add fresh stabilizing material in an amount equal to one-half the original amount.

(b) Finish the surface of the treated subgrade so that it does not vary by more than 1/2 inch from the established grade and cross section at any point. When tested with a 12 foot straightedge, the maximum variation of the finished surface from the testing edge is 1/2 inch.

Measurement

00344.80 Measurement - The quantities of treated subgrade will be measured on the area basis, measured along the lines and grades of the area actually treated.

The quantities of soil stabilizing materials will be measured on the dry weight basis. Packaged materials will be accepted at the net weight shown by the manufacturer, subject to periodic verification and approval. Provide a certificate with each shipment together with a certified copy of the weight of each delivery. Measurement of stabilizing material will not include any which is lost, displaced, used in reworking, used in restoration work or used contrary to direction.

Payment

00344.90 Payment - The accepted quantities of treated subgrade and soil stabilizing materials will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Treated subgrade, ___ inches Thick	Square Yard
(b) Lime	Ton
(c) Portland Cement	Ton
(d) Calcium Chloride	Ton
(e) Sodium Chloride	Ton

In item (a), the depth of the treated subgrade will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- draining water from the subgrade
- soil stabilization work
- smoothing the subgrade in preparation for staking
- blading, shaping and compacting the subgrade, including roadbed materials, to final line, grade and cross section

Section 00350 - Geosynthetic Installation

Description

00350.00 Scope - This work consists of furnishing and placing geotextile in drains, under embankments, for embankment reinforcement, under riprap, buttresses, inlays, shear keys, over roadbed subgrades, and beneath pavement overlays as shown or directed.

00350.01 Definitions - Terms not defined in this subsection may be found in ASTM D 123 and ASTM D 4439. If there is a conflict, definitions in this subsection take precedence.

Cross-Machine Direction - The direction in the plane of the fabric perpendicular to the direction of manufacture.

Drainage Geotextile - For installation as a filter in subsurface drains or other drainage locations.

Embankment Geotextile - For installation as a reinforcement within embankments and/or as a separator under embankments.

Geosynthetics - A planar product manufactured from polymeric material used with soil, rock, earth or other geotechnical, engineering related material as an integral part of a man-made product, structure or system.

Geogrid - A geosynthetic used for reinforcement which is formed by a regular network of tensile elements with apertures of sufficient size to allow strike-through of surrounding soil, rock or other geotechnical material.

Geotextile - A permeable geosynthetic comprised solely of textiles.

- **Nonwoven Geotextile** - A textile produced by bonding and/or interlocking of fibers by mechanical, heat or chemical means.

- **Woven Geotextile** - A textile comprising of two or more sets of filaments or yarns interlaced in such a way that they result in a uniform pattern.

Machine Direction - The direction in the plane of the fabric parallel to the direction of manufacture.

Pavement Overlay Geotextile - For installation as a reinforcement beneath an asphalt concrete overlay.

Riprap Geotextile - For installation as a filter and/or separator behind or beneath riprap, buttresses, inlays, shear keys and/or erosion control applications.

Roll - Unit of continuous geosynthetic without transverse seams as furnished by the manufacturer. Roll sizes may vary between manufacturer's and types of geosynthetics.

Roll Values:

- **Average Roll Value** - The average roll value for each property is determined by testing a representative number of samples in a roll according to the test methods specified in Section 02320. An average of these tests becomes the average roll value for each roll tested.

- **Minimum Average Roll Value** - The minimum average roll value for each property is the mean of the average roll values for all rolls tested minus two standard deviations, all as determined by the manufacturer. The minimum average roll value for each property is determined by testing a representative number of rolls in a production run according to ASTM D 4354 sampling procedures and the test methods specified in Section 02320.

- **Minimum Value** - The minimum value is the specified value for each geosynthetic property that shall be met or exceeded by the manufacturer's minimum average roll value for the production run and, if sampled and tested by the Agency, by the average roll value for any roll.

Seam Allowance - The minimum distance from the edge of a geotextile to the stitch line nearest to that edge.

Seam Type - A designation relating to the essential characteristics of geotextile positioning and rows of stitching in a specified sewn seam as shown on the plans.

Selvage - The finished edge of a geotextile parallel to the machine direction.

Stitch Type - A designation relating to the essential characteristics of the interlacing of sewn ~~thread(s)~~threads in a specified seam as shown on the plans.

Subgrade Geotextile - For installation as a separator and/or reinforcement on subgrades and in other material separation applications.

Ultraviolet ~~(UV)~~ Rays - Direct radiation from the sun during daylight hours, even on cloudy days.

Ultraviolet Stability - The ability of a geosynthetic to resist deterioration when exposed to UV radiation.

Materials

00350.10 Materials - Furnish materials meeting the requirements of Section 02320.

Equipment

00350.20 Field Seam Stitching Equipment - Use field seam stitching equipment that provides an acceptable lock-type stitch as recommended by the geotextile manufacturer and approved by the Engineer.

00350.21 Asphalt Distributor - Design, equip, maintain, and operate the asphalt distributor according to 00730.22.

Construction

00350.40 General - Provide geosynthetic as furnished by the manufacturer and protect against damage and deterioration. Prevent excessive mud, wet concrete, epoxy and like materials from coming in contact with the geosynthetic. Store all geosynthetics in a dry place and off the ground at all times according to ASTM D 4873. Cover all geosynthetics with a dark protective covering when received. The geosynthetic will be rejected for use if the Engineer determines it has defects or deterioration, or has been damaged.

00350.41 Geotextile Installation Requirements:

(a) General:

(1) Placement:

a. Surface Preparation - Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle in any way.

Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.

b. On Slopes - Place the geotextile with the machine direction oriented up-down the slope. Lap the upper sheets over the lower sheets. When the geotextile is placed on a slope steeper than 6V:1H, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent the slippage and tearing of the geotextile. Start placement of fill material on the geotextile at the toe of the slope and proceed upwards.

c. Where Exposed To Water - If geotextiles are placed under water or in areas where water will flow, the geotextile may be placed with the machine direction parallel to the direction of water flow instead of the placement direction specified in 00350.41(a-1-b). Overlap sheets so the upstream sheet is placed over the top of the downstream sheet. Adequately secure the geotextile to prevent slippage. As the geotextile is placed under water, place the backfill material on it to the required thickness. Do not place geotextile more than 50 feet ahead of the specified cover material.

(2) Overlaps - Minimum overlap requirements for geotextiles are:

Application	Minimum Overlap Requirements (Inch)
Drains	12
Embankment Stabilization	24
Pavement Overlays	*
Riprap and Rock Buttresses	24
Roadbed Subgrade Stabilization	24

* Use sufficient overlap to ensure closure, but not more than 6 inches.

If the Engineer determines the specified overlap is not sufficient, increase the overlap to provide adequate coverage or, if approved by the Engineer, sew the geotextile together in the field. If field sewn, the provisions of 00350.20 and 00350.41(a-3) apply.

(3) Field Seams:

a. General - When field sewn seams are required, make them as follows:

Sew field seams with polymeric thread consisting of polypropylene, polyester or kevlar, and as resistant to deterioration as the geotextile being sewn. Use a color of thread that contrasts with the geotextile being sewn so the stitches are exposed for inspection when the geotextile is placed. Seams shall meet the testing requirements of 02320.11(b).

b. Stitch Requirements - Use two rows of lock-type stitching, Type 401, to make the seams, as shown. The two rows of stitching shall be 1/2 inch apart with a tolerance of plus or minus 1/4 inch and not cross except for restitching.

c. Minimum Seam Allowance - The minimum seam allowance (the minimum distance from the edge of geotextile to the nearest stitching) is:

Seam Type (See Plans)	Minimum Seam Allowance (Inch)
Flat or Prayer Seam, Type SSa-1	1 1/2
"J" Seam, Type SSn-1	1
Butterfly-folded Seam, Type SSd-1	1

d. Seam Type - Obtain the geotextile manufacturer's recommendation for the type of seam and stitch to be used. If the Contractor does not obtain and provide the foregoing technical information use a "J" seam with at least three stitches per 1 inch. The flat, or prayer, seam may be used for repair of damaged in-place geotextile.

(4) Protection of Geotextile - Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff and construction activities.

Traffic or construction equipment will not be allowed directly on the geotextile except as authorized in 00350.41(f-5) or as directed.

During installation cover the geotextile with specified cover material as soon as possible. Do not leave in uncovered condition for more than ~~five~~5 days~~, except when used with temporary, wrap-faced, mechanically stabilized earth walls and asphalt overlays as required in Section 00596 and 0350.41(f), respectively~~.

Place cover material on the geotextile in such a manner that the geotextile is not torn, punctured or shifted. Use a minimum 6 inch thick cover layer or twice the maximum aggregate size, whichever is thicker. Do not end-dump cover material directly on geotextiles other than riprap geotextile.

Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than 3 inches deep or half the layer thickness, whichever is lesser. Do not turn vehicles on the first layer.

(5) Repair of Geotextile - Repair or replace all torn, punctured or contaminated geotextiles during construction at no cost to the Agency. Repair by placing a patch of the specified geotextile over the affected area. Overlap the existing geotextile with the patch according to 00350.41(a-1). Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or Special Provisions, or as directed.

(b) Drainage Geotextile - When used in trenches for drains, place the geotextile in the trench as shown on the plans to loosely conform to the shape of the trench with no wrinkles or folds.

(c) Embankment Geotextile - Construct embankment stabilization according to details shown on the plans. Place the geotextile layers so the geotextile machine direction is transverse to the embankment centerline. Spread the geotextile so all slack and wrinkles are eliminated. Construct embankment in uniform layers according to Section 00330.

(d) Riprap Geotextile - Place geotextile behind and beneath riprap, buttresses, inlays, shear keys and erosion control applications according to the details shown. Demonstrate to the satisfaction of the Engineer that the combination of the rock-fill drop height and the thickness of

any aggregate cushion, when specified or required, is adequate to prevent puncturing or damaging the geotextile when placing the riprap or stone embankment material. If an aggregate cushion is used, place according to 00350.41(a-4). In addition, the following limits apply:

Size of Rock	Maximum Drop Height (Feet)	
	Onto Geotextile Material	Onto an Aggregate Cushion Blanket
Greater than 200 pounds	0	3
200 pounds or less	3	3

After placing the riprap, backfill all voids in the riprap face so the geotextile is completely covered and not visible.

(e) Subgrade Geotextile - For roadbed subgrade separation, prepare the subgrade according to Section 00330.

Correct geotextile failures, as evidenced by soil pumping or roadbed distortion, by removing any covering material in the affected area and placing a geotextile patch on the exposed geotextile according to 00350.41(a-5). Cover the patch with the specified cover material and compact before proceeding.

(f) Pavement Overlay Geotextile:

(1) General - Place geotextile and pavement overlay in four basic steps:

- Surface preparation
- Sealant application
- Geotextile placement
- Overlay placement

(2) Weather Limitations - Do not place sealant and geotextile unless the weather limitations of 00745.40 are met, as appropriate, except the minimum air temperature shall be 50° F for paving grade asphalt sealant placement and 60° F for asphalt emulsion sealant placement.

(3) Surface Preparation - Prepare the pavement surface on which the sealant is to be placed according to 00730.42 and the following:

- Clean and fill cracks exceeding 1/8 inch width with a bituminous crack filler from the QPL.
- Repair minor irregularities or depressions as directed.
- Allow crack filling material to cure before placing geotextile.
- Where the pavement is severely cracked, rutted, deformed or otherwise distressed, place a leveling course as directed instead of extensive surface preparation.

(4) Sealant Application - Use a normal paving grade asphalt. A cationic or anionic emulsion may be used as approved. Do not use cutbacks or emulsions that contain solvents.

Uniformly spray the asphalt sealant at normal application temperature by means of a pressure distributor conforming to 00350.21 on the prepared dry pavement surface. Apply at the rate of 0.20 - 0.30 gallon per square yard, or as recommended by the geotextile manufacturer or as directed.

If using emulsions, increase the application rate 50~~%~~ percent or as directed. Some underlying surfaces may require a higher application rate. Within street intersections, on steep grades or in other zones where vehicle speed changes are commonplace, reduce the normal application rate by 20~~%~~ percent or as directed.

The target width of the sealant application shall be the geotextile width plus 6 inches. Apply the sealant only as far in advance of the geotextile installation as appropriate to ensure a tacky surface at the time of geotextile placement. Place the geotextile the same day as the sealant. Do not allow traffic on the sealant. Clean excess asphalt from the road surface.

(5) Geotextile Placement - Place the geotextile into the sealant using mechanical or manual laydown equipment capable of providing a smooth installation with a minimum amount of wrinkling or folding from the water (break) before placing the geotextile.

Slit wrinkles or folds exceeding 1 inch and lay flat. Shingle-lap not more than 6 inches in the direction of the paving. Broom and/or pneumatic roll to maximize geotextile contact with the pavement surface. Additional hand-placed sealant material may be required at laps as determined.

Limit traffic to necessary construction equipment and emergency vehicles on the geotextile before and during paving unless otherwise directed. Turn the paver and other vehicles gradually. Keep turning to a minimum to avoid geotextile movement and damage. Avoid abrupt starts and stops.

(6) Overlay Placement - Place the overlay the same day the geotextile is placed. Remove sealant that bleeds through the geotextile. Do not windrow asphalt concrete material on the geotextile ahead of the paving machine. Do not use an asphalt concrete material pickup machine.

Measurement

00350.80 Measurement - The quantities of each geosynthetic installation will be measured on the area basis along the lines and grades of the surface area actually covered as shown or as required, except for drainage applications.

The quantities of drainage geotextile will be measured on the area basis, computed by multiplying the length of the trench where geotextile is used by the perimeter of the trench as determined from the neat lines shown, or as directed.

Payment

00350.90 Payment - The accepted quantities for geosynthetics will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Drainage Geotextile, Type ____	Square Yard
(b)	Embankment Geotextile	Square Yard
(c)	Riprap Geotextile, Type ____	Square Yard
(d)	Subgrade Geotextile	Square Yard
(e)	Pavement Overlay Geotextile	Square Yard

In items (a) and (c), the type of geotextile will be inserted in the blank.

Item (e) includes preparation work, sealant, and geotextile.

Payment will be payment in full furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for constructing laps, seams, joints, and patches unless the Engineer orders additional amounts over the minimum. For laps wider than the minimum or specified width, payment will be made for the added lap width at the Contract unit price.

If the Engineer orders geosynthetics with properties more stringent than specified, a price adjustment will be allowed only for the difference in material cost.

Section 00360 - Drainage Blankets

Description

00360.00 Scope - This work consists of furnishing and placing drainage blanket material to the lines, grades and dimensions shown on the plans or as directed.

Materials

00360.10 Sand Drainage Blanket - Furnish sand drainage blanket material meeting the following gradation limits determined by AASHTO T 27 and AASHTO T 11:

Sieve Size	Percent Passing
No. 10	95 - 100
No. 40	50 - 100
No. 60	20 - 40
No. 200	0.0 - 5.0

00360.11 Granular Drainage Blanket - Furnish granular drainage blanket material that is clean, free draining, durable crushed or uncrushed rock, meeting the following gradation limits determined by AASHTO T 27:

Sieve Size	Percent Passing
6"	100
4"	90 - 100
1/2"	60 - 80
No. 10	0 - 10
No. 100	0 - 5

Granular drainage blanket material will be accepted without testing if the Engineer visually determines the material meets the above requirements.

00360.12 Reclaimed Glass - Reclaimed glass meeting the requirements of Section 02695 may be used as a substitute for sand drainage blanket and granular drainage blanket material.

00360.15 Quality Control - Provide quality control according to Section 00165.

Equipment

00360.20 General - Use equipment capable of hauling, spreading and compacting the material to specified density without segregation.

If drainage blanket material is used to drain areas described in 00360.41, hauling with end dump trucks and spreading with bulldozers and other appropriate equipment will be allowed.

Labor

00360.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT, CAgT, and CDT technical certifications.

- ~~CEBT~~
- ~~CAgT~~
- ~~CDT~~

Construction

00360.40 Planned Locations - On prepared excavations or embankments constructed as shown on the plans or as directed, place the drainage blanket as follows:

- Spread and compact to required depth with no layer exceeding 3 feet.
- If a subsurface drain system is installed immediately under or adjacent to the drainage blanket, place the drainage blanket directly against the subsurface drain system.
- Prevent contamination of drainage blanket material.

00360.41 Other Locations - When used to drain an unstable or wet area, excavate or trench the existing low areas as directed for positive drainage before placement of drainage blanket material.

00360.42 Compaction and Density Requirements - Compact the drainage blanket according to 00330.43.

Measurement

00360.80 Measurement - The quantities of sand and granular drainage blanket material will be measured on the volume basis in place and will be limited to the neat lines, grades, and dimensions shown or directed, or on the weight basis.

Payment

00360.90 Payment - The accepted quantities of sand and granular drainage blankets will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Sand Drainage Blanket	Cubic Yard or Ton
(b)	Granular Drainage Blanket	Cubic Yard or Ton

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00370 - Finishing Roadbeds

Description

00370.00 Scope - This work consists of the following:

- **Within Roadbed Cross Section** - Trimming, shaping, and finishing the subgrade, ditches, slopes, and other graded surface areas to the lines, grades, cross sections, and condition specified.

- **Outside Roadbed Cross Section** - Obliterating surfacings by removing existing paved surfaces, and loosening, breaking up, and spreading the existing bases lying outside the new roadbed cross section and blending into the adjacent terrain.

If existing paved surfaces and bases are to be excavated and removed, then performance, measurement, and payment of the work will be according to Section 00330.

Construction

00370.40 Within Roadbed Cross Section - After the roadbed earthwork has been substantially completed, do the following:

(a) Subgrade:

- Remove vegetative growth.
- Excavate unstable subgrade material, and backfill according to 00330.41(a-9).
- Trim and shape the entire subgrade to be free of ruts, depressions and irregularities.
- Compact all fills according to 00330.43.
- Finish the surface to within a tolerance of plus or minus 3/4 inch or as directed.

(b) Ditches:

- Remove all litter, debris and obstructions.
- Trim and shape to neat lines all ditches, channels and canals provided for waterways.

(c) Slopes:

- Remove all exposed roots, debris, and all stones more than 3 inches in size which are loose or could become loosened.
- Make roadbed embankment slopes as smooth, safe and sightly as practical with the materials used to construct the embankments.
- Trim and shape all excavation and embankment side slopes.

(d) Structure Sites:

- Clean out all sewers, culverts, drains, and their appurtenances constructed under the Contract.
- Remove all extraneous matter in the vicinity of bridge ends, culvert ends, inlets, walls, and other areas.
- Trim and shape the cleaned areas.

(e) Disposal of Materials - Dispose of all materials removed in 00370.40(a) through 00370.40(d) according to 00290.20.

00370.41 Outside Roadbed Cross Section - Remove existing paved surfaces, if any, loosen the remaining bases and surfacings by scarifying, plowing, vibrating, rolling and/or other means, to a depth of at least 12 inches, or to solid rock, whichever is the lesser depth.

- Break the loosened materials into fragments having no dimension greater than 3 inches, unless the aggregate in the original material exceeds that size.
- Spread and mix the loosened and broken materials, and blend them into the adjacent terrain as directed.

Maintenance

00370.60 Maintenance - Maintain the finished work in its finished condition until final completion of the Contract work, or until it is covered with a subsequent course of material placed under the Contract.

Measurement

00370.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00370.90 Payment - The accepted work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Finishing Roadbeds	Lump Sum
(b) Obliterating Surfacings	Lump Sum

Item (a) includes trimming, shaping and finishing the subgrade, ditches, and slopes, including areas occupied by approach roads, road connections, interchanges, ramps, frontage roads, multiple lanes, and any other areas on which earthwork is performed under this Contract.

Item (b) includes removing existing paved surfaces, and loosening, breaking up, spreading, and mixing the old bases lying outside the new roadbed cross section and blending into the adjacent terrain.

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Excavation of unstable subgrade material and backfill will be paid for according to 00330.90.

When the Contract Schedule of Items does not indicate payment for the work under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00390 - Riprap Protection

Description

00390.00 Scope - This work consists of furnishing and placing an erosion resistant cover material for protecting slopes and basins at locations shown or as directed.

00390.01 Definitions:

Riprap Geotextile - A geotextile placed between the area prepared for it and the riprap.

Filter Blanket - A layer of graded granular material placed between the area prepared for it and the riprap.

Riprap Backing - An option of using either riprap geotextile or a filter blanket placed between the area prepared for it and the riprap.

Loose Riprap - Specified classes of graded rock placed on prepared slope, riprap geotextile or filter blanket, as specified.

Keyed Riprap - Loose riprap placed on prepared slope, riprap geotextile or filter blanket, as specified, and keyed in place by slapping the surface with a piece of armor plating.

Grouted Riprap - Loose riprap with all or part of the spaces filled with Portland cement mortar.

Riprap Basin - Energy dissipater consisting of loose riprap placed at pipe outlets as specified.

Materials

00390.10 Riprap Geotextile - Furnish riprap geotextile meeting the requirements of Section 02320.

00390.11 Riprap Requirements:

(a) General - Furnish rock for loose riprap meeting the following requirements:

- Meet the test requirements of 00390.11(b).
- Be angular in shape. Thickness of a single rock shall not be less than one-third its length. Rounded rock will not be accepted unless authorized by the Engineer.
- Meet the gradation requirements for the class specified.
- Be free from overburden, spoil, shale and organic material. Non-durable rock, shale or rock with shale seams is not acceptable.

(b) Test Requirements - Furnish the rock meeting the following test requirements:

Material Test	Requirement
Apparent Specific Gravity (AASHTO T 85)	2.50 ~~Min.~~Minimum
% Absorption (AASHTO T 85)	6.0 ~~Max.~~Maximum
Degradation (ODOT TM ~~208A~~208)	
Passing No. 20 Sieve	35.0% ~~Max.~~Maximum
Sediment Height	8~~" Max.~~.0" Maximum
Soundness (AASHTO T 104)	
Average Loss of 2 1/2" - 1 1/2" and	

1 1/2" - 3/4" fraction after 5 alternations	16.0% ~~Max.~~Maximum	

(c) Gradation Requirements - Grade loose riprap by class and weight of rock according to the following:

Class 50	Class 100	Class 200	Class 700	Class 2000	
		Weight of Rock (Pounds)			**Percent (by Weight)**
50 - 30	100 - 60	200 - 140	700 - 500	2000 - 1400	20.0
30 - 15	60 - 25	140 - 80	500 - 200	1400 - 700	30.0
15 - 2	25 - 2	80 - 8	200 - 20	700 - 40	40.0
2 - 0	2 - 0	8 - 0	20 - 0	40 - 0	10.0 - 0

Uniformly grade each load of riprap from the smallest to the largest weight specified. Control of gradation will be by visual inspection.

(1) Control Sample - If directed, provide, at a satisfactory location near the Project, a rock sample of at least 5 tons meeting the gradation for the class specified. This sample will be used as a frequent visual reference for judging the gradation of the riprap supplied.

(2) Sampling and Testing Assistance - Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truck loads of rock. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the Agency.

00390.12 Grouted Riprap - Furnish rock for grouted riprap meeting the requirements of 00390.11, and furnish the Portland cement grout meeting the requirements of 02080.40.

00390.13 Filter Blanket - Furnish filter blanket materials meeting the following requirements according to riprap class:

Riprap Class	Filter Blanket
Class 2000	16 inch layer of Class 50 riprap conforming to 00390.11
Class 700	9 inch layer of 6" - 0 stone embankment meeting the test requirements of 00330.16
Class 200	6 inch layer of 4" - 0 stone embankment meeting the test requirements of 00330.16
Class 100	No filter blanket required
Class 50	No filter blanket required

Construction

00390.40 Preparation - Remove brush, trees, stumps and other organic material from slopes to be protected by riprap and dress to a smooth surface. Remove all unsuitable material to the depth shown or directed and replace with approved material. Compact filled areas as specified in Section 00330.

Provide riprap protection as early as the structure foundation construction permits. Prepare the surfaces to be protected as shown. Maintain the trench slopes, riprap geotextile or filter blanket until the riprap is placed.

00390.41 Riprap Geotextile - If required, install riprap geotextile according to the requirements of Section 00350 and as shown or directed.

00390.42 Filter Blanket Construction - If required, place the filter blanket on the prepared area to the full specified thickness in one operation, using methods which will not cause segregation. The surface of the finished layer shall be reasonably even.

00390.43 Riprap Backing - When allowed in the Special Provisions or indicated on the plans, the Contractor shall have the option of placing either riprap geotextile or a filter blanket behind the riprap. Install the backing according to 00390.41 or 00390.42.

00390.44 Riprap:

(a) General - Unless otherwise directed, place the riprap protection as the embankment is constructed. Its placement shall lag behind embankment construction only as necessary to allow proper embankment construction and prevent mixture of embankment and riprap material.

(b) Loose Riprap - Place riprap on the prepared area:

- With a clam-shell, orange-peel bucket, skip or similar approved device which will contain the riprap material to its final destination. Do not open the bucket until it has been lowered to the slope on which the material is being placed.
- To its full course thickness in one operation.
- According to 00350.~~43,~~41(d), if riprap is placed on geotextile.
- By methods that do not cause segregation of riprap or displace the underlying material.
- To produce a compact riprap protection in which all sizes of material are placed in their proper proportion.
- With some hand placing, or rearranging of individual stones by mechanical equipment, or some other approved means to provide a smooth finished surface.

Where filter material and/or riprap are placed under water, increase their thicknesses as shown or as directed.

(c) Keyed Riprap - After placing loose riprap material according to 00390.44(a) and 00390.44(b), key the riprap into place by slapping the surface with a piece of armor plating (approximately 4 feet x 5 feet in size weighing approximately 5,000 pounds) or other approved means which will produce a nearly smooth surface.

(d) Grouted Riprap - Place loose riprap material according to 00390.44(a) and 00390.44(b). If the depth specified for grouting is more than 12 inches, place the riprap in lifts of 12 inches or less and grout each lift before placing the next lift. Construct and grout the succeeding lifts before the grout in the previous lift has hardened.

Thoroughly moisten the stones and sluice any excess fines to the underside of the riprap before grouting. Deliver the grout to the place of final deposit by any means that will ensure uniformity and prevent segregation of the grout. Spade or rod the grout into the spaces to completely fill the voids in the riprap. Control pressure grouting and do not unseat the stones. Penetration of the grout shall be to the depth shown on the plans. If a rough surface is specified, brush the

stone until 25 ~~%~~ to 50~~%~~ percent of the depth of surface stone is exposed. For a smooth surface, grout the crevices to within 5/8 inch of the surface.

Provide weep holes through the riprap as shown or as directed.

Place and cure grout according to 00440.40(d) and 00440.40(e) except as provided above.

(e) Riprap Basins - Excavate, backfill and construct riprap basins, without a riprap geotextile or filter blanket, at pipe outlets with Class 50 riprap as shown or as directed.

Maintenance

00390.60 General - Maintain the riprap protection until accepted. Replace any material displaced by any cause at no additional cost to the Agency.

Measurement

00390.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Filter Blanket - Filter blanket will be measured on the area basis of the finished surface, limited to the neat lines shown or directed.

(b) Riprap Backing - Riprap backing will be measured on the area basis of the finished geotextile or the filter blanket surface, limited to the neat lines shown or directed.

(c) Riprap - Riprap will be measured on the volume basis in place or on the weight basis.

When measurement of riprap is on the volume basis in place and the Engineer determines that this basis is impractical, the pay volume will be determined by loose measure in the hauling vehicles on the basis that 1.00 cubic yard, vehicle measure, is equivalent to 0.70 cubic yard in place.

(d) Riprap Basins - Riprap basins will be measured on a unit basis of basins constructed.

Payment

00390.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Filter Blanket	Square Yard
(b)	Riprap Backing	Square Yard
(c)	Loose Riprap, Class ___	Cubic Yard or Ton
(d)	Grouted Riprap, Class ___	Cubic Yard or Ton
(e)	Keyed Riprap, Class ___	Cubic Yard or Ton
(f)	Riprap Basins	Each

In items (c), (d), and (e), the class of riprap will be inserted in the blank.

Item (d) includes the grout.

Riprap geotextile will be paid for according to 00350.90, except when it is included in item (b).

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00396 - Shotcrete Slope Stabilization

Description

00396.00 Scope - This work consists of constructing pneumatically applied shotcrete stabilization blankets onto slope surfaces at locations shown or as directed.

00396.01 Definitions, Standards, and Requirements:

Requirements - Design the shotcrete mix and be responsible for the quality of shotcrete used in the work.

Shotcrete - Either dry-mixed or wet-mixed material composed of portland cement, fine and coarse aggregate, water and reinforced with either welded wire fabric or steel fibers.

Standards - Construct shotcrete according to these Specifications and applicable sections of the latest edition of the American Concrete Institute's "Guide to Shotcrete" (ACI 506).

Materials

00396.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement 02510.10
Cement (Type I or II) 02010.10
Chemical Admixtures 02040
Coarse Aggregate 02690.20
Curing Materials 02050.10
Fine Aggregate.....02690.30
Grout 02080.20
PVC Pipe.....~~02410.70~~02415
Water.....02020
Welded Wire Fabric.....02510.40

00396.11 Prepackaged Product - Premixed and prepackaged concrete products, with or without steel fibers, manufactured as a shotcrete product may be used for on-site mixed shotcrete if the materials meet this specification and if approved.

00396.12 Aggregates - Combined fine and coarse aggregates shall meet the following grading requirements as determined by AASHTO T 27:

Sieve Size	Percent Passing (by Weight)
1/2"	100
3/8"	90 - 100
No. 4	70 - 85
No. 8	50 - 70
No. 16	35 - 55
No. 30	20 - 35
No. 50	8 - 20
No. 100	2 - 10

00396.13 Steel Fiber Reinforcement - If steel fiber reinforced shotcrete is required, the steel fibers shall:

- Be between 1/2 inch and 1 1/2 inches long.

- Meet the requirements of ASTM A 820 Type 1, Deformed.
- Have a length to diameter ratio of less than 80.
- Have a minimum tensile strength of 160,000 psi.

Only steel fibers manufactured specifically for use in shotcrete applications will be allowed. The steel fiber content shall not be less than 100 pounds per cubic yard of shotcrete.

00396.14 Acceptance Sampling and Testing:

(a) General - Prepare shotcrete test panels on vertically supported open face molds. The molds shall:

- Have internal dimensions of at least 18 inches x 18 inches x 4 inches.
- Be rigid, nonabsorbent and nonreactive with cement.

Place the shotcrete in the molds utilizing the same shotcrete mix, air and water pressure, and nozzle tip that will be used in the actual placement of shotcrete on production surfaces. Protect the panels for at least 24 hours or until final set has taken place.

(1) Preproduction Testing - Prepare at least two test panels for each mix design for testing. Cure the test panels in a manner similar to the anticipated field conditions. Provide a copy of the mix design and the compressive strength test results to the Engineer at least ~~seven~~ 7 calendar days before starting any production work. Do not begin production shotcrete work until satisfactory test results are obtained.

(2) Production Testing - Prepare, in the presence of the Engineer, at least two test panels daily for each ~~nozzleperson~~nozzle person during shotcrete operations, plus one test panel shot whenever the nozzle equipment is changed during the daily work period. Cure the shotcrete panels under the same conditions as the production shotcrete.

(b) Compressive Strength Tests:

(1) Compressive Test Cores - Obtain 3 inch diameter test cores from the cured shotcrete test panels prepared according to 00396.14(a-1) and 00396.14(a-2). Use a 3 inch inside diameter core bit to obtain cores.

(2) Shotcrete Compressive Strength - The shotcrete cores shall attain 2,500 psi compressive strength at ~~seven~~ 7 calendar days (1,800 psi at ~~three~~ 3 calendar days) as determined by AASHTO T 22. The production testing cores obtained by the Contractor will be tested by the Agency.

(c) Failure Of Shotcrete - If any shotcrete section is deficient in any of the specified criteria, remedy that section as directed at no additional cost to the Agency. The remedies may include, but are not limited to, removal and replacement of the deficient section.

Equipment

00396.20 General - Provide mixing equipment capable of thoroughly mixing the materials in sufficient quantity to maintain uniform and continuous application.

00396.21 Pump System - The pump system that conveys premixed shotcrete ingredients shall deliver a uniform and continuous flow of material, without segregation or loss of the ingredients.

00396.22 Air Compressor - The air compressor shall be capable of providing:

- A supply of clean air adequate for maintaining sufficient nozzle velocity for all parts of the work and for the simultaneous operation of a blow pipe for clearing away rebound.
- A minimum of 250 cubic feet per minute per operating nozzle.

00396.23 Dry-Mix Delivery Equipment - Dry-mix delivery equipment shall be capable of discharging the aggregate-cement mixture into the delivery hose and deliver a continuous stream of uniformly mixed material to the discharge nozzle. Equip the discharge nozzle with a manually operated water injection system (water ring) for directing an even distribution of water through the aggregate-cement mixture. The water valve shall be capable of ready adjustment to vary the quantity of water, and be convenient to the ~~nozzleperson.~~nozzle person. Provide greater water pressure than the operating air pressure at the discharge nozzle to assure that the water is thoroughly mixed with the other materials. Use steady, nonpulsating water pressure. Regularly inspect and replace equipment parts, especially the nozzle liner and water ring, as necessary or directed.

When prepackaged material is used, predampening (also referred to as premoisturizing) equipment shall be used.

00396.24 Wet-Mix Delivery Equipment - Wet-mix delivery equipment shall be capable of discharging the premixed materials into the delivery hose and delivering a continuous stream of uniformly mixed material to the discharge nozzle. Follow the manufacturer's recommendations on the type and size of nozzle to be used, and on cleaning, inspection and maintenance of the equipment.

Labor

00396.30 Qualifications - At least ~~seven~~7 calendar days before beginning shotcrete work, provide written evidence that the on-site supervisor, nozzle operator, and delivery equipment operator have performed satisfactory work in similar capacities elsewhere for a sufficient length of time to be fully qualified to perform their duties.

The on-site supervisor shall have not less than ~~two~~ 2 year's full-time experience as a shotcrete nozzle operator. The nozzle operator and delivery equipment operator shall have served at least ~~one~~ 1 year of full-time apprenticeship on similar applications with the same type of equipment. Before starting shotcrete work, the nozzle operator shall, in the presence of the Engineer, demonstrate their ability to apply shotcrete on a mold for a test panel according to 00396.14. The nozzle operator, before permission is given to place shotcrete in permanent construction, shall make one satisfactory test panel for each mix used during the course of the work.

Construction

00396.40 Surface Preparation - Before applying shotcrete to rock surfaces, remove all loose material and vegetation and clean with air, water jets or other approved means. Remove loose material from soil surfaces with air jets.

Do not place shotcrete on any surface which is frozen, spongy or where there is free water. Dampen the surface before applying shotcrete.

00396.41 Shotcrete Blanket Thickness Control - Control shotcrete blanket thickness by installing noncorrosive pins, nails or other gauging devices normal to the face so that they protrude the required shotcrete thickness outside the face. Place the pins on a maximum 5 foot square pattern. When welded wire fabric reinforcement is used, place at least a 1 inch cover of shotcrete over the wire fabric.

00396.42 Anchor Bars - Clean and blow clear all drilled holes before installing the anchor bars. Fill drilled holes using a grout tube extending to the bottom of the hole.

00396.43 Welded Wire Fabric - Place welded wire fabric as shown or directed. Overlap sheets at least 8 inches and secure with tie wire.

00396.44 Weep Holes - Do not drill holes larger than 3 inches in diameter. Install the drain pipe before applying shotcrete. Extend the end of the pipe 1 inch to 3 inches outside the slope. Protect pipe ends during shotcreting and clean weep holes after shotcrete is placed.

00396.45 Batching and Mixing Shotcrete:

(a) Dry-Mix Process - Batch cement/aggregate mix by weight or volume. Predampen the dry-mix after it flows out of the packaging but before it flows into the main hopper in order to ensure that the premix will flow at a uniform rate. Do not use predampened cement/aggregate mix in the work if it is allowed to stand more than 45 minutes.

(b) Wet-Mix Process - Batch and mix wet-mix shotcrete according to ASTM C 94.

00396.46 Batching and Mixing Steel Fibers - Determine the procedure for adding steel fibers to the shotcrete. Obtain Engineer's approval. Demonstrate the procedure in the field for approval before production operation begins. If fibers are added at the nozzle, uniformly distribute the fibers throughout the mortar matrix without isolated concentrations. If fibers are added to the dry or wet mix process, use a screen having a mesh of 1 1/2 inch to 2 1/2 inches to prevent any fiber balls from entering the shotcrete line, unless it is demonstrated that fiber balls are not being formed without a screen. Do not add fibers to the dry or wet mix at a rate faster than can be blended with the other ingredients without forming balls or clumps. Bulk fibers that have a tendency to tangle together shall pass through a vibrating screen or be sifted into the mix so they enter it as individual elements and not as clumps.

00396.47 Shotcrete Application - Apply shotcrete from the lower portion of the area to the top so rebound does not accumulate on the portion of the surface that still has to be covered. Hold the nozzle at a distance and at an angle approximately perpendicular to the working face so rebound material will be minimal and compaction will be maximized. Shotcrete shall emerge from the nozzle in a uniform and continuous flow. When, for any reason, the flow becomes intermittent, divert the nozzle from the work until uniform and continuous flow resumes. A ~~nozzleperson's~~nozzle person's helper, equipped with an air blowout jet, shall attend the ~~nozzleperson~~nozzle person at all times during the placement of shotcrete to keep the working area free from rebound.

Do not work rebound material into the finished product. Rebound is defined as the shotcrete constituents which fail to adhere to the surface to which the shotcrete is being applied. Do not salvage it or include it in later batches.

Shooting will be suspended if:

- High wind prevents the ~~nozzleperson~~nozzle person from proper application of the material.
- The temperature is below 40° F.
- External factors, such as rain, wash cement out of the freshly placed material or cause sloughs in the work.

Taper construction joints over a distance of at least 12 inches to a thin edge. Thoroughly wet the surface of such joints before any adjacent section of shotcrete is placed. Do not use square construction joints.

Remove dummy areas, sags, or other defects and replace with a new layer, at no additional cost to the Agency. Replace any fabric reinforcement that is damaged with lapped and tied wire fabric.

Allow previous layers of shotcrete to take initial set before applying additional layers of shotcrete. Clean all loose material before applying additional layers.

00396.48 Finishing and Curing - Leave the shotcrete surface in a natural gun finish.

Apply Type 2, white-pigmented curing compound immediately after gunning to cure the shotcrete. Keep shotcrete surfaces from freezing for at least ~~seven~~7 calendar days after application. Any curing compound in contact with exposed welded wire fabric, anchor bars and previous shotcrete surfaces shall be sandblasted before placing subsequent shotcrete.

Measurement

00396.80 Measurement - The quantities of shotcrete will be measured on the area basis along the finished shotcrete surface area.

Payment

00396.90 Payment - The accepted quantities of shotcrete will be paid for at the Contract unit price, per square yard, for the item "Shotcrete Slope Stabilization".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00398 - Rock Slope Stabilization and Reinforcement

Description

00398.00 Scope - This work consists of furnishing and installing rock slope stabilization and reinforcement items as shown or specified in close conformity to the lines, grades, and dimensions shown or established.

Definitions

00398.02 Definitions:

Barrier Mounted Rock Protection Screen - A system of screening and concrete barrier designed to intercept small falling rocks.

Post-Supported Rock Protection Screen Behind Barrier/Guardrail - A gabion wire mesh screen placed at the highway shoulder edge and supported by posts up to 8 feet high to intercept rocks generally less than 2 feet in diameter.

Post-Supported Wire Mesh Slope Protection - Gabion wire mesh suspended above the ground with support posts and draped over a rockfall slope area. Post-supported wire mesh is used to intercept occasional falling rock generally less than 2 feet in diameter from slopes above the installation and the draped portion is used to prevent rocks from reaching the travel lanes.

Rock Reinforcing Bolts - Steel rods inserted into predrilled holes in rock and tensioned to a required load and bonded in place with grout.

Rock Reinforcing Dowels - Untensioned steel rods inserted into predrilled holes in rock and bonded in place with grout or polyester resin.

Rockfall Net System - A proprietary rockfall system constructed of interlocking steel rings or interlaced cable panels suspended from wide-flange support posts and incorporating braking elements. The system is designed to withstand high energy rockfall with minor maintenance required.

Wire Mesh Slope Protection - Gabion wire mesh draped over a rockfall slope area and anchored with soil or rock anchors. Wire mesh is used where rocks are generally less than 2 feet in diameter and to prevent rocks from reaching travel lanes.

00398.03 Rockfall Net System Submittals - Submit unstamped working drawings, field construction manuals, and product brochures prepared by the manufacturer of proprietary rockfall net systems, as necessary, according to 00150.35. Submit this information at least 30 calendar days before beginning fabrication or construction of the rockfall net system. Do not begin installation prior to receipt of the Engineer's written approval.

(a) Working Drawings - Provide working drawings that included at least the following information:

- **General Notes** - Necessary information on the design and construction of the rockfall net system.
- **Materials and Quantity Summary List** - All items of each net system.

- **Plan and Elevation Views** - The net system alignment and offsets to construction centerline, locations of support posts and footings, all end, lateral, top and bottom support ropes, anchor ropes and braking elements, net height, and section lengths.

- **Typical Sections** - Net system footings, footing-to-post connections, net connections, anchor type, retaining rope and braking element connections, and anchor locations.

- **Structural and Geometric Details** - The following minimum structural and geometric details:

  - Footing and leveling pad details
  - Rock and soil footing details
  - Anchor details
  - End, lateral, and intermediate support rope details
  - Support column details, including column plate details, breakaway connections and cable guide assemblies

(b) Field Construction Manual - Provide a field construction manual, prepared by the manufacturer of the proprietary rockfall net system, including step-by-step directions for constructing the rockfall net system.

00398.04 Rock Reinforcing Bolts and Rock Reinforcing Dowels Submittals - Submit a detailed work plan to the Engineer 10 calendar days prior to the preconstruction conference. Include the following:

- Construction schedule and sequence.
- Drilling methods and equipment.
- Components for rock reinforcing bolts and rock reinforcing dowels, couplers, bearing plates, rock reinforcing bolt mechanical anchorage system (if used), flat washers, and beveled washer specifications including the manufacturer's data sheets.
- Drill hole diameter.
- Grout mix or polyester resin from the QPL~~ or approved equal~~, including manufacturer's data sheets. Include the procedures for placing the grout and resin.
- Corrosion protection, either galvanizing or epoxy coating, for the rock reinforcing bolts and rock reinforcing dowels.
- Installation, stressing procedures, torque wrench, test jack, and pressure gauge to be used.
- Calibration data for each torque wrench, test jack, and pressure gauge to be used. An independent testing laboratory shall have performed the calibration tests within 60 calendar days of the date submitted. The torque wrenches shall have a capacity at least 20~~%~~ percent greater than the rock reinforcing bolt manufacturer's recommended torque to achieve the design and test loads. The torque wrench shall have an accuracy of at least ± 2~~%~~ percent of the full-scale reading, and a resolution of at least 1~~%~~ percent of the full-scale reading.

The Engineer will respond within 21 calendar days after receipt of the work plan. Do not proceed with the work until the Engineer has approved the work plan in writing.

Materials

00398.10 Anchors:

(a) Steel Anchor Bolts - Furnish 1 inch diameter continuously threaded or deformed, Grade 75 steel anchor bolts, complete with keyhole plate, grout tube, washer and nut, meeting the requirements of AASHTO M 31 (ASTM A 615). Provide anchor bolts made of one continuous bar. Welding and couplers will not be allowed. Galvanize all steel anchor bolts according to AASHTO M 232 (ASTM A 153). Provide grout tubes, grout sealers, and other grouting accessories for grouting anchor bolts of type recommended by the manufacturer and as approved.

(b) Steel Plates, Washers, and Nuts - Furnish steel plates, washers, and nuts for steel anchor bolts meeting the requirements of ASTM F 432. Provide 3/8 inch flat steel plates that provide not less than 6 inch by 6 inch area for each bolt. Provide steel or malleable iron beveled washers and hardened steel machine washers. Provide heavy-hexagonal type nuts. Galvanize all plates, washers, and nuts according to AASHTO M 232 (ASTM A 153), Class C, except castings shall be Class A and forgings shall be Class B.

(c) Wire Rope Anchors - Furnish cable for wire rope anchors meeting the current requirements of Federal Specification RR-W-410 and ASTM A 1023. Provide general purpose, 3/4 inch diameter, 6 x 19 IWRC, galvanized wire rope, with the wire rope core made from extra improved plow steel. Minimum breaking force shall be 58,800 pounds. Attach ferrules to the cable to prevent pullout of the cable from the encapsulating concrete during testing as described in 00398.42(e). Galvanize all ferrules and thimbles according to AASHTO M 232 (ASTM A 153).

(d) Concrete - Furnish concrete for anchors, support posts, and brace footings meeting the requirements of Section 00440 except the minimum strength shall be 4,000 psi.

(e) Cement Grout - Furnish non-epoxy cement grout for anchors in rock from section 02080.20 of the QPL~~, or an approved equal.~~. Follow the manufacturer's recommendations for water-cement ratio, mixing and set times.

(f) Polyester Resin - Furnish high strength (HS) or low strength (LS) polyester resin for post anchors in rock from section 00535 of the QPL~~, or an approved equal~~.

00398.11 Posts, Braces, and Appurtenances - Furnish 4 inch outside diameter, Schedule 40, hot-dip galvanized post and braces made from steel pipe according to ASTM A 53, Grade B. Furnish 4.5 inch O.D. pipe size (to accommodate post), Schedule 40, hot-dip galvanized post sleeves made from steel pipe according to ASTM A 53, Grade B. Furnish post caps, strap clamps, bolts, and nuts that are hot-dip galvanized according to AASHTO M 232 (ASTM A 153). Repair all cutting, welding, and drilling as well as other damage to the galvanizing according to 02420.10(d).

00398.12 Top Horizontal Support Rope and Support Post Retaining Rope - Furnish top horizontal support rope and support post retaining rope of the sizes shown and meeting the current requirements of Federal Specification RR-W-410 and ASTM A 1023. Provide Type 1, general purpose, Class 2, 6 x 19 IWRC, galvanized wire rope, with the wire rope core made from extra improved plow steel.

00398.13 Hardware - Furnish all rings and eyes of drop-forged steel that has been heat treated after forging. Furnish wire rope thimbles and clips that are sized for the wire rope shown. Galvanize all rings, eyes, thimbles, wire rope clips, U-bolts and miscellaneous hardware according to AASHTO M 232 (ASTM A 153), Class C, except castings shall be Class A and forgings shall be Class B.

00398.14 Wire Mesh Materials:

(a) Gabion Wire Mesh Fabric - Furnish gabion wire mesh fabric meeting the requirements of ASTM A 975, Style 1, 8 by 10 mesh type with Class 3 coating, soft temper.

(b) PVC Coated Gabion Wire Mesh Fabric - Furnish PVC coated gabion wire mesh fabric meeting the requirements of ASTM A 975, Style 3, 8 by 10 mesh type with Class 3 coating, soft temper. The color of the PVC coating shall be approved by the Engineer.

(c) Gabion Wire High Tensile Steel Fasteners and Lacing Wire - Furnish 11 gauge high tensile steel fasteners meeting the requirements of ASTM A 975 and ASTM A 764. Provide Class 3 zinc coating according to ASTM A 641. Install the fasteners as shown and as recommended by the manufacturer. Provide minimum panel to panel connection strengths meeting the requirements of ASTM A 975.

If stainless steel fasteners are required for corrosive environmental conditions, provide them according to ASTM A 313, Type 302.

Provide lacing wire with the same coating material as the gabion wire mesh fabric furnished on the order and conforming to ASTM A 641 and ASTM A 975. If PVC coating is required, provide the same color as the gabion wire mesh fabric.

00398.15 Rock Reinforcing Bolts and Rock Reinforcing Dowels - Furnish rock reinforcing bolts, rock reinforcing dowels, and all hardware that is galvanized or epoxy coated prior to installation. Cement grout or polyester resin will not be a allowed as a substitute for the required protective coatings.

(a) Rock Reinforcing Bolts - Provide rock reinforcing bolts, including mechanical anchorage system, plates, washers, and nuts from ~~section 00398 of~~ the QPL~~ or an approved equal~~. If mechanical anchorage is not selected, use a rock reinforcing bolt system from a manufacturer regularly engaged in the manufacturer of rock reinforcing bolts.

Provide grout tubes, grout sealers, and other grouting accessories for grouting rock reinforcing bolts of types recommended by the manufacturer and as approved.

(b) Rock Reinforcing Dowels - Provide rock reinforcing dowels, plates, washers, and nuts from a manufacturer regularly engaged in the manufacturer of rock reinforcing dowels. Provide grout or polyester resin meeting the requirements of this Section.

If polyester resin is selected, use a proven non-shrink polyester resin for rock reinforcing dowels capable of permanently developing the bond and internal strength between the rock reinforcing dowel and rock. Use a single speed cartridge system to anchor the dowel in rock. Select the cartridge diameter as recommended by the manufacturer to ensure complete encapsulation of the rock reinforcing dowel and satisfactory in-hole mixing. Select a polyester resin with a gel time which is consistent with rapid installation. Polyester resin to be incorporated into the rock reinforcing dowel installation shall be within the shelf-life period stated by the manufacturer. Provide samples of the polyester resins for testing upon request of the Engineer. Store polyester resins according to the manufacturer's recommendations.

00398.16 Rockfall Net Systems - For proprietary rockfall net systems, provide products from the selected company according to the company's specifications and these applicable material Specifications. If there is a conflict between the company's specifications and the Agency's Specifications, the Agency's Specifications will take precedence. Obtain all materials for the selected proprietary rockfall net system from the same company. Use only one proprietary rockfall net system on the Project unless different proprietary rockfall net systems are specified.

Equipment

00398.20 Anchor, Bolt, and Dowel Equipment - Provide all equipment necessary to establish the steel bolt anchors, wire rope anchors, rock reinforcing bolts, and rock reinforcing dowels in the holes at the locations and depths shown and by the Engineer, and to tighten nuts, eyes and other hardware to the required tension according to the instructions of the manufacturer subject to the approval of the Engineer.

Provide and maintain in good working condition the necessary torque wrenches and related equipment for the installation of steel bolt and wire rope anchors, rock reinforcing bolts, and rock reinforcing dowels.

Labor

00398.30 Measurement Assistance - Furnish labor, at no additional cost to the Agency, to assist with the measurement of actual quantities of wire mesh slope protection, post-supported wire mesh slope protection, and shotcrete slope stabilization placed on the slopes.

00398.32 Rock Reinforcing Bolts and Rock Reinforcing Dowels Personnel Qualification - Furnish personnel skilled in the installation of rock reinforcing bolts and rock reinforcing dowels. Experience shall be relevant to anticipated rock conditions and size of rock reinforcing bolts and rock reinforcing dowels being installed. The on-site supervisor and drill operator shall have no less than ~~two~~ 2 years of demonstrated experience in rock reinforcing bolt and rock reinforcing dowel installation. Submit experience documentation to the Engineer 10 calendar days prior to the preconstruction conference. Include current reference names and phone numbers, project names, locations, and the year of actual construction.

The Engineer will respond within 21 calendar days after receipt of the submittal. If, after checking references submitted by the Contractor, it is in the judgment of the Engineer that the proposed employees are not qualified; they will not be allowed to work on the Project. Do not proceed with the work until the Engineer has approved the submittal in writing.

Construction

00398.40 Lines, Grades, and Preparation Work - Clear, grub, and prepare the area of slope protection. Remove all shrubs, brush, snags, downed timber, float rock, and other obstacles, including trees up to 6 inches in diameter which interfere with construction. If directed, preserve trees and geographic features at the top of the wire mesh and cable mesh by varying the post and anchor locations to miss them.

Excavate for concrete footings to reasonably neat lines, but not less than the specified dimensions in soil or rock. Do not disturb the original ground at the sides and bottom of the excavation.

Dispose of materials, including excess excavation, according to 00290.20.

00398.41 Rock Slope Protection - Construct the kinds and types of rock slope protection at the locations shown or directed. Verify existing ground elevations, anchor locations, footing locations, elevations, and alignments prior to construction. The Contractor may encounter a variety of foundation conditions during construction of the rock slope protection items. Be prepared to install rock slope protection items in all types of materials including soil, mixed rock and soil, and solid rock.

00398.42 Support Posts, Sleeves, Braces, and Footings - Space support posts equidistant at intervals not exceeding those shown. Measure the interval parallel to the grade of the post line and in the line of the posts from center to center of the posts. Set the end support posts at the beginning and end of each continuous length and at abrupt changes in vertical and horizontal

alignments. Place all support posts in a vertical position, plumb and in line unless otherwise directed.

Securely fasten diagonal braces to the end support posts or intermediate support posts as shown. Excavate and place concrete as shown for the brace footing.

Dimension, place, backfill, and strike off support post sleeves according to 00398.45.

00398.43 Centralizers - Install centralizers that adequately support the bolt or cable in the center of the hole and place within 1 foot of each end of the anchor according to the following:

(a) Wire Mesh Slope Protection - Use centralizers in all anchor holes.

(b) Post-Supported Wire Mesh Slope Protection - Use centralizers in all end anchor holes.

(c) Post-Supported Rock Protection Screen Behind Barrier/Guardrail - Use centralizers in all end anchor holes.

00398.44 Anchors in Solid Rock - Where solid rock is encountered without an overburden of soil, install steel anchor bolts and wire rope anchors according to the following:

(a) Wire Mesh Slope Protection - 6 feet into the solid rock or as shown for all anchors.

(b) Post-Supported Wire Mesh Slope Protection - 3 feet into solid rock or as shown for post anchors. 6 feet into solid rock or as shown for end anchors and support post retaining rope anchors.

(c) Post-Supported Rock Protection Screen Behind Barrier/Guardrail - 6 feet into solid rock or as shown for all anchors.

Place grout according to the manufacturer's recommendations and as directed.

00398.45 Anchors in Soil and Mixed Soil and Rock - Where an overburden of soil, loose rock, or surfacing materials covers solid rock, install the anchors according to the following:

(a) Wire Mesh Slope Protection - 6 feet for all anchors. If solid rock is encountered before this depth is reached, install anchors in the solid rock according to 00398.44(a) unless otherwise directed.

(b) Post-Supported Wire Mesh Slope Protection - 3 feet for post anchors. 6 feet for end anchors and support post retaining rope anchors. If solid rock is encountered before these depths are reached install anchors in the solid rock according to 00398.44(b) unless otherwise directed.

(c) Post-Supported Rock Protection Screen Behind Barrier/Guardrail - 6 feet for all anchors. If solid rock is encountered before these depths are reached install anchors in the solid rock according to 00398.44(c) unless otherwise directed.

Place grout according to the manufacturer's recommendations and as directed.

Dimensions of footings shall not be less than shown and shall fill the excavated areas. Moisten the sides of the excavation to a depth of 2 inches and remove all loose soil and rock in the hole prior to placement of concrete. If the hole is overexcavated fill the entire cavity with concrete. Place the concrete with contact against firm soil at the sides and bottom and tamp around the steel anchor bolts, wire rope anchors, or post sleeves while the steel anchor bolts, wire rope anchors, or post

sleeves are held firmly in proper position. Strike off, slope or crown and smooth the surface of the concrete at the ground level to shed water.

Allow concrete to cure for at least ~~five~~5 calendar days before the support ropes and retaining ropes are attached and subjected to strain.

00398.46 Anchor Testing - Anchors shall have a minimum pullout capacity of 20,000 pounds per foot. Field verify pullout capacity by testing not less than 25~~%~~ percent of the total number of anchors installed. The Engineer will determine which anchors will be tested. Replace failed anchors at no additional cost to the Agency.

Perform testing against a temporary yoke or load frame. Do not allow any part of the yoke or load frame to bear within 3 feet of the anchor. Determine applied test loads with either a calibrated pressure gauge or a load cell. Use pressure gauges or load cells commonly used in the testing of rock bolts and anchors.

A pullout test consists of loading the anchor assembly to the minimum pullout capacity. The anchor is acceptable if it sustains this load for 10 minutes with no loss of load.

00398.47 Gabion Wire Mesh Installation - Install gabion wire mesh so that the bottom of the fabric rests on the slope as shown and according to the following:

(a) Wire Mesh Slope Protection - Place gabion wire mesh with the fabric curl toward the slope. Loop the fabric over the top horizontal support rope and attach to itself with high tensile steel fasteners or lacing wire as shown. Do not tension the fabric in any direction. It is to remain loose to increase its dampening effect on rolling rocks.

Lap the gabion wire mesh fabric as shown. If horizontal laps are needed, overlap the lower fabric so it is on top and away from the slope to avoid the possibility of falling material hanging up. Locate the bottom of the fabric so material dislodged under the fabric can drain freely from the bottom, yet will not flow or bounce onto the roadway. Secure the ends of all lacing wires to the fabric with a minimum of 1.5 turns.

(b) Post-Supported Wire Mesh Slope Protection - Place gabion wire mesh for post supported wire mesh slope protection according to 00398.44(a). In addition, adjust the turnbuckles at the ends of the top horizontal support rope for a maximum sag of 1 inch between any two support posts.

(c) Post-Supported Rock Protection Screen Behind Barrier/Guardrail - Attach the gabion wire mesh to the support posts and top horizontal support rope as shown. Lap the gabion wire mesh fabric as shown. Do not tension the fabric in any direction. Adjust the turnbuckles at the ends of the top horizontal support rope for a maximum sag of 1 inch between any two support posts.

00398.48 Top Horizontal Support Rope and Support Post Retaining Rope Attachment - For post-supported wire mesh slope protection and post-supported rock protection screen behind barrier/guardrail, install top horizontal support ropes on the posts as shown. Ensure that the top horizontal support rope will move freely in the U-bolt hangers. Use one continuous length of cable for each complete section of screen. Attach the top horizontal support rope to the end anchors as shown. Tension the rope so that when the gabion wire mesh fabric is in place, it will be fully supported. Take up additional tension with turnbuckles. Ensure that a minimum of 4 inches of take~~-~~-up remains in the turnbuckle when full tension has been applied.

In addition, for post supported wire mesh protection, install the post retaining ropes to the anchors and support posts as shown. Tension the ropes with the turnbuckles so that the cable is taut but

does not bend the support post toward the slope when the gabion wire mesh fabric is installed. Ensure that a minimum of 2 inches of take-up remains in the turnbuckle when full tension has been applied.

00398.49 Barrier Mounted Rock Protection Screen - Install concrete barrier according to Section 00820 and as shown. Attach protective screen to the concrete barrier as shown.

00398.50 Rock Reinforcing Bolts and Rock Reinforcing Dowels - Protect rock reinforcing bolts and rock reinforcing dowels at all times from damage and corrosion. Corrosion, pitting or damage to the rock reinforcing bolt may be cause for rejection. Damage includes, but is not limited to, abrasions, cuts, nicks, welds, and weld splatter. Prior to installation, remove all mill scale, flaking rust, and grease.

Drill holes to the diameter and depth recommended by the manufacturer. Unless otherwise directed, align drill holes normal to the rock face or as specified. Clean the drill holes of all drill cuttings and debris prior to installing the rock reinforcing bolts and rock reinforcing dowels and install and proof test as follows:

(a) Rock Reinforcing Bolts:

(1) Installing Bolts - Install and tension each rock reinforcing bolt to the design load before grouting. Conduct proof testing of each bolt as described below. Place grout in the drill hole to ensure the filling of the entire space between the bolt and sides of the drill hole, and the full encapsulation of the bolt. If necessary, control leakage of grout into rock seams using accepted methods and as directed. Pump the grout to the far end of the drill hole and continue pumping until grout is forced out of the de-airing tube at the face of the hole. After testing and grouting, cut the bolt off, if necessary, so that no more than 3 inches extends beyond the nut.

(2) Proof Testing Bolts - Tension each production rock reinforcing bolt installed to 120~~%~~ percent of the design load using a calibrated hollow ram hydraulic jack. Hold that tension for a minimum of 10 minutes. The Engineer will analyze the rock reinforcing bolt test results and determine whether the rock reinforcing bolt is acceptable. If no loss of load occurs in this time period, the rock reinforcing bolt is accepted. If a rock reinforcing bolt fails this test, the rock reinforcing bolt will be rejected and a replacement bolt installed in a separate hole adjacent to the failed bolt. Test the new rock reinforcing bolt. The Engineer may require additional proof testing if any rock reinforcing bolts fail. No additional payment will be made for failed rock reinforcing bolts or for additional proof testing.

After tensioning and testing, lock off at 100~~%~~ percent of the design load and grout the bolt. Carry out grouting within ~~three~~3 days of tensioning the rock bolt to provide corrosion protection and lock the tension stress permanently into the system.

(b) Rock Reinforcing Dowels:

(1) Installing Dowels - Place the grout mix or resin cartridges in the drill hole according to the manufacturer's recommendations. Ensure that resin cartridges are placed at a sufficient spacing to cause excess resin to be forced out the face of the hole when the rock reinforcing dowel is spun into place. Failure of resin to be extruded from the face of the hole may be cause for rejection of the bolt installation. After installation of the plate and nut, torque the nut to a nominal 100 foot-pounds to ensure proper seating against the rock surface. Conduct proof testing of rock reinforcing dowels as described below. After testing, cut the bolt off, if necessary, so that no more than 3 inches extends beyond the nut.

(2) Proof Testing Dowels - Proof test at least 10%, percent, but not less than three each, of installed rock reinforcing dowels. The proof test shall be conducted by the Contractor and the Engineer will interpret the results. Tension the rock reinforcing dowel to 10 kips with a calibrated hollow ram hydraulic jack. Hold the load for 10 minutes with no loss of load. A rock reinforcing dowel will be considered to have failed if any movement of the dowel occurs. The Engineer may require additional proof testing beyond the 10% percent if any rock reinforcing dowels fail. Replace failed rock reinforcing dowels with a separate rock reinforcing dowel installed in a separate hole. No additional payment will be made for failed rock reinforcing dowels or for additional proof testing.

00398.51 Rockfall Net Systems - Provide for a field representative from the selected proprietary rockfall net system to be present at the start of the rockfall net system construction. Supervisory personnel of the Contractor, the company field representative, and any subcontractors who are involved in the construction of the rockfall net system shall meet with the Engineer for a rockfall net system preconstruction conference. At this conference, discuss methods of accomplishing all phases of the work required to construct the rockfall net system. If all representatives are not in attendance the rockfall net system preconstruction conference and start of net construction will be rescheduled.

In addition to the rockfall net system preconstruction conference, the company field representative shall be available as needed during the construction of the rockfall net system to provide instructions and recommendations, and to assist the Contractor or Engineer. Follow instructions and recommendations of the representative if approved by the Engineer.

Measurement

00398.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Wire Mesh Slope Protection - Wire mesh slope protection will be measured on the area basis, along the surface area of wire mesh fabric on the slope.

(b) Post-Supported Wire Mesh Slope Protection - Post-supported wire mesh slope protection will be measured on the area basis, along the surface of the wire mesh from center to center of end posts.

(c) Post-Supported Rock Protection Screen Behind Barrier/Guardrail - Post-supported rock protection screen behind concrete barrier and guardrail will be measured on the length basis, from center to center of end posts along the line and grade of each separate run.

(d) Barrier Mounted Rock Protection Screen - Barrier mounted rock protection screen will be measured on the length basis, from center to center of end posts along the line and grade of each separate run.

(e) Rock Reinforcing Bolts and Rock Reinforcing Dowels - Rock reinforcing bolts and rock reinforcing dowels will be measured on the length basis, along the entire length of each rock reinforcing bolt and rock reinforcing dowel (embedded and protruding).

(f) Rockfall Net Systems - Rockfall net systems will be measured on the length basis, from center to center of end posts along the line and grade of each separate run.

Payment

00398.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Wire Mesh Slope Protection	Square Foot
(b)	Post-Supported Wire Mesh Slope Protection	Square Foot
(c)	Rock Protection Screen Behind Concrete Barrier and Guardrail	Foot
(d)	Barrier Mounted Rock Protection Screen	Foot
(e)	Rock Reinforcing Bolt	Foot
(f)	Rock Reinforcing Dowel	Foot
(g)	Rockfall Net System	Foot

Item (d) includes the concrete barrier.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for rock and soil anchors, wire rope, rail, concrete, grout, polyester resin, steel posts, and hardware.

PART 00400 - DRAINAGE AND SEWERS

Section 00405 - Trench Excavation, Bedding, and Backfill

Description

00405.00 Scope - This work consists of excavating trenches, constructing trench foundations, and placing bedding, pipe zone material and backfill.

00405.01 General - Excavate, backfill and dispose of excess excavated materials in connection with minor structures and conduits such as subsurface drain, culvert, siphon, irrigation and sewer pipe of nominal inside diameters not exceeding 72 inches. Perform excavation for major structures and conduits with a nominal inside diameter or width greater than 72 inches according to Section 00510.

Trench excavation does not include earthwork covered under any other section, or any earthwork that may be specifically included and provided for other pay items of the Contract. Dispose of excess excavated materials and perform other matters not covered in this Section according to Section 00330.

00405.02 Definitions:

Boulder Excavation - The removal, without drilling, blasting or splitting, of masses of rock having one or more dimensions of 3 feet or greater.

Common Excavation - The removal of all material not classified as rock excavation.

Flexible Pipe - For the purpose of these Specifications, potable water pipes and pipes constructed of corrugated metal, PVC, and polyethylene are considered flexible pipes.

Pipe Bedding - Furnishing, placing and compacting specified materials on the trench foundation so as to uniformly support the barrel of the pipe.

Pipe Zone - The area from the top of the bedding to a point 8 inches, minimum, above the top outside of the pipe barrel for the full width of the trench.

Rigid Pipe - For the purpose of these Specifications, pipes constructed of concrete and ductile iron are considered rigid pipes.

Rock Excavation - Excavation of solid ledge rock that, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring, or breaking up with power-operated tools.
The term "Rock Excavation" indicates a method of removal and not a geological formation.

Surface Removal - The removal of surface material such as topsoil, sod, pavement, sidewalks, or gravel, that requires different equipment or methods than those used for trench excavation.

Trench Backfill - Furnishing, placing, and compacting material other than Controlled Low-Strength Material (CLSM) in the trench, between the top of the pipe zone material and the bottom of the pavement base rock, ground surface or surface material.

Trench Excavation - The removal of all material encountered in the trench to the depths as shown or as directed. Trench excavation is classified as either common or rock excavation.

Trench Foundation - The bottom of the trench on which the pipe bedding is to lie and which provides support for the pipe.

00405.03 Lines, Grades, and Cross Sections - Excavate trenches to the lines, depths, grades and cross sections shown on the plans or as established. Variations will be allowed only when necessary to ensure firm foundations and when such variations will not be detrimental to the work.

Materials

00405.10 General - Materials may be native or imported, as specified.

00405.11 Trench Foundation - Where additional excavation is required due to groundwater or other unstable conditions so that the native material cannot support the pipe, furnish one of the following materials for trench foundation:

- Selected general backfill conforming to 00330.13.
- Selected granular backfill conforming to 00330.14.
- Selected stone backfill conforming to 00330.15.
- Other approved material.

00405.12 Bedding - If groundwater is present in the bedding zone, use 3/4" - 0 aggregate bedding. If groundwater is not present, and unless otherwise specified, furnish one of the following materials for bedding the pipe:

- 3/8" - 0 PCC fine aggregate conforming to 02690.30(h).
- Commercially available 3/4" - 0 aggregate.
- No. 10 - 0 sand drainage blanket material conforming to 00360.10.
- Reasonably well graded, from maximum size to dust, sand with 100~~%~~ percent passing the 3/8 inch sieve.
- Commercially available 3/8" - 0 or No. 10 - 0 sand.
- A continuous cradle of concrete conforming to Section 00440. Acceptance of the concrete will be by visual inspection.

00405.13 Pipe Zone Material - For flexible pipes, backfill the pipe zone with bedding material as described in 00405.12.

For rigid pipes, unless otherwise directed, furnish either:

- 1" - 0 or 3/4" - 0 base aggregate conforming to 02630.10, or
- Commercially available 1" - 0 or 3/4" - 0 aggregate.

00405.14 Trench Backfill - Furnish the following materials where shown or required:

(a) Class A Backfill - Use native or common material that, in the opinion of the Engineer, meets the characteristics required for the specific surface loading or other criteria of the backfill zone.

(b) Class B Backfill - Use granular material consisting of gravel or crushed rock meeting the requirements of Section 00641. Designated size shall be 1" - 0 or 3/4" - 0.

(c) Class C Backfill - Use clean sand with no particle size larger than 1/4 inch.

(d) Class D Backfill - Use pit run or bar run material, well graded from coarse to fine. The maximum dimension shall be 3 inches.

(e) Class E Backfill - Use Controlled Low-Strength Material (CLSM) conforming to Section 00442.

00405.15 Quality Control - Provide quality control according to Section 00165.

Labor

00405.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT, CAgT, and CDT technical certifications.

~~• CEBT~~
~~• CAgT~~
~~• CDT~~

Construction

00405.40 General - Perform all excavation and backfilling according to the following requirements:

(a) Limitation on Commencement - Do not commence excavation until the undisturbed or existing ground has been measured and the measurements have been approved by the Engineer.

(b) Natural Stream Protection - Hold to a minimum excavations in, or adjacent to, natural stream beds. Comply with 00290.30(a). Restore the streambed according to 00405.46(f).

(c) Partial Embankment Construction for Exposed Pipe - Construct partial embankment according to 00330.42(c-6) and the plans, before excavating trenches.

(d) Temporary Handling of Water - Provide temporary measures according to 00405.43.

00405.41 Trench Excavation - Excavate trenches according to the following:

(a) Within Paved Areas to Be Preserved - Excavate trenches for pipe installation by the open excavation method, unless otherwise directed. Do not disturb the adjoining pavement more than necessary.

(b) Open Trench Limit - Limit the length of open trench to 100 feet, or as allowed. Related resurfacing shall be completed within 800 feet of the open trench limit.

(c) Trench Width - Keep the trench width at the ground surface to the minimum necessary to install the pipe in a safe manner, but not less than 24 inches. In all cases, make trenches of sufficient width to allow for shoring and to permit proper jointing of the pipe and backfilling of material along the sides of the pipe. Refer to the Standard Drawings for minimum trench widths for various diameter pipes. Make excavations for manholes and other structures wide enough to provide a minimum of 12 inches between the structure surface and the sides of the excavation. Keep the top of the trench within right-of-way or permit limits.

(d) Trench Grade - Excavate trenches to the lines and grades shown or as established, with proper allowance for pipe thickness, pipe bedding and foundation stabilization. Place pipe bedding on a firm, undisturbed, foundation, true to grade. If the trench is excavated below grade without authorization, restore to grade with material of the type specified for pipe bedding at no

additional cost to the Agency. Place the material over the full width of the trench, in compacted layers not exceeding 6 inches.

(e) Disposal of Excess Material - Place excavated material at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, or interfere with the function of existing drainage facilities.

Make arrangements for and dispose of all excess material not required elsewhere on the Project in an approved manner, at no additional cost to the Agency, and according to 00330.41(a-4).

(f) Trench Protection - Provide the materials, labor and equipment necessary to protect trenches at all times. Provide safe working conditions in the trench and protect the work, existing property, utilities, pavement, and the public. The method of protection shall be according to the Contractor's design. The Contractor may elect to use any combination of shoring, overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work, provided the method meets with the approval of the Engineer and complies with all applicable local, state, and federal safety codes.

Be responsible for damages resulting from improper removal of shoring or from failure to shore.

(g) Existing Abandoned Facilities - Remove and dispose of existing abandoned pipe, structures and other facilities as necessary to construct the trench according to 00310.41(c).

00405.42 Rock Excavation - Where rock excavation as defined in this Section is required, remove the rock to provide the minimum clearances shown on the Standard Drawings. Excavate and remove the overburden and expose the rock to allow the Engineer to measure the rock prior to removal.

If using explosives, comply with the requirements of 00170.94. Prior to blasting, obtain the approval of the Engineer and the appropriate permits. Provide all tools and devices required for loading and using explosives, blasting caps and accessories. When blasting rock in trenches, cover the area to be shot with blasting mats or other protective material to prevent the scattering of rock fragments outside of the excavation.

00405.43 Dewatering - Promptly remove and dispose of all water entering the trench during the time the trench is being prepared for the pipe laying, during the laying of the pipe and until the backfill at the pipe zone has been completed. Dispose of the water in an approved manner without damage to adjacent property.

Control groundwater to prevent softening of the bottom of excavations or formation of "quick" conditions or "boils". Design and operate dewatering systems to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

When dewatering near a river, lake, or stream, conform to the requirements of 00290.30(a) and Section 00280. When the presence of water or other conditions in the excavated area would be detrimental to the purpose of the work, obtain approval of the Engineer for the temporary measures required to correct or care for the condition.

If water or other conditions encountered require permanent correction or care not anticipated by the Contract and not due to the Contractor's neglect or method of operation, perform the work according to 00140.60.

00405.44 Trench Foundation - Make the full length and width of completed trench bottoms firm. Do not place bedding material before the trench foundation is inspected and approved. If bell and spigot pipe is used, recess the trench bottom to accommodate the bell.

When, in the judgment of the Engineer, the existing material in the bottom of the trench is unsuitable for supporting the pipe, excavate below grade, as directed. Replace the excavated material with imported trench foundation material conforming to 00405.11. Place the trench foundation material in 6 inch layers and compact according to 00330.43 except compact selected stone backfill material in 12 inch layers. Bring the trench foundation material to the elevation established.

00405.45 Pipe Bedding - Spread the bedding smoothly to the proper grade so that the pipe is uniformly supported along the barrel. Excavate bell holes at each joint to permit proper assembly and inspection of the joint. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length.

00405.46 Backfilling - Backfill with material conforming to 00405.13 and the details shown, or as directed.

(a) General - Begin backfilling when:

- The foundation has been prepared, if required.
- The bedding has been prepared.
- The drainage facilities and fittings are installed.
- The installation has been inspected and approved.

Thoroughly tamp and compact all trench backfill with machine or pneumatic operated tampers of a size and type that will obtain the required density.

Test for density according to 00330.43.

Backfill either to the top of the trench, the surrounding ground level, or the upper limit of excavation, as directed. Dispose of excess excavated material not used in backfill work according to Section 00330.

(b) Pipe Zone - Place the materials in the pipe zone in layers not greater than 6 inches thick and in a manner that equalizes pressure on the structure and minimizes stress. Before placing backfill material, condition, aerate, or wet the material so that the moisture content of each layer is within minus 4~~%~~ percent to plus 2~~%~~ percent of optimum moisture content.

As required under the haunches of pipe and in areas not accessible to mechanical tampers or to testing, compact with hand methods to ensure intimate contact between the backfill material and the pipe or structure. Provide thorough compaction.

Ponding or jetting will not be allowed within the pipe zone.

(c) Trench Backfill - The following requirements apply in the trench backfill area and in the pipe zone, except where in conflict with the requirements of 00405.46(b):

(1) General - Use Class B trench backfill unless otherwise specified or approved.

The Engineer may sample excavated material to determine the suitability of the Class A material for use as backfill. If the material is approved, the Contractor may elect to use the material in place of the specified backfill. Prevent excavated material from becoming

saturated beyond the critical moisture limits, and replace any saturated Class A material with Class B, C, or D material, as specified, at no additional cost to the Agency.

(2) Class A, B, C, or D Backfill - Backfill the trench above the pipe zone in successive lifts. Do not allow the backfill to free-fall into the trench until at least 3 feet of cover is provided over the top of the pipe. Modify the method of compaction as necessary to protect the pipe.

Compact the top 3 feet of trench backfill material within the roadway and shoulders, and within a 2V:1H slope line projected from each subgrade shoulder, to not less than 95~~%~~ percent of maximum density. Compact all other trench backfill material to not less than 90~~%~~ percent of maximum density.

Determine the maximum density by AASHTO T 99. If the specified compaction is not obtained, the Contractor may be required to use a modified compaction procedure or reduce the thickness of lifts. If approved materials meeting the Specifications cannot be compacted to the required density regardless of compactive effort or method, the Engineer may reduce the required density or direct that alternate materials be used. Do not proceed with excavation and pipe laying operations until the backfill can be compacted to the satisfaction of the Engineer.

If the material is not density testable, the Engineer will observe each layer for deflection or reaction under the compaction equipment to verify that no soft or pumping areas remain. Compact until there is no perceptible deflection under the compaction equipment.

When the backfilling is complete, finish the surface area as specified. In paved or graveled areas, maintain the surface of the trench backfill level with the existing grade with 3/4" - 0 crushed aggregate material, or asphalt concrete if directed, until final pavement replacement is complete and accepted.

(3) Class E Backfill - Backfill the trench above the pipe zone with CLSM material. If the CLSM is to be used as a temporary surfacing, backfill the CLSM to the top of the trench and strike it off to provide a smooth surface. If the CLSM is not to be used as a temporary surfacing, backfill the CLSM up to the bottom of the proposed resurfacing. No compaction of CLSM is allowed. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved, or opened to traffic until permanent surface restoration is completed, if it has hardened sufficiently to prevent rutting.

(d) Ponding or Jetting of Backfill Materials - Ponding or jetting will not be allowed within roadbed lateral limits. Ponding or jetting will be allowed outside roadbeds when approved by the Engineer in writing.

Use Class C or D trench backfill material at no additional cost to the Agency. Provide drainage at the bottom of the trench to remove water from the jetting operation. Compact to the density and deflection requirements of 00405.46(c).

Furnish equipment that provides a minimum gauge pressure of 35 psi at the discharge nozzle. Use a rigid pipe that will reach within 1 foot of the bottom of the backfill. Insert the pipe at intervals not exceeding 4 feet throughout the entire width and length of the trench backfill.

(e) Temporary Trench Plating - When temporary steel plates are installed over a street cut, they shall be capable of carrying at least an MS-18 loading. Place steel plates with a minimum of 12 inches bearing on all sides of a cut. Anchor steel plates to minimize shifting. Shim the edges of all steel plates with cold mix asphalt.

(f) Restoration of Streambeds - Comply with 00290.30(a) and Section 00280. Upon completion of the work:

- Restore the streambed to its former condition of resistance to scour.
- Remove all matter that has come into the stream due to the Contractor's activities.

00405.48 Surface Removal:

(a) General - For trench resurfacing, see Section 00495.

(b) Topsoil - Where trenches cross lawns, garden areas, pastures, cultivated fields or other areas on which topsoil exists, remove the topsoil to a minimum 12 inch depth and place the material in a stockpile. Do not mix the topsoil with other excavated material. After the trench has been backfilled, replace the topsoil.

In lieu of stockpiling the topsoil, approved imported topsoil may be substituted, to a depth specified or approved, at no additional cost to the Agency.

Maintain the finished grade of the topsoil level with the area adjacent to the trench until final acceptance by the Engineer, and repair damage to adjacent topsoil caused by the Contractor's operations. Remove all rock, gravel, clay and other foreign materials from the surface. Regrade and add topsoil as required.

(c) Pavement, Curb, and Sidewalk - Use saws to cut portland cement concrete pavement, curbs and sidewalks, regardless of thickness. In bituminous pavement, when no pavement overlay will occur, saw-cut the pavement along each edge of the area to be removed. When roadways will receive a pavement overlay as part of the Project or following trench resurfacing, bituminous pavement to be removed may be cut by wheel cutter, jack hammer, or other approved methods.

Upon completion of backfill and just prior to pavement re-surfacing, saw the surfacing on both sides of the trench a minimum of 6 inches wider than each top of the trench. In areas of any undermined or damaged surfacing, re-saw to a width outside these areas. When saw-cutting, follow lines parallel to the pipe centerline.

Where the width changes in areas of asphalt pavement re-surfacing, cut the transition between the different widths at 45 degrees. When the pipe line changes direction, or there is a connecting pipe line that requires the saw cut alignment to change at an angle greater than 60 degrees, make a minimum 24 inch transition saw cut. If there is damaged or undermined surfacing at the transition point, make the transition saw cut beyond the damaged or undermined surfacing. Make the transition saw cut angle half the angle change in the direction of the pipe line or connecting line.

If the asphalt surfacing is to be overlaid, the second saw cut will only be required to firm subgrade.

A second saw cut for concrete sidewalks, driveways and pavements will not be required unless needed to reach firm subgrade.

Remove and dispose of pavement lying within the limits of the cuts and from any adjoining areas damaged by the cutting and removal operations according to Section 00310.

Measurement

00405.80 Measurement - Except for rock excavation, boulder excavation, and trench foundation, no measurement of quantities will be made for work performed under this Section.

Imported topsoil will be measured according to 01040.80.

00405.81 Rock Excavation and Boulder Excavation - The quantities of rock excavation and boulder excavation will be measured as follows:

(a) Rock Excavation - Rock excavation will be measured on the volume basis. Measurement will be of the actual dimensions of rock removed within the following limits:

- **Length** - Length will be the horizontal distance measured along the centerline of the trench excluding manholes, inlets, and other structures.

- **Width** - Width will be the width of the rock removed but will not be greater than the outside diameter of the pipe bell plus 12 inches.

- **Depth** - Depth will be measured at 30 foot intervals, or as specified, along the centerline of the trench. The depth will not be greater than 6 inches below the outside bell of the pipe.

Rock excavation for manholes, inlets, and other structures will be computed from the rock excavated to a depth 6 inches below the bottom of the structure and an area within a line parallel with, and 12 inches outside of, the actual dimensions of the manhole, inlet, or structure.

No separate measurement will be made for the following:

- Soft or disintegrated rock.
- Hardpan or cemented gravel that can be removed with a hand pick or power-operated excavator or shovel.
- Loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere.
- Rock outside of the minimum limits of measurement allowed, which may fall into the excavation.

(b) Boulder Excavation - Boulder excavation will be measured on the volume basis. Measurement will be made in the field by the Engineer after removal of each boulder from the excavation but prior to removal from the site. Each boulder removed will be measured for length, width, and height. The volume of each boulder will be determined as the product of 85~~%~~ percent of each of the three measured dimensions.

00405.82 Trench Foundation - The quantities of unsuitable trench foundation will be measured on either the weight basis or the volume basis as follows:

- **Weight Basis** - Trench foundation will be measured on the weight basis. The quantity of replacement foundation material will be based on weigh tickets from scales meeting the requirements of Section 00190. Present weigh tickets to the Engineer for signature on the day the material is delivered.

- **Volume Basis** - Trench foundation will be measured on the volume basis, computed using the following dimensions:

  - **Length** - Length will be the horizontal distance measured along the centerline of the trench. Measurement will be continuous through manhole or structure locations.

  - **Width** - Width will be the nominal inside diameter of the pipe plus two times dimension "B" from "Table A" shown on the standard drawings.

- **Depth** - Depth will be the vertical distance from the top of the underlying surface (following excavation of unsuitable material) to the bottom of the pipe bedding. The depth will be measured at intervals of 30 feet, or as specified, along the centerline of the trench and the average depth between points will be used for the volume computation.

Payment

00405.90 Payment - The accepted quantities of rock excavation, boulder excavation, and trench foundation will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Rock Excavation	Cubic Yard
(b)	Boulder Excavation	Cubic Yard
(c)	Trench Foundation	Ton or Cubic Yard

Item (c) includes removal of unsuitable material and replacement as necessary to provide a stable foundation for the pipe.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Imported topsoil will be paid for according to 01040.90.

No separate or additional payment will be made for:

- trench excavation
- trench backfill
- saw cutting
- trench protection
- pipe bedding
- pipe zone material
- dewatering

Section 00406 - Tunneling, Boring, and Jacking

Description

00406.00 Scope - This work consists of installing conduits, pipes, casings, linings, and sleeves by tunneling, boring, and jacking without excavating the overlying surface.

00406.01 Descriptive Terms:

Tunneling - Tunneling includes all methods by which an underground passageway is excavated and lining materials are brought in and placed.

Boring - Boring includes all methods by which a conduit, casing, pipe or sleeve is pushed or pulled into place and in which the excavation method precludes the stationing of a worker within the conduit without stopping or removing the excavation equipment.

Jacking - Jacking includes all methods by which a conduit, casing, pipe or sleeve is pushed or pulled into place with one or more workers inside to excavate and assist in keeping the conduit on the required grade and alignment.

Materials

00406.10 Pipe Bedding and Pipe Zone Material - Furnish pipe bedding and pipe zone material meeting the requirements of Section 00405.

00406.11 Pipe - Furnish pipe materials meeting the strength, class, and type specified or shown.

00406.12 Casing - Furnish casing of a size to permit proper construction to the required lines and grades. Furnish casings that are made of smooth steel pipe or concrete pipe suitable for the purpose intended. Optionally, the casing may be constructed of galvanized, standard-offset, tunnel liner plate with gauge and section modulus as approved.

The class of casing specified is based on the superimposed loads and not on the stresses resulting from jacking or boring operations. Any increase in casing strength to withstand jacking or boring operations shall be the responsibility of the Contractor.

When pressure grouting is specified, equip jacked casings 36 inch diameter and larger with nipples installed at the springline and the crown, at 10 foot centers.

00406.13 Grout - Furnish grout for filling the annular space between the carrier pipe and the casing pipe of one part portland cement, five parts sand, and seven parts 3/8 inch maximum size rounded aggregate by volume, or as approved.

Furnish grout for pressure grouting outside jacked carrier or casing pipe of one part portland cement and three parts sand by volume, or as approved.

00406.14 Sand - Furnish sand for filling the annular space between the carrier pipe and the casing pipe of clean, sharp, and well graded so that 100~~%~~ percent passes the No. 8 sieve, and between 10~~%~~ percent and 35~~%~~ percent passes the No. 50 sieve, or as approved.

Construction

00406.40 Excavation - Excavation for work under this Section is unclassified and includes whatever materials are encountered to the depths shown or required.

00406.41 Required Submittals - Before beginning the work, submit the following to the Engineer according to 00150.35:

(a) Tunneling - Submit the following stamped working drawings:

- Tunnel shaft bracing design and dimensions
- Tunnel support details
- Method of backpacking tunnel supports
- Design of bracing to prevent lining from shifting or flotation
- Backfill material or pressure concrete mix design, placement method and equipment
- Poling plate dimensions and details, when required

(b) Boring and Jacking - Submit the following unstamped working drawings:

- Jacking pit construction
- Casing or conduit
- Jacking head
- Excavation method
- Tee or wye installation
- A substitute design for any part of the system that is changed as a result of the jacking or boring operation
- Bracing to prevent pipe shift and flotation, if placed in a casing, and the materials, method and equipment for backfilling
- Backfill material or pressure grout mix, placement method and equipment

Submit for review the following stamped working drawings:

- Jacking pit bracing
- Any structure that is required because of the particular method or procedure used by the Contractor

00406.42 Tunneling - Construct the pipe on a firm subgrade, thoroughly compacted and true to grade. If the material in the bottom of the tunnel is ledge rock, extend excavation of the tunnel to a depth below the bottom of the pipe, and provide a bedding of crushed aggregate or concrete as specified in Section 00405. Restore to grade any excavation made below grade without approval by backfilling with approved bedding material, at no additional cost to the Agency.

00406.43 Boring and Jacking - Boring or jacking may be allowed in lieu of the open trench method or tunneling with approval of the Engineer. Jack or bore all conduit, casings, pipe or sleeves to the required line and grade.

Equip the leading section of pipe or casing with a jacking head. Perform all excavation entirely within the jacking head.

Should loss of surrounding material occur during the jacking or boring operation, backpack or grout the voids before the completion of the shift. Fill or backpack all voids with grout or granular material as approved.

00406.44 Concrete Pipe - Protect the driving ends of concrete pipe against spalling and other damage. Protect intermediate joints by the installation of sufficient bearing shims to properly distribute the bearing stresses. Remove all sections of conduit showing signs of failure and replace with new sections, or with approved cast-in-place sections, which are adequate to carry the loads imposed on them.

00406.45 Smooth Steel Casing - Join sections of smooth steel casing to be jacked or bored by welding the joints with a continuous weld for the full circumference, or by other approved means. Provide joints capable of resisting the jacking or boring forces.

Brace pipe installed in casing to prevent shifting or flotation. Fill the void between the casing and the pipe with grout or other material, as specified or approved.

00406.46 Grouting Voids Outside Casing - On pipes 36 inch or larger, fill completely the void space between the tunnel and the casing or liner plate with approved grout. After the casing or carrier pipe has been jacked or tunneled into position, fill with grout under pressure, through the grout holes provided, to fill all voids outside the pipe using the following sequence:

- Grout at the springline hole at one end and pump the grout until it appears in the grout hole at the crown.
- Grout through the opposite springline hole until the grout appears at the hole in the crown.
- Grout through the hole at the crown until the grout appears in the next set of holes along the pipe.
- Plug the holes at the starting point and move to the next set of holes.
- Repeat the sequence until the full length of the pipe has been grouted.

Provide a continuous color video recording of the grout placement, to provide documentation that grout was properly placed according to the above Specifications. On the video, identify the location of the grouting operation in relationship to the end of the casing, tunnel or liner plate.

00406.47 Cradles for Cased or Tunneled Pipe - Where cradles are shown, provide a strapped cradle under the barrel of the carrier pipe. The barrel shall bear continuously on the cradles.

00406.48 Placing Fill in Casing - Where shown, completely fill the annular space between the pipe and the casing, tunnel liner or tunnel wall with approved grout or sand to prevent pipe flotation. Pour or pump the fill from the two ends and from intermediate points as necessary. Complete grouting in a continuous operation without stopping. Perform sand filling using a gunite machine or other approved equipment.

00406.49 Railroad Crossings - Perform all work in railroad rights-of-way according to the railroad permit.

Measurement

00406.80 Measurement - No measurement of quantities will be made for tunneling, boring, or jacking work, or for casing or conduit used to install pipe.

Where tunneling, boring, jacking, or open trench excavation is used at the Contractor's option in lieu of another specified method, measurement will be made as originally bid.

The quantities of pipe installed by tunneling, boring, or jacking will be measured according to the appropriate items under which this work is required.

Payment

00406.90 Payment - The additional effort required to install conduits, pipes, casings, linings, and sleeves by tunneling, boring, or jacking (other than under a railroad) will be paid for at the Contract lump sum amount for the item "Tunneling, Boring, and Jacking".

If tunneling, boring, jacking, or open trench excavation is used at the Contractor's option in lieu of another specified method, payment will be made as originally bid.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Tunneling, boring, or jacking under a railroad will be paid for according to 00445.91.

Pipe will be paid for according to the appropriate items under which this work is required.

Section 00410 - Common Provisions for Pipe Lining

Description

00410.00 Scope - This work consists of rehabilitating existing pipes by furnishing and installing pipe liners by pipe bursting and lining, slip lining, and cured-in-place lining as shown.

00410.01 Definitions:

~~**Pipe Bursting and Lining** - Breaking and expanding the diameter of an existing pipe and inserting a new pipe inside the broken pipe.~~

Cured-In-Place Pipe ~~**(CIPP)**~~ - Inserting a resin impregnated ~~lined~~ tube into an existing pipe, expanding it, and curing it to form a new lined pipe.

Gravity Pipe - Pipe designed to convey fluids under conditions where the hydraulic gradient and free-water surface are coincident within the pipe.

Host Pipe - The existing pipe to be lined.

Obstruction - An object that protrudes into the host pipe that may impede the liner installation, create an unfavorable condition after the liner has been installed, and may not be removed by conventional cleaning equipment. This may be a protruding service lateral tap, grout or mineral deposit, heavy roots, off set joint, broken or collapsed pipe, change in internal pipe diameter, or similar condition.

Pipe Bursting and Lining - Breaking and expanding the diameter of an existing pipe and inserting a new pipe inside the broken pipe.

Slip Lining - Inserting a new smaller diameter pipe ~~inside~~into an existing pipe and filling the remaining annular space.

Point Repair - A localized repair of the host pipe to a condition suitable for pipe lining.

Service Line Connection - A side or lateral pipe connection to the sewer main.

00410.03 Submittals - Submit the following to the Engineer ~~for review and approval~~ 10 calendar days ~~prior to~~before the preconstruction conference:

- ~~Catalog cuts, specifications, dimensioned drawings, installation details, and sketches.~~
- Installation plan that includes the method of installation, sequencing, host pipe preparation, temporary modification of existing structures, equipment by size, make, model and manufacturer.
- Manhole connection and ~~service connection details~~repair plan.
- ~~A detailed written narrative of the pipe lining construction procedure and sequence.~~
- ~~Bypass pumping plan. Include an emergency response plan for the sewage bypass pumping system to divert the flows in the event of a failure of the bypass pumping system. In addition, submit the plan again at least 20 calendar days prior to pipe installation.~~
- ~~The pipe fusion equipment operator technician's experience and verifiable references.~~
- ~~The pipe insertion equipment operator technician's experience and verifiable references.~~
- ~~The pipe bursting and insertion equipment operator technician's experience and verifiable references.~~

~~Furnish a certificate of compliance for all high density polyethylene (HDPE) pipe and fittings furnished confirming that the materials supplied conform to the specified requirements. Include certified laboratory testing data confirming satisfactory results were obtained on a sample of the pipe to be provided under the Contract.~~

~~**00410.04 CIPP Submittals** - In addition of the submittals described in 00410.03, submit the following for CIPP 10 calendar days prior to the preconstruction conference:~~

- ~~Documentation showing the installer meets the installation qualifications listed in 00410.31.~~
- ~~Certification by the lining system manufacturer that the installer is fully licensed and certified as competent to perform the work.~~
- ~~Proof of certification that manufacturing and installation processes operate under a quality management system which is third-party certified to ISO 9000 or other recognized organization standards.~~
- ~~Manufacturer's certification of successful previous CIPP installation in the United States of proposed product of 1,000,000 feet or 4,000 manhole-to-manhole segments.~~
- ~~Certification from the manufacturer that the materials meet the requirements of these specifications and intended use. Certification of test results confirming that the liner and resin meet the minimum chemical resistance requirements according to ASTM F 1216 and ASTM F 1743.~~
- ~~Catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of system components of the tube and resin system. Include manufacturer's recommendation for handling, storage, insertion, curing, trimming, finishing, and repair of damaged liner.~~
- ~~A list of the key qualified personnel who are assigned to and will work on this project and Certification of worker training for installing CIPP liners.~~
- ~~Flow diversion plan for the mainline including service laterals (if applicable).~~
- ~~Detailed method for samplings, including recommended location and size of each sample, method of removal, and method of liner repair including a procedure to repair the cured liner when core/plate samples are taken.~~
- ~~Calculations for the volume of resin to be used for each segment including the calculated amount of excess resin necessary to account for liner material properties, changes in the resin's physical and chemical characteristics due to polymerization and the structural condition of the gravity pipe.~~
- ~~Detailed description of the wet out process. Include tube and resin manufactures wet out recommendations including the roller gap, material feed speed and vacuum requirements for each liner size and thickness. If wet out occurs off-site, provide certification by the person in responsible charge that the entire wet out process including handling and delivery to the site followed the defined procedures.~~
- ~~Detailed narrative description and sketches to describe all proposed manhole preparation, modification, preservation, and restoration activities.~~
- ~~A letter identifying the cleaning methods Contractor plans to employ to remove sediment, debris, grease, scale, encrustation, mineral deposits, and roots throughout the gravity pipe to be lined and in the structures to be repaired. The letter shall include a detailed explanation of the cleaning process and a schedule of activities, references where Contractor has used the identified cleaning method successfully in the past and a list of the actions to mitigate any impact to the public during the cleaning operation.~~
- ~~A plan for the process of removing resin impregnated uncured liner from the host conduit, including protection of the host system from escaping resin.~~

- ~~Independent third party test results for the gravity CIPP product for approval supporting the structural performance (short-term and long-term) of the product. Test samples shall be prepared so as to simulate installation methods and trauma of the product.~~
- ~~Statement of experience of the manufacturer's representative(s) who will be on site during the work.~~
- ~~Resin manufacturer installation procedures including curing and cooling temperature and time requirements and sequences.~~

~~Submit to the Engineer for review, 14 calendar days prior to fabricating the CIPP tube, a stamped design of the proposed CIPP liner according to 00150.35. Provide a design meeting the requirements of 00410.06. Detailed calculations shall confirm the liner thickness for the proposed resin system. List all assumptions, design criteria, and material characteristics whether they are based the information in the specification, plans, and Agency provided materials or not.~~

~~Submit to the Engineer property owner notification records five calendar days prior to beginning installation.~~

~~Submit a log of the actual volume of resin used prior to Second Notification.~~

~~00410.06 CIPP Design Parameters~~ ~~- Follow the design considerations of ASTM F 1216 and meet the following conditions and parameters:~~

~~Condition~~	~~Parameter~~
~~Service Life~~	~~Greater than 50 year~~
~~Pipe Conditions~~	~~Fully deteriorated~~
~~Load Conditions~~	
~~Soil~~	~~*~~
~~Traffic~~	~~*~~
~~Groundwater Elevation~~	~~*~~
~~Design Thickness~~	~~Calculate and express this thickness as the absolute minimum thickness that will be acceptable (Minimum thickness allowed is 1/4 inch)~~
~~Pipe Ovality~~	~~*~~
~~Modulus of Soil Reaction~~	~~*~~
~~Enhancement Factor~~	~~*~~
~~Long-term Flexural~~	
~~Strength~~	~~50% of initial (ASTM D 790)~~
~~Modulus of Elasticity~~	~~50% of initial (ASTM D 790)~~
~~Maximum Deflection~~	~~5%~~
~~Minimum Factor of Safety~~	~~2.0~~
~~Resin Migration Allowance~~	~~10% maximum~~
~~Allowable Deformity~~	~~*~~

~~* These parameters will be listed in the Special Provisions.~~

~~Design the CIPP wall thickness to withstand all imposed loads, including live loads and, if applicable, hydrostatic pressure. Include considerations for ring bending, deflection, combined loading buckling and ovality in the design of the CIPP.~~

~~Materials~~

00410.10 Pipe - Furnish 8 inch to 12 inch nominal size HDPE pipe meeting the requirements of ASTM D 3035 and 02410.65 and having a minimum SDR of 17. At the date of installation, the HDPE materials shall not be more than 6 months old from the date of manufacture.

00410.11 CIPP Tube - Furnish CIPP tube that consists of one or more layers of absorbent non woven felt fabric meeting the requirements of ASTM F 1216, Section 5.1, ASTM F 1743, Section 5.2.1 and the following minimum standards:

Characteristic	Test Method	Polyester Resin	Vinylester and Epoxy Resins
Flexural Strength	ASTM D 790	4,500 psi	5,000 psi
Flexural Modulus of Elasticity	ASTM D 790		
Short-term		250,000 psi	400,000 psi
Long-term		125,000 psi	200,000 psi

Fabricate the tube to a size that when installed, conforms to the internal circumference and length of the original pipe. Make allowance for circumferential or longitudinal stretching during inversion.

Provide flexible tubing exhibiting the following characteristics:

- Be homogeneous across the wall thickness containing no intermediate or encapsulated elastomeric layers.
- No part of the tube shall be less than 100 percent saturated by resin.
- Shall have a relatively uniform thickness that when compressed at the installation pressures will equal or exceed the calculated minimum design thickness.
- Shall not contain material that may cause delamination in the cured CIPP.
- Shall be coated with an impermeable, flexible material on the outside layer of the tube (before inversion).
- Seams shall be stronger than the non-seamed felt material.

00410.12 CIPP Resin - Furnish CIPP resins meeting the requirements of ASTM F 1216, Section 5.2 and ASTM F 1743, Section 5.2.3. The resin installed CIPP liner system shall produce a CIPP that will comply with the structural requirements specified and be inert with respect to the flow media in the gravity pipe.

Provide resin that is compatible with the rehabilitation process, is able to cure in the presence or absence of water, and has an initiation temperature for cure as recommended by the resin manufacturer. Provide a general purpose or enhanced strength unsaturated, thermosetting, polyester, vinylester, or epoxy resin and a catalyst system compatible with the installation process.

Use a sufficient quantity of resin for tube impregnation to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. Use a serial vacuum impregnation process. Use a roller system to uniformly distribute the resin throughout the tube.

Color the resin with a pigment compatible with the resin system, as specified by the resin manufacturer, and reviewed by the Engineer. Submit documentation from the resin manufacturer specifically describing the chemical characteristics of the resin system, including allowable mixing, impregnation, and handling time, transportation and storage time, and recommended curing cycle including temperatures, pressures, and times.

~~The resin manufacturer's documentation shall also include maximum allowable time for handling the impregnated tube prior to insertion and the maximum allowable elapsed time from insertion to exotherm. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the physical properties of the resin, the resin manufacturer shall describe these measures and the time limits beyond which even these measures will not prevent alteration of the physical properties of the resin.~~

- Service connection details and product information.
- Property notification fliers.
- Host pipe point repair plan, including methods and equipment.
- Sewer cleaning methods and location of debris disposal facility.
- Bypass and flow diversion plan according to 00490.40.

Submit pre-installation video inspection and reports 7 calendar days before beginning pipe lining work.

Submit post-installation video inspection reports.

Equipment

00410.20 ~~Pipe Bursting, Fusion, and Pipe Assembly~~By-pass Pumping Equipment - ~~Use~~Provide pumps, hoses, manifolds, and associated equipment~~, approved by the pipe manufacturer and the Engineer, designed for pipe bursting, slip lining, and butt fusion welding. Do not use copper or copper-alloy heating faces~~ meeting requirements of 00490.40.

~~Labor~~

00410.~~30 Personnel Qualifications~~22 Pipe Cleaning Equipment - ~~Operate butt fusion~~Provide equipment ~~with technicians who have been certified by the pipe manufacturer and who have a minimum of two years experience of butt fusion welding eight inch or larger diameter pipe liners~~specifically designed for cleaning sanitary and storm sewers. Provide special cutting and grinding attachments required to remove obstructions from host pipe before lining.

~~Operate pipe bursting and insertion equipment with technicians who have a minimum of three years experience in the installation of HDPE pipe using slip lining technology and pipe bursting lining technology as appropriate.~~

~~**00410.31 CIPP Personnel** - Perform CIPP installations with installers who are qualified, fully licensed, and certified by the manufacturer of the CIPP product system to be used on the Project. In addition, the installer shall have installed at least 50,000 feet of the CIPP product system.~~

~~Provide a manufacturer's representative with a minimum of two years experience with continuous in line mixing, wet out, and curing of CIPP in gravity pipes.~~

~~The manufacturer's representative shall be on-site during the initial CIPP wet out and cure. At other times when the representative is not on-site, provide the telephone number of a manufacturer's representative who is available on a 24 hour basis throughout the Project duration.~~

00410.23 Debris Transport Equipment - Provide equipment specifically designed to contain and transport debris removed from sewers.

Construction

00410.40 General - Handle and store all HDPE pipe to ensure that the pipe is not cut, gouged, scored, or otherwise damaged. Store the pipe so that it is not deformed axially or circumferentially. Before installing the pipe, inspect all liner pipe to verify its condition with the Engineer. Cut out and remove from the site liner pipe segments with cuts, gouges, or scoring in the pipe wall exceeding 10% of the wall thickness. File a pipe condition inspection report with and receive approval from the Engineer prior to installation.

For CIPP rehabilitation, remove all existing lateral taps that protrude into the existing pipeline prior to beginning cleaning.

00410.41 Pipe Joining - For approval of butt fusion welds, submit three qualification samples for each size of pipe liner to be welded. Make samples using the same materials, equipment, and methods to be used on the Project. Construct the test welds in the presence of the Engineer. Joint strength shall be equal to that of the adjacent pipe and the pipe bead (1/8 inch to 3/16 inch in height) and be uniform and continuous around the entire circumference of the pipe, both inside and outside.

Use only cotton or other non-synthetic cloths to clean the inside and outside of pipe liner ends before welding.

Join sections of HDPE pipe liner in continuous lengths on-site above ground. Use butt fusion methods according to ASTM D 2657, Section 8 and the recommendations of the pipe liner manufacturer. Follow the cold weather procedures at all times. Electrofusion may be used for field closures as necessary when appropriate fusion equipment can be utilized in a trench type environment. For end sections or tail pipe, utilize electrofusion couplings.

00410.42 Pipe Cleaning00410.40 General - Verify existing host pipe diameter, length, and condition before ordering materials.

00410.41 Pipe Cleaning - Flush and clean all parts of the existing gravity pipe system to remove all debris and obstructions. In addition, for host pipes repaired by CIPP, remove all mineral deposits, encrustation and grease.debris and foreign material. Cleaning methods may include washing with high-pressure water, mechanical removal, sandblasting of the walls, entry with hand tools, or other methods as approved by the Engineer.. Do not use chemicals without written approval of the Engineer.

Transport and dispose of all material removed from the host pipe to an approved disposal facility. Do not dispose of material back into the collection system.

Conduct work that prevents blockage and minimizes surcharging in the sewer manholes and connecting sewer pipelines. Promptly repair damage to existing facilities as a result of the Contractor's work at no additional cost to the Agency.

00410.42 Dye Testing - Verify service connections as shown or directed using an inert water coloring dye. Document results of dye testing showing the location and activity status of each connection tested. Coordinate access the properties and structures on which to perform dye testing and connection verification.

00410.43 Pre-InstallationConstruction Video Inspection - After cleaning, inspect the existing gravity pipe by , perform pre-construction video inspection according to 00445.74 using personnel trained in locating breaks, obstacles, and service connections by video inspection. Prepare printed inspection reports that show the location in relation to

~~an adjacent manhole of each infiltration point observed during inspection. In addition, note other points of significance such as locations of gravity pipe service connections, unusual conditions, roots, storm gravity pipe connections, sags, collapsed pipe sections, and broken pipe. Provide the video and inspection reports to the Engineer for review at least seven calendar days prior to beginning CIPP installation, pipe bursting, and slip lining operations. Some conditions noted in the inspection report may need to be corrected before continuing with the gravity pipe rehabilitation.~~

~~**00410.44**~~Section 00415.

00410.44 Host Pipe Preparation - Before installing the liner remove obstructions and perform pipe repairs as shown or as required by the lining method.

00410.45 Property Notification - Notify all affected properties in writing 1 week before installing the pipe lining. Notify all affected properties in writing 24 hours before any service interruption. When work has been stopped for at least 7 calendar days, notify all affected properties again 24 hours before resuming work. Make personal contact with any property that cannot be reconnected within the time stated in the written notice. Obtain permission from the property owner before entering private property.

00410.46 Bypass Pumping and Flow Diversion - Perform bypass pumping according to 00490.40. Contain or divert flows from service lines until reconnected.

00410.47 Structure Restoration - Seal all holes and voids in manhole and structure walls immediately surrounding the new liner. Provide a smooth transition between the existing structure channel invert and the liner.

Reinstall manhole cones, slabs, grade rings, frames, covers, inverts, and reconstruct benches and channels after each pipe liner installation. Replace manhole steps removed for liner installation with new steps, as shown. Repair holes resulting from removal of existing steps as approved.

00410.48 Surface Restoration - Restore damaged surfacing according to 00495.

Finishing, Cleaning Up, and Testing

00410.70 General - After completing each manhole to manhole section and before connecting service lines, flush and clean all parts of the system by removing all debris from the pipe.

00410.71 Testing - Conduct pipe testing according to 00445.72 and 00445.73.

00410.72 Post-Construction Video Inspection - After completing each manhole to manhole section of pipe liner installation, service reconnections, finish work, and final cleaning, perform post-construction video inspections according to Section 00415.

00410.73 Repairs - Perform repairs according to 00415.70(c).

Section 00411 - Pipe Bursting and Slip Lining

Description

00411.00 Scope - This work consists of furnishing and installing high density polyethylene (HDPE) pipe in gravity sewer pipe by the pipe bursting and slip lining methods.

00411.01 Submittals - In addition to the submittals described in 00410.03, submit the following 10 calendar days before the preconstruction conference.

- Method of pipe bursting, including listed equipment by size, make, model and manufacturer.
- Method of slip lining, including listed equipment by size, make, model and manufacturer.

Materials

00411.10 Pipe - Furnish high molecular weight, high-density polyethylene pipe and fittings that are made from virgin grade material, to the diameter specified, and to tolerances meeting the requirements of ASTM F 714 with a minimum ratio of orthogonal diameters, before installation, of 0.95.

(a) Markings - Provide pipe materials that are legibly marked, by the pipe manufacturer, with the following information:

- Name and trademark of manufacturer.
- Nominal pipe size.
- Dimension ratio.
- The letters PE followed by the polyethylene grade according to ASTM D 1248, followed by the hydrostatic design basis in hundreds of psi.
- Manufacturing standard reference.
- A production code from which the date and place of manufacture can be determined.

(b) Pipe Color - Provide uniformly colored black or gray pipe.

(c) Dimension Ratio - Provide nominal 8 to 18 inch sized pipe having a minimum dimension ratio (DR) of 17.

00411.11 Service Connections - Furnish lateral service connections to the sewer main with manufactured gasketed tees, electrofusion saddle tees, or approved equal that provide water-tight connections between the rehabilitated sewer main and the service line connection.

Equipment

00411.20 Pipe Bursting, Fusion, and Pipe Assembly Equipment - Use equipment, approved by the pipe manufacturer and the Engineer, designed for pipe bursting, butt fusion, and saddle fitting welding. Use heating faces that have a non-stick coatings. Provide joining equipment capable of attaining appropriate fusion temperature, alignment, and pressure.

Use manufacturer's recommended pipe bursting tools for the diameter of pipe to be installed, as well as the diameter and material of pipe to be replaced.

Labor

00411.30 Personnel Qualifications - Provide installers that are certified by the manufacturer and have at least 2 years of experience of butt fusion welding of 8 inch and larger diameter pipes. Provide a supervisor with the same certification as the installers in addition to having installation experience on at least 50,000 feet of 8 inch and larger diameter pipes.

Construction

00411.40 Pipe Joining - Perform joining methods meeting the requirements of ASTM F 2620 and the pipe manufacturer's recommendations, or as approved.

Perform full penetration welds that provide a homogeneous material across the entire cross section of the weld. Remove fusion beads greater than 1/16" on the inside of the pipe using an approved cutting device.

Perform trial fusion welds in the field and provide samples before installation of the pipe. Use the same fusion machine that was used in the trial welds for the final welds incorporated into the work.

Electrofusion may be used for field closures as necessary when fusion equipment can be utilized in a trench type environment.

Other joining methods may be used if the pipe material is selected from the QPL.

00411.41 Receiving Pits and Insertion Pits - Locate all pits to suit the specified pipe lining operation. Use existing manholes where practical. Remove manhole inverts, benches, and channels to permit access for installation equipment. Enlarge the input and output pipe openings if required to accommodate the maximum outside diameter size of the insertion equipment. Do not put undue stress on existing structures. Reinstall inverts and reconstruct benches and channels after pipe liners have been installed.

In areas where new manholes are not being installed or existing manholes are not available, excavate and restore pits at no additional cost to the Agency. ~~This may include providing a new manhole if an existing manhole is removed or damaged.~~

~~**00410.45 Property Owner Notification** - Notify all affected parties in writing 24 hours prior to beginning pipe liner installation. When work has been stopped for at least seven calendar days, notify all affected parties again 24 hours prior to resuming work. Make personal contact with any party that cannot be reconnected within the time stated in the written notice. Before entering private property, obtain permission from the property owner.~~

~~When it is necessary to shut down a private service lateral to perform the rehabilitation work, notify all the affected parties one week prior to and again 24 hours prior to the shutdown. Gravity pipe service shall not be out of service for more than eight hours and not between 6:00 p.m. and 8:00 a.m.~~

~~**00410.46 Bypass Pumping** - Provide a standby bypass pump on-site. Provide bypass pumping consisting of furnishing, installing, and maintaining all power, primary and standby pumps, appurtenances, and bypass piping required to maintain existing flows and services. Notify the Engineer 24 hours prior to commencing the bypass pumping operation.~~

~~Pump the flow in an enclosed hose or pipe that is adequately protected from traffic, and redirect the flow into a sanitary gravity pipe system for sewage flow and into a storm gravity pipe for storm drainage flow. Dumping, spilling, backup, or free flow of sewage on private property, gutters, streets, sidewalks, or into storm gravity pipes is not allowed. The Contractor is liable for all~~

~~cleanup, damages, and resultant fines in the event of a spill. After the work is completed, return flow to the replaced gravity pipe and remove all temporary equipment.~~

~~Pump out or otherwise positively drain all locations, a minimum of once every 24 hours, where the gravity pipe service is disconnected from the main gravity pipe for more than one day. Use more frequent pumping in locations where flows exceed the capacity of temporary storage provided.~~

~~Bypass or contain all gravity pipe service lateral connections from the time of disconnection to the time of reconnection by means of mechanical pumps and manifold system or by a bladder tank system, capable of holding adequate sewage from each gravity pipe service connection for a period of 24 hours. Empty or pump each bladder each 24 hour period and properly dispose.~~

~~Equip pump engines in a manner that keeps the pump noise to a minimum and comply with 00290.32.~~

~~Make temporary tie ins and remove the bypass plugs between the relined section and the existing system at the end of each working day.~~

~~**00410.47 Sags in Line Repair** - If the pre-installation video inspection reveals a sag in the existing gravity pipe greater than one-half the diameter of the existing pipe, install replacement pipe such that it has an acceptable grade without sags. Take necessary measures to eliminate these sags by replacing the pipe, or digging a sag elimination pit and bringing the bottom of the pipe to a uniform grade in line with the existing pipe invert, or by other measures that are acceptable to the Engineer.~~

~~**00410.48 Point Repairs** - Repair the pipe where point repairs are shown. If the pre-installation video inspection reveals an obstruction that cannot be removed by conventional gravity pipe cleaning, upon approval from the Engineer, make a point repair to uncover and remove or repair the obstruction prior to lining. Point repairs not shown will be paid for as Extra Work when approved by the Engineer.~~

~~**00410.49**~~**00411.42 Installation:**

(a) Pipe Bursting ~~**and Lining**~~ - Break existing pipe by utilizing a constant tension system with a hydraulic or pneumatic bursting device that breaks away the pipe. A static "cone cracking" method may be used~~, but only by advancing the mole bursting head with~~ if approved. Create a ~~"solid steel tow rod" pulled by a constant tension hydraulic pulling wrenching system. The advancement of the bursting mole head with a chain is not allowed. The~~ void ~~created by the bursting device shall be~~ of sufficient size to accommodate the ~~HDPE~~ pipe. ~~Install the HDPE pipe immediately after the void has been formed by bursting.~~ Continue pipe bursting and lining without interruption ~~from one manhole to another manhole~~for the entire pipe segment unless ~~the Engineer allows~~ otherwise approved. Extend the ~~HDPE~~ pipe 12 inches into the manhole or concrete structure ~~past the inside wall~~ to allow for ~~pipe initial~~ contraction/relaxation after installation.

(b) Slip Lining - ~~Excavate, expose, and isolate all service line connections prior to replacing the existing gravity pipe.~~

~~Connect a fabricated pulling head to the leading end of the HDPE pipe that is positioned on rollers. Connect a power winch cable to the pulling head so the HDPE pipe can be pulled into the existing gravity pipe. Extend the HDPE pipe 12 inches into the manhole or structure past the inside wall to allow for pipe initial contraction/relaxation after installation.~~

~~**(c) CIPP** - Install CIPP according to ASTM F 1216 Section 7, ASTM F 1743 Section 6, and the manufacturer's recommendations.~~

~~**(1) General -** Where practicable, liners may be installed in continuous runs through manholes where there are two of more continuous gravity pipe segments requiring lining, especially to connect several short segments with continuous lining.~~

Do not ~~allow the temperature of water discharged from processing liners to exceed the level allowed by State or local requirements.~~

~~Furnish one additional operational robotic cutter assembly train and key spare components on-site on a continuous basis as a "stand-by" unit in the event of primary equipment breakdowns.~~

~~**(2) Pipe Liner End Seal** - Install a joint seal at the ends of the new pipe~~ score or damage the liner ~~to the rehabilitated host pipe connection to prevent water movement~~pipe during the installation process. Fill annular space between the ~~two systems. Apply a cementitious grout at this joint if the pipe~~ new liner ~~fails to provide a tight seal because of broken or misaligned pipe at the liner ends. The grout shall be compatible with the pipe liner material, provide a watertight seal and be subject to the approval of the Engineer. Perform sealing at no additional cost to the Agency.~~

~~**00410.50 Service Line Reconnection:**~~

~~**(a) Pipe Bursting and Lining and Slip Lining** - Reconnect all service line connections after the pipe air tests have been performed and accepted. Connect service lines to the HDPE pipe using electrofusion saddle type fittings.~~

~~**(b) CIPP** - Reconnect all service line connections after the liner has been fully cured and air tests have been performed and accepted. Use an~~ and the host pipe as approved ~~internal cutting device and television camera to restore service connections to the full diameter of the service~~.

~~**00410.51 Manhole and Structure**~~ **00411.43 Connections:**

(a) ~~**Pipe Bursting and Lining and Slip Lining**~~**General** - After completing the ~~HDPE pipe~~ installation, allow ~~a minimum of 12 hours to elapse to allow~~ the pipe to stabilize ~~prior to~~ for at least 12 hours before making the final connections ~~to~~.

(b) Manholes - Make all connections to concrete manholes ~~and~~, structures~~. Install a water stop or flange adapter, at each connection, that is fused and seated perpendicular to the pipe liner axis around the pipe liner exterior, and grouted into the concrete structure or manhole wall to create a watertight seal~~, and pipelines using slip-on sanded adaptors.

~~**(b) CIPP** - Seal all holes and voids in manhole and structure walls immediately surrounding the new liner with a hydrophilic rubber joint seal and chemical grout.~~

(c) Service Line - Reconnect all service lines as approved after the air tests have been performed and accepted.

Finishing~~, Clean~~ and Cleaning Up ~~and Testing~~

~~**00410.70 General** - After completing each manhole to manhole section and prior to connecting service lines, flush and clean all parts of the system by removing all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the pipe. Conduct air tests according to 00445.72(c). Plug the ends with gasketed caps or plugs securely fastened or blocked to withstand test procedures. If the tested section is acceptable, reconnect service lines using electrofusion saddle type fittings.~~

~~**00410.72 Post-Installation Video Inspection** - After completing each manhole to manhole section of pipe liner installation, service reconnections, finish work, and final cleaning, perform a video inspection of the pipe and make a written report according to 00445.74. Provide printed reports and the original video to the Engineer.~~

~~Notify the Engineer at least 48 hours in advance of post-installation video inspection. The Engineer may observe the inspection. Inspect all completed work, including detailed inspection of all service line reconnections, and as directed.~~

~~**00410.74 Repairs** - For CIPP, repair leaks and remove and repair wrinkles, blisters, dry spots in resins, and other defects in the finish pipe as directed and at no additional cost to the Agency.~~

~~**00410.75 Warranty** - Furnish a Warranty for the CIPP according to 00170.85(b-1), for a Warranty period of one year. The Warranty period will start at the issuance of the Third Notification.~~

~~For purposes of the Warranty, the CIPP will be deemed to have failed when:~~

- ~~Leakage through the liner or between liner and pipe is detected~~
- ~~Reduction of the liner thickness is more than 10 percent~~
- ~~There is any separation of the liner from the existing pipe~~

~~The Warranty shall recite that, upon written notification by the Agency, that the CIPP or portions of the CIPP have failed, the Contractor will repair and replace the liner or portions of the liner within 6 months of the Agency's written notification.~~

~~Provide materials and use procedures to repair and replace failed liners that meet the specifications in effect at the time of original installation, or if no longer available, use current CIPP specifications.~~

00411.70 Manhole Base Reconstruction - Reconstruct manhole bases by removing the existing base and constructing a new base with a finished surface no higher than 6 inches below the outside portion of the lowest pipe outflow. Shape new smooth, depression free channels to the elevation shown. Remove the bottom manhole step as required for the new base. Do not damage existing manhole walls or existing pipes. Repair all cracks with non-shrink grout.

Measurement

~~0041~~00411.80 Measurement - ~~Work performed under this Section will be measured according to the following:~~

~~**(a) Pipe Liners** -~~The quantities of ~~installed~~ pipe ~~liners~~bursting and the quantities of slip lining of the various kinds, types, and sizes will be measured on the length basis. The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, structures, special sections, or the ends of pipe, whichever is applicable.

~~**(b) Sag Repair** -~~The quantities of ~~sag repair will be measured on the length basis, to the nearest foot.~~

~~**(c) Point Repairs and Service Line Reconnections** - The quantities of point repairs and~~ service line reconnections will be measured on ~~the~~a unit basis, regardless of size.

~~**(d) Video Inspection** - The quantities of video inspection will be measured on the length basis, to the nearest foot. The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, structures, special sections, or~~

~~the ends of pipe, whichever is applicable. Measurement will be made twice, once for pre-installation video inspection and again for post-installation video inspection.~~

Payment

~~0041~~00411**.90 Payment** - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Pipe Bursting~~ and HDPE Liner~~, _____ inch.	Foot
(b) ~~HDPE Liner~~Slip Lining, _____ inch	Foot
~~(c) CIPP Liner, _____ inch~~	~~Foot~~
~~(d) Sag Repairs~~	~~Foot~~
~~(e) Point Repairs~~	~~Each~~
(f) Service Line ~~Reconnection~~ Reconnections	Each
~~(g) Pipe Lining Video Inspection~~	~~Foot~~

In items (a) and (b), the nominal size of the new ~~HDPE~~ liner pipe will be inserted in the blank.

~~In item (c), the nominal size of the existing pipe will be inserted in the blank.~~

~~Item (g) includes pre-installation video inspection and post-installation video inspection.~~

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00412 - Cured-in-Place Pipe Lining

Description

00412.00 Scope - This work consists of rehabilitating existing pipes by furnishing and installing pipe liners by cured-in-place pipe (CIPP) lining methods as shown.

00412.01 Submittals - In addition of the submittals described in 00410.03, submit the following 10 calendar days before the preconstruction conference:

- Certification by the lining system manufacturer that the installer is licensed and certified as competent to perform the work.
- Documentation showing the installer meets the qualifications listed in 00412.30, and a list of the key qualified personnel who are assigned to work on this project.
- Certification that manufacturing processes operate under a quality management system according to recognized industry standards.
- Certification of test results confirming that the CIPP liner system meets the minimum chemical resistance requirements according to ASTM F 1216 and ASTM F 1743.
- Catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of system components of the tube and resin system. Include manufacturer's recommendation for handling, storage, insertion, curing, trimming, finishing, and repair of damaged liner.
- Calculations for the volume of resin to be used for each segment and detailed description of the wet out process. Include tube and resin manufacturers wet out recommendations including the roller gap, material feed speed and vacuum requirements for each liner size and thickness.
- End seal material to be used, and method of installation. If a grout sealing method is proposed or suggested, provide certification from the grout manufacturer or supplier that the grout material for sealing structures and service laterals is compatible with the proposed resin and liner system and is suitable for use in aqueous environments.
- Sampling and testing plan for physical properties according to ASTM F 1216 and ASTM F 1743, including name and location of laboratory performing testing on installed liner system. Provide certification that each test shall be performed by a laboratory with appropriate accreditation for the specific test to be performed.
- Stamped design of the proposed CIPP liner system according to 00150.35 and 00412.02.

Upon liner system delivery, submit wet-out logs documenting resin volumes used.

00412.02 Design Parameters - Follow the design considerations of ASTM F 1216 and meet the following:

Condition	Parameter
Service Life	Greater than 50 year
Pipe Conditions	Fully deteriorated
Load Conditions:	
Soil	*
Traffic	*
Groundwater Elevation	*
Pipe Ovality	*
Modulus of Soil Reaction	*
Enhancement Factor	7.0
Long-term Flexural:	

Strength.....50% of initial (ASTM D 790)
Modulus of Elasticity.....50% of initial (ASTM D 790)
Maximum Deflection 5%
Minimum Factor of Safety..... 2.0

* Parameters will be listed in the Special Provisions.

Materials

00412.10 Tube - Furnish tubing that consists of absorbent non-woven felt fabric meeting the requirements of ASTM F 1216, Section 5.1 and exhibits the following characteristics:

- A smooth, impermeable, bonded coating on the inside of the finished pipe.
- Sewn or bonded seams, stronger than non-seamed material, as recommended by the tube manufacturer.
- No allowable delamination in the cured CIPP.

Verify pipe lengths and pipe diameters before ordering tubing.

00412.11 Resin - Furnish resins meeting the requirements of ASTM F 1216, Section 5.2, or ASTM F 1743, Section 5.2.3. Comply with the structural requirements specified for the installed liner system.

Furnish thermosetting polyester, vinylester, or epoxy resin and a catalyst system compatible with the installation process, and is able to cure in the presence or absence of water. Color the resin with a pigment compatible with the resin system.

00412.12 Liner Properties - Furnish liners that have the minimum physical properties stated in ASTM F 1216, ASTM F 1743 and ASTM D 2990, and are also resistant to chemical properties and flow characteristics typically found in municipal sanitary sewer flows. Fabricate the liner to a size that when cured, will tightly fit the pipe being rehabilitated. The finished liner system shall be homogeneous across the wall thickness containing no intermediate or encapsulated elastomeric layers.

Characteristic	Test Method	Epoxy/Vinylester	Polyester Resin
Initial Flexural Strength	ASTM D 790	5,000 psi	4,500 psi
Initial Flexural Modulus of Elasticity	ASTM D 790	400,000 psi	250,000 psi (min.)

Labor

00412.30 Personnel Qualifications - Provide installers who:

- Are licensed, and certified by the manufacturer of the CIPP product system to be used on the Project.
- Have at least 3 years of active experience in the installation of CIPP.
- Have installed at least 50,000 feet of CIPP in similar conditions.

Construction

00412.40 General - Handle and store all liner material to ensure that the material is not torn, cut, exposed to direct sunlight or otherwise damaged. Before installing the liner, verify its condition with the Engineer. If any part of the liner material becomes torn, cut, or damaged before or during insertion, repair or replace it at no additional cost to the Agency before proceeding further.

00412.41 Installation - Install CIPP according to ASTM F 1216 Section 7, ASTM F 1743 Section 6, and the manufacturer's recommendations.

(a) General - Liners may be installed in continuous runs through manholes where there are two or more continuous host pipe segments requiring lining.

Provide temporary downstream dams or filtration measures in the pipeline to catch excess resin and construction debris.

Do not allow the temperature of water discharged from processing liners to exceed the level allowed by State or local requirements.

Provide a "back-up" robotic cutter assembly train and key spare components on-site during CIPP lining activities.

(b) Pipe Liner End Seal - Install an end seal when reconnecting to the rehabilitated host pipe.

00412.42 Service Line Reconnection - Reinstate active service laterals using an internal cutter. Open hole to a minimum of 95 percent, but do not exceed 105 percent of the service lateral diameter. Make each connection free from burrs or projections, and with a smooth and crack-free edge.

Finishing, Cleaning Up, and Testing

00412.70 General - Remove temporary dams or filtration measures after work is complete and pipe is clean and restored.

00412.71 Material Sampling and Testing - Obtain samples and perform material testing according to ASTM F 1216 and ASTM F 1743. Perform one physical properties test per 1,000 feet installed, or as specified.

00412.72 Repairs - Before making repairs, provide the CIPP liner system manufacturer's recommendations for liner repairs, subject to approval. Repair or replace CIPP liners that have:

- Wrinkles, fins or other discontinuities in the lower one-third of the pipe that are perpendicular to the flow and exceed 1/2 inches in height, or are greater than 3 percent of the host pipe inside diameter.
- Wrinkles, fins or other discontinuities in the upper two-thirds of the pipe that are perpendicular to the flow and are greater in height than 5 percent of the host pipe inside diameter.
- Blisters or dry spots present.
- Leakage through the liner in excess of ASTM F 1216 and ASTM F 1743 standards.
- Separation of the liner from the host pipe.
- Delamination of CIPP layers.

00412.75 Warranty - A 1 year Contractor warranty, according to 00170.85(b-1), is required for the CIPP work.

Make all repairs and replace the liner or portions of the liner within 6 months of the Agency's written notification of failure of an item.

Furnish materials and use procedures to repair and replace failed liners that meet the specifications in effect at the time of original installation, or if no longer available, use current CIPP specifications.

Measurement

00412.80 Measurement - The quantities of installed CIPP liners, of the various kinds, types, and sizes, will be measured on the length basis. The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, structures, special sections, or the ends of pipe, whichever is applicable.

The quantities of service line reconnections will be measured on the unit basis, regardless of size.

Payment

00412.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) CIPP Liner, _____ inch	Foot
(b) Service Line Reconnections	Each

In item (a), the nominal size of the host pipe will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00415 - Video Pipe Inspection

Description

00415.00 Scope - This work consists of cleaning 4 inch to 72 inch in diameter pipes and inspecting them using video and related electronic equipment and making a recorded narrative and written report of the findings.

Equipment

00415.20 Mainline Inspection Equipment - Use the following equipment unless otherwise approved.

(a) Camera and Lighting - Use a digital color video camera equipped with an illumination devise that provides clear and sharp images with all pipe sizes and material types. The camera and lighting are capable of operating in 100% humidity conditions with ability to pan and tilt 275° and rotate 360°.

(b) Footage Meter - Provide on the recorded video a footage meter displaying footage in tenths of feet and indicating the camera's position from its starting point. Calibrate the footage meter to be accurate within 2 feet per 1,000 feet.

(d) Drive Device - Use tractors, manual winches, power winches, video cable, powered rewinds, self-propulsion, or other devices that do not obstruct the camera view. Maintain the camera along the approximate center vertical axis of the pipe at all times.

00415.21 Service Line Lateral Inspection Equipment - Use the following equipment unless otherwise approved.

(a) Push Camera - Provide a portable camera system that can be manually inserted into service line laterals. The imaging capabilities and illumination requirements for the push camera system are similar to 00415.20(a). Provide a hand-held push camera on site at all times.

(b) Lateral Launch Camera - Provide a camera component as part of the mainline video inspection system that can be launched into a service line lateral connection while inspecting mainline. The lateral launch camera is capable of inspecting the length of the lateral from the mainline connection to beyond the edge of the right-of-way. The imaging capabilities and lighting requirements for the lateral launch camera system are similar to 00415.20(a).

(c) Electronic Location Device - Provide a radio transmitter that can be attached to the video camera system that can be detected from the surface to determine the horizontal and vertical position of the pipes below ground. Provide a locator device on site at all times.

Construction

00415.40 General Video Inspection:

(a) Notice and Access - Notify the Engineer a minimum of 48 hours before beginning cleaning or video inspection. Allow access to the Engineer at all times to observe the video monitor and all other operations.

(b) Cleaning - Install a screen to catch debris at the downstream end of the pipe run. Clean the pipe of obstructions that will impede video inspection. Avoid causing damage to pipe while completing the cleaning operation. Remove and dispose of solid debris according to 00290.20.

(c) Inspection - After cleaning, pre-charge the pipe with clean water to assist in locating bellies and deformations of the pipe. Control the flow into the segment to be inspected. If required, perform bypass pumping according to Section 00490. Perform continuous video inspection while pipe remains clean. Video inspect pipes one segment at a time. Do not move the camera at a speed greater than 30 feet per minute. Move the camera through the line in either direction stopping, panning or tilting as necessary to permit documentation of the pipe's condition including the location of all lateral connections, additional connections to the mainline and other characteristics. Stop and inspect joints as directed in the Special Provisions.

If, during the inspection operation, the camera will not pass through the entire segment, set up equipment so that the inspection can be performed from the opposite access point back to the obstruction.

(d) Narrative and Extent of Inspection - Provide a verbal narrative description on each video inspection recording. Include the following minimum information in the narrative: the beginning and the end of the video, the site location or street address, access point identifications, the total footage of the pipe inspected, the company name, the operator's name and the date, time and weather conditions.

Make note of all joints, lateral connections, and other conditions within the pipe.

(e) Footage Metering - Begin all video inspection with the footage meter set to zero and begin video inspection from the middle of the access point. Provide accurate on-screen distance measurements in the video recording. Ensure that the footage information on the recorded video corresponds to the footage references in the written inspection report.

(f) Recording Format and Labeling - Record the video inspection using an approved file format.

Furnish recordings on an approved media storage device including a text file to indicate the project number and name, date of inspection, pipe segment number, Contractor's name and whether it is a pre-construction or post-construction video, filenames, and description of file contents.

(g) Continuity, Image and Audio - Record video continuously, without editing or starts and stops, in color from the beginning to the end of each pipe segment. Ensure that the pipe image is free of visual distortions and appears level and centered in the pipe being inspected. Ensure that the audio portion of the composite video recording is sufficiently free from electrical interference and background noise to provide complete clarity of the narrative description.

(h) Video Inspection Recording and Written Inspection Report - Furnish one copy of all pre-construction and post-construction video inspection reports and video recordings within three days after completing the inspections or as specified. All accepted video recordings, inspection reports, and any related information become the property of the Agency.

Include in the written report the location in relation to an adjacent access point for each feature observed during inspection. Include other points of significance including locations of building pipes, unusual conditions, roots, location and depth of pipe sags, all connections, pipe material and size, and broken pipe. Ensure that the footage information on the recorded video corresponds to the footage references in the written inspection report.

00415.41 Pre-Construction Video Inspection:

(a) Types of Inspection - Perform the following pre-construction video inspections:

- For new pipe installations, one inspection of service line laterals with a push camera.
- For existing pipe installations, one inspection of the mainline.

(b) Mainline Inspection - Clean and complete video inspection of all existing mainline pipes and positively locate each lateral connection to the mainline as shown or directed.

(c) Lateral Inspection and Field Location - Locate and video inspect each lateral from its mainline connection to the edge of the right-of-way or to a distance as specified or directed. Use an electronic location device to verify the path of the lateral. Use marker paint to record the alignment of the lateral on the ground. Indicate where the lateral crosses the right of way line.

For open-trench work, inspect laterals using a hand-held push camera. Have a hand-held push camera and a locator device on site for the project duration, whether or not it is used to complete the lateral inspection.

For trenchless work in mains with a diameter of 18 inches and less, use a lateral camera. The Engineer will view inspection as it is performed. For mains larger than 18 inches, use an approved method.

Record all information about its condition, live or abandoned service, length, distances to surface features, fittings, and all obstructions.

Finishing and Cleaning Up

00415.70 Post-Construction Video Inspection:

(a) Types of Inspection - Perform the following post-construction video inspections for new pipe installations and existing pipe installations:

- One inspection of the mainline.
- One inspection of service line laterals with a launch camera.

(b) Inspection of Completed Work - Video inspect all completed work according to 00415.40.

(c) Corrections to Deficiencies in Work - Each delivered video recording will be reviewed and any pipe deficiencies noted. Correct all pipe deficiencies that are revealed in the recording and written report within 48 hours after receiving notification. Re-perform the video inspection, submit the new video, and update the written report at no additional cost to the Agency.

Measurement

00415.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Mainline Video Inspection - Mainline video inspection will be measured on the length basis. The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, special sections, or the ends of pipe, whichever is applicable. Pipes with sloped ends will be measured from the top of the sloped end section.

(b) Service Line Lateral Video Inspection - Service line lateral video inspections, regardless of length, will be measured on the unit basis. When multiple service line laterals are connected to the mainline by a single shared connection, each service line lateral will be counted separately.

Payment

00415.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Mainline Video Inspection	Foot
(b) Service Line Video Inspection, Launch Camera	Each
(c) Service Line Video Inspection, Push Camera	Each

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for ~~additional testing, cleaning, and video inspection required as a result of correction of unsatisfactory work.~~:

- providing the hand-held push camera and locator device on site at all times
- excavation work
- restoration work

Section 00420 - Salvaging Pipe

Description

00420.00 Scope - This work consists of removing, cleaning, and stockpiling or relaying culvert pipe and other pipe.

Acceptable pipe, parts and special sections will be referred to as "salvaged".

Materials

00420.10 Materials - Furnish joint materials, connecting bands, and other materials required in relaying pipe meeting the requirements of ~~to~~ the Specifications for the type of pipe and materials involved. Salvaged material may be used if approved.

Construction

00420.40 Trench Excavation - Excavate and backfill trenches to remove pipe and to relay salvaged pipe according to Section 00405.

00420.41 Removal of Pipe - Excavate materials over the pipe, and remove, disassemble and clean the exposed pipe without damaging the pipe. Acceptable partial sections of pipe may be cut off for reuse.

00420.42 Stockpiling - Stockpile salvaged materials not used on the Project as directed.

00420.43 Relaying - Install salvaged materials at the locations, in the quantities designated, and conforming to Specifications for new installations. As directed, cut sections of salvaged pipe to obtain the length required for relaying. Make connections to new pipe, inlet and outlet structures, salvaged or new end sections, or other special sections as provided in the Specifications for new pipe installations.

Measurement

00420.80 Measurement - The quantities of salvaged pipe will be measured on the length basis, regardless of size, kind, or type that is removed, cleaned, and stockpiled or relaid. Stockpiled pipe will be measured from end to end of each pipe. Relaid pipe will be measured according to Section 00445.

The maximum depth to flow line for each run of relaid pipe will be determined along the pipe centerline, by measuring vertically from the flow line to the surface of the original ground, paved surface or subgrade and slopes of other excavations, whichever is less.

Payment

00420.90 Payment - The accepted quantities of salvaged, stockpiled, and relaid pipe will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Salvaging and Stockpiling _____ Pipe	Foot
(b) Salvaging and Relaying _____ Pipe, _____ Depth	Foot

In item (a), the nominal diameter of pipe will be inserted in the blank.

In item (b), the nominal diameter of the pipe will be inserted in the first blank, and the maximum flow line depth "5 feet", "10 feet", "20 feet", "over 20 feet" will be inserted in the second blank.

Payment will be payment in full for furnishing all materials, equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for removing, cleaning, transporting, and stockpiling or relaying the pipe or for excavation or backfill.

Section 00430 - Subsurface Drains

Description

00430.00 Scope - This work consists of constructing subsurface drains to the lines and grades shown or established using drain pipe, special filter material or granular drain material, and drainage geotextile.

00430.01 Descriptive Terms - The terms used in designating drain pipe or when referring to them on the plans are as follows:

Aluminum - The base metal for aluminum sheets.

Concrete, Steel, Aluminum, Polyethylene, Polyvinyl Chloride - The basic material of the pipe.

Drain Pipe - Perforated pipe of specified material.

Metal - Aluminum and steel.

Steel - The base metal for galvanized or aluminum coated sheets.

Subsurface Drain - Drainage system beneath the base, usually with a perforated drain pipe, to collect and drain groundwater.

00430.02 Contractor's Options - If the Contractor has an option of using different kinds of pipe, the option and its limitations will be shown on the plans or on a "Pipe Data" sheet of the plans.

The limiting factors and requirements shown on the plans or on the Pipe Data sheet are minimums. The Contractor may substitute stronger, larger, and higher quality material at any installation site, provided the substitution meets the approval of the Engineer and is made at no additional cost to the Agency.

00430.03 Size Determination - The nominal size of pipe will be determined according to AASHTO tolerances for pipe dimensions for the appropriate kind or class of pipe.

Materials

00430.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete	00440
Delineators	00840
Drainage Geotextile	02320
Perforated Concrete Pipe	02410.10
Perforated Corrugated Aluminum Alloy Pipe	02420.50
Perforated Corrugated Polyethylene Pipe	~~02410.60~~02415.10
Perforated Corrugated Steel Pipe	02420.30
Perforated Polyvinyl Chloride Pipe	~~02410.70~~02415.50
Protective Coatings	02420.20
Special Filter Materials	02610.10

Furnish wire mesh that is commercial quality 1/4 inch galvanized metal screening.

00430.11 Granular Drain Backfill Material - Furnish granular drain backfill material of 1 1/2" - 3/4", 1 1/4" - 3/4", or 3/4" - 1/2" crushed or uncrushed rock or gravel meeting the requirements of 02690.20(d) and the following gradation requirements:

	Percent Passing (by weight) Designated Sizes		
Sieve Size	**1 1/2" - 3/4"**	**1 1/4" - 3/4"**	**3/4" - 1/2"**
2"	100		
1 1/2"	95 - 100	100	
1 1/4"	–	90 - 100	
1"	–	–	100
3/4"	0 - 15	0 - 15	90 - 100
1/2"	0 - 2	0 - 2	0 - 15
1/4"	–	–	0 - 3

Construction

00430.40 General - Excavate trench, prepare bedding, backfill, except as noted in 00430.46, according to Section 00405 and dispose of excavated materials according to Section 00330. If required, place geotextile according to Section 00350 before backfilling.

Install a Type W-1 delineator at each outlet protection block as shown.

00430.41 Foundations in Unyielding Material - Excavate rock, hardpan or other unyielding materials a minimum of 3 inches below established grade of the pipe exterior to place special filter material or drain backfill material.

00430.42 Laying Pipe - Lay the pipe according to Section 00445. Place pipe with perforations down unless otherwise directed.

00430.43 Joining Pipe - Fasten pipes together with appropriate coupling fittings or bands as specified for the type of pipe used. Close upstream end of pipe with plugs suitable to prevent entry of soil materials.

00430.44 Contact Surfaces, Aluminum to Concrete - Coat aluminum pipe and aluminum coated steel pipe that contact portland cement concrete with asphalt mastic according to Section 00445.

00430.45 Inspection - The installation will be inspected after the pipe is laid and joined and before backfilling. Remove and reinstall or replace any pipe found to be out of alignment, unduly settled or damaged.

00430.46 Backfilling:

(a) Special Filter Material - After the pipe is installed and inspected, place up to 12 inches of uncompacted special filter material above the top of the pipe. Above this, place approved backfill material or special filter material, as directed, and compact according to Section 00405.

(b) Granular Drain Backfill Material - Drainage geotextile is required when using granular drain backfill material. Place granular drain backfill material according to (a) above and as shown.

Measurement

00430.80 Measurement - The quantities of subsurface drain pipes of the various kinds, types, and sizes will be measured, with no deduction for fittings and special sections, along the pipe flow line from end to end of pipe.

The quantities of subsurface drain outlets will be measured on the unit basis.

Drainage geotextile will be measured according to 00350.80.

Delineators will be measured according to 00840.80.

Trench resurfacing will be measured according to 00495.80.

Payment

00430.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) _____ Inch Drain Pipe	Foot
(b) Subsurface Drain Outlets	Each

In item (a), the nominal diameter of pipe will be inserted in the blank.

Item (b) includes furnishing and installing pipe, constructing outlet protection blocks, connecting pipe to inlets, and excavating and disposing of excess materials.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Drainage geotextile will be paid for according to 00350.90.

Delineators will be paid for according to 00840.90.

Trench resurfacing will be paid for according to 00495.90.

No separate or additional payment will be made for trench excavation, backfill, special filter material, or granular drain backfill material or for fittings and special pipe sections.

Section 00432 - Wearing Surface Drains

Description

00432.00 Scope - This work consists of constructing wearing surface drains and outlets to the dimensions, lines, and grades shown and directed.

Materials

00432.10 Aggregate - Furnish aggregate for wearing surface drains meeting the applicable requirements for the coarse aggregate used in the ~~open-graded HMAC~~PAC wearing course on the Project.

00432.11 Asphalt Cement - Furnish asphalt cement meeting the applicable requirements for the asphalt cement used in the ~~open-graded HMAC~~PAC wearing course on the Project.

00432.12 Broadband Limits - Furnish 3/4 inch ATPB for the wearing surface drain material.

00432.14 Acceptance of Drain Material - Acceptance of the wearing surface drain material will be visual by the Engineer at the point of placement.

00432.15 Drain Outlets - Furnish non-perforated 3 inch PVC Schedule 40 pipe meeting the requirements of ~~02410.70~~02415.50.

Furnish commercial quality 1/4 inch mesh galvanized metal screening for the end of each outlet pipe.

Furnish concrete for protection blocks at drain outlets meeting the requirements of Section 00440.

Equipment

00432.20 Compactors - Provide compactors meeting the ~~applicable~~ requirements of ~~00745.24~~00743.21.

00432.22 Planing Machines or Grinders - Provide planing machines or grinders capable of loosening pavement material to the dimensions, lines, and grades shown.

The equipment shall produce a trench with clean, vertical sides.

Construction

00432.40 Season and Temperature Limitations - Place wearing surface drain material within the limitations for ~~open-graded HMAC~~ specified in ~~00745~~00743.40.

00432.41 Scheduling - Construct wearing surface drains before placing the ~~open-graded HMAC~~PAC wearing surface. Place the ~~open-graded HMAC~~PAC wearing surface no more than ~~four~~ 4 weeks after construction of the drains.

00432.42 Preparation of Underlying Surfaces - Thoroughly clean the wearing surface drain trench, and treat with emulsified asphalt tack coat conforming to Section 00730.

00432.43 Hauling, Depositing, and Placing - Haul, deposit, and place the wearing surface drain material in a manner acceptable to the Engineer.

00432.44 Compaction - Compact the wearing surface drain material ~~as specified in 00745.49(d) for open-graded HMAC~~according to 00743.49.

Do not crush the outlet drain pipe during compaction.

00432.45 Disposal of Materials - ~~Materials removed under this Section that are not used on the Project become the property of the Contractor at the point of origin.~~ Dispose of ~~the material~~all materials according to 00290.20~~ unless special sites are specified in the Special Provisions~~.

Maintenance

00432.60 Correction of Defects - Correct defects in material and work according to ~~00745~~00743.60.

Finishing

00432.70 Pavement Smoothness - The surface of the finished trench shall meet the ~~applicable~~ requirements of ~~00745~~00743.70.

00432.75 Correction of Pavement Roughness - Correct pavement roughness according to ~~00745.75~~ 00743.71.

Measurement

00432.80 Measurement - The quantities of wearing surface drains will be measured on the length basis, for each continuous run of wearing surface drain, excluding wearing surface drain outlets.

The quantities of wearing surface drain outlets will be measured on the unit basis, by actual count.

Payment

00432.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Wearing Surface Drains	Foot
(b) Wearing Surface Drain Outlets	Each

Item (a) includes removing and disposing of existing materials.

Item (b) includes the protection block, drain pipe, and rodent screen.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00435 - Prefabricated Vertical Drains

Description

00435.00 Scope - This work consists of furnishing and installing prefabricated vertical drains at locations and according to details shown or directed.

Materials

00435.10 Drains - Furnish new prefabricated vertical drains from the QPL or that meet the requirements of these specifications.

00435.11 Core - Furnish a continuous plastic core material with grooved channels, a pattern of protruding studs, or mesh-type materials fabricated to promote drainage along the axis of the vertical drain. Furnish vertical drain material meeting the requirements of ASTM D 638 and ASTM D 4716.

00435.12 Jacket - Furnish the jacket material meeting the following requirements:

- Be a synthetic, non-woven geotextile capable of resisting all bending, punching and tensile forces imposed during installation.
- Not crack, peel or otherwise become damaged during installation.
- Be sufficiently rigid when embedded to withstand lateral earth pressures and to ensure vertical flow capacity through the core.
- Allow free passage of pore water to the core without passage of soil material or piping.

Test the jacket material in both saturated and dry conditions. It shall conform to the following:

	Requirement	
Test	**Specification**	**Minimum Value**
Grab Tensile	ASTM D 4632	80 pounds
Trapezoidal Tear	ASTM D 4533	25 pounds
Puncture Strength	ASTM D 4833	50 pounds
Burst Strength	ASTM D 3786	130 psi
Permeability	ASTM D 4491	0.05 mm/sec.

00435.13 Assembled Drain - Furnish assembled drains meeting the following requirements:

- Be resistant against wet rot, mildew, bacterial action, insects, salts, acids, alkalis, solvents and any other significant ingredients in the groundwater.
- Be band-shaped (rectangular cross section) with an aspect ratio (width divided by thickness) not exceeding 50.
- Have a minimum equivalent diameter of 2 inches using the following definition of equivalent diameter:

$$d_w = \frac{(a+b)}{2}$$

Where:

d_w = diameter of a circular drain equivalent to the band shaped drain
a = width of the band shaped drain
b = thickness of the band shaped drain

00435.14 Acceptance Requirements - Each shipment of prefabricated vertical drain materials shall be accompanied by a manufacturer's Quality Compliance Certificate according to 00165.35.

Submit three samples of any proposed splices for approval at least 21 calendar days before the installation of any drains.

Identify the drain materials with labels or tags that include the manufacturer's name, lot or control number, individual roll number and date of manufacture.

Equipment

00435.20 General - Install prefabricated vertical drains using a mandrel or sleeve that:

- Has a maximum cross-sectional area of 10 square inches.
- Is sufficiently stiff to prevent wobble or deflection during use.
- Protects the prefabricated vertical drain material from tears, cuts and abrasion during installation.
- Has an anchor plate or similar arrangement at the bottom to prevent soil from entering the drain during its installation, and to anchor the drain tip at the required depth at the time of withdrawal. Use anchors conforming to the dimensions of the mandrel or sleeve.

Construction

00435.40 Prefabricated Vertical Drain Installation Requirements:

(a) Acquisition and Storage - During shipment and storage, wrap the drain in heavy paper, burlap or similar heavy-duty protective covering and protect it from sunlight, mud, dirt, dust, debris and other detrimental substances.

Material damaged during shipping, unloading, storing or handling will be rejected.

(b) Proposed Installation Details - Submit full details on the material, equipment, sequence and method proposed for prefabricated vertical drain installation to the Engineer for review at least 14 calendar days before beginning trial prefabricated vertical drain installation.

(c) Trial Installation - Before production installation of prefabricated vertical drains, demonstrate that material, equipment and methods produce a satisfactory installation, at permanent installation sites. Install at least five trial drains totaling approximately 250 feet at locations designated.

(d) Production Installations - The Engineer's approval of the method or equipment used to install the trial drains does not necessarily constitute acceptance for the remainder of the Project. If at any time the Engineer determines that the method of installation or equipment does not produce satisfactory prefabricated vertical drains, alter the method or equipment as directed to comply with the plans and specifications.

(e) Installation Procedure - Prefabricated vertical drains will be located, numbered and staked by the Engineer.

- Preserve stakes and protect field instrumentation equipment. Stakes and instrumentation damaged by the Contractor will be repaired or replaced by Agency forces. The cost of repair or replacement will be deducted from monies due the Contractor. Do not work in the affected area until repair or replacement has been made.

- Locate the prefabricated vertical drains within 6 inches of the staked locations. Prefabricated vertical drains more than 6 inches from the staked locations, damaged or improperly installed, will be rejected and abandoned in place without payment. Rejected drains will be replaced at no additional cost to the Agency.
- Install prefabricated vertical drains in the presence of the Engineer's representative.
- Provide the Engineer with a suitable means to determine the depth of the drains at any time during installation and the final length installed at each location.
- Plumb equipment for installing prefabricated vertical drains before installing each drain. Do not deviate from the vertical more than 0.2 foot in 10 feet during installation of the drains.
- Install prefabricated vertical drains using a mandrel or sleeve inserted into the soil using a continuous push static weight or vibration while keeping disturbance of the subsoil to a minimum. Installation by driving will not be allowed. Jetting techniques will be allowed only after receiving written approval from the Engineer. The mandrel or sleeve penetration rate shall normally be between 0.5 and 2 feet per second.
- Install the prefabricated vertical drains from the designated working surface to the depth shown or as directed.
- Perform the installation without damaging the drain while advancing or retracting the mandrel or sleeve. Alternately raising or lowering the mandrel while advancing will not be allowed. Retract the mandrel or sleeve after each drain is installed. Raising the mandrel will be allowed only after completing a drain installation.
- Cut off completed prefabricated vertical drains neatly 1 foot above the designated working surface.

(f) Obstruction Clearance Procedures - Satisfactory installation may require clearing man-made or natural obstructions that prevent the proper insertion of the mandrel or sleeve and installation of prefabricated vertical drains.

Where obstructions are encountered:

- Immediately notify the Engineer before completing the drain and before installing other drains.
- Upon the Engineer's approval, attempt to install a drain adjacent to the obstructed location.
- Based on the results of this attempt and when directed, attempt to install a second offset drain within 2 feet horizontally of the obstructed drain, or if directed, implement obstruction clearance procedures and install the drain at the specified location.

The Contractor may use augering, spudding or other approved methods to loosen the soil and remove any obstruction material before installing prefabricated vertical drains. Do not penetrate more than 2 feet into the underlying compressible soil.

If augering, use augers with a minimum outside diameter equal to the largest horizontal dimension of the mandrel sleeve, shoe or anchor, whichever is greatest. The maximum outside diameter of the auger shall not be more than 3 inches greater than the minimum outside diameter.

00435.41 Splicing - Splice prefabricated vertical drain material by stapling to ensure structural and hydraulic continuity of the drain. Overlap the jacket and core a minimum of 6 inches at each splice.

A maximum of one splice per drain installed is allowed.

Measurement

00435.80 Measurement - The quantities of prefabricated vertical drains and obstruction clearance will be measured on the length basis as follows:

(a) Prefabricated Vertical Drains - The length of drains will be the distance the installation mandrel tip penetrates below the specified surface plus the required cutoff length above the designated working surface.

(b) Obstruction Clearance - The length of obstruction clearance will be the length from the designated working surface at the time of installation to the depth penetrated by the auger or spud, or if directed, to the bottom of the obstruction.

Obstruction clearance will be measured for payment only when authorized by the Engineer.

Payment

00435.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Prefabricated Vertical Drains	Foot
(b) Obstruction Clearance	Foot

Item (a) includes trial installations and splices.

Item (b) includes pre-augering, spudding or performing other acceptable methods to clear obstructions so that prefabricated vertical drains may be satisfactorily installed, including disposing of any surplus preaugered or obstruction clearance materials.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- unacceptable trial drain installations
- drains that are not installed and anchored to the required depth
- clearing obstructions caused by the Contractor or obstructions within 2 feet of the specified surface
- prefabricated vertical drains placed in excess of the designed length unless additional lengths are directed by the Engineer
- prefabricated vertical drains installed more than 6 inches from the staked location, damaged or improperly installed

Section 00440 - Commercial Grade Concrete

Description

00440.00 Scope - This work consists of furnishing, placing and finishing commercial grade concrete (CGC).

Materials

00440.10 Materials - Furnish materials meeting the following requirements:

Admixtures 02040
~~Aggregates .....02690~~
Bonding Agents 02070
Cement.....02010
Curing Materials 02050
Grout 02080
Modifiers.....02030
Water.....02020

00440.11 Proportions - Furnish, in writing to the Engineer, the proportions by weight of the following materials before using any CGC:

- air entraining admixtures
- cement
- each size of aggregate
- fly ash
- other admixtures
- water

00440.12 Properties of ~~CGC~~Commercial Grade Concrete - Furnish a workable CGC mixture that is uniform in composition and consistency, and unless otherwise shown or specified, has the following characteristics:

- **Entrained Air** - 4.0~~%~~ to 7.0~~%~~ percent
- **Slump** - 5 inches or less
- **Compressive Strength** - Minimum 3,000 psi at 28 days
- **Temperature** - Minimum 50 °F to maximum 90 °F

00440.13 Field-Mixed Concrete - ~~CGC may be field mixed for work items listed in 00440.14(a).~~ CGC mixed work items listed in 00440.14(a) may be field mixed conventionally, or by volumetric/mobile mixers conforming to ASTM C 685. When approved, concrete sidewalks, concrete driveways, and other flat concrete surfaces may be field mixed using volumetric/mobile mixers conforming to ASTM C 685.

00440.14 Acceptance Sampling and Testing:

(a) General - Acceptance sampling and testing will be based on samples obtained at the site of placement from the discharge of the delivery vehicle. All sampling and testing shall be performed by a QCT.

CGC mixture may be accepted visually for the following items of work:

Work Item	Section
Bollards	00815
Electrical Conduit Backfill	00960
Fence Post Footings	01050
Guardrail Anchors	00810
Irrigation System Thrust Blocks	01120
Mailbox Support Footings	01070
Outlet Protection Blocks	00430
Perforated Steel Square Tube Sign Support Footings	~~00930~~00920

(b) Delivery Tickets - Send a delivery ticket with each load of CGC recording the source, day, time of batch, size of load, and quantity of individual constituents in the load. ~~A delivery ticket will~~Delivery tickets are not ~~be~~ required for field-mixed concrete except when volumetric/mobile mixers are used.

(c) Plastic CGC - Acceptance of plastic CGC will be based on tests performed by the QCT according to the MFTP and 00440.12.

(d) Hardened CGC - Acceptance of the hardened CGC will be according to 00440.12. Cast one set of cylinders per 20 cubic yards, with a maximum of one set per day.

00440.15 Quality Control - Provide quality control according to Section 00165.

Labor

00440.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CSTT and QCT technical certifications.

~~• CSTT~~
~~• QCT~~

Construction

00440.40 General:

(a) Mixing - Mix CGC to the extent that ensures a uniform distribution of materials throughout the mixture.

(b) Placing - Place CGC according to the appropriate Sections in which CGC is required and the following:

- Place using the best common practices to avoid segregation.
- Vibrate and spade to achieve a dense homogeneous concrete, free of voids and rock pockets.
- Place within 90 minutes after batching and mixing.

(c) Forms - Provide forms for CGC according to the appropriate Sections in which CGC is required and best common practices. Place to the lines and grades shown or directed.

(d) Weather - Do not place CGC when the air temperature is below 35 °F without approval.

Protect CGC from freezing if the air temperature is expected to drop below 35 °F during the first ~~five~~ 5 calendar days after placement.

(e) Curing - Cure CGC by covering with wet burlap, canvas, sand, or other acceptable material, and keep moist for a minimum of ~~seven~~ 7 calendar days.

Curing compounds may be used except on concrete surfaces or reinforcement that will come in contact with adjacent concrete pours. Use curing compounds according to the following:

Section	Item	Type 1 or 1-D (Clear)	Type 2 (White-Pigmented)
00480	drainage curbs	*	*
00599	slope paving curbs and berm paving	Yes	No
00759	walks, sidewalk ramps, driveways, surfacings, curbs, and islands	*	*
* Use Type 2 except when the Engineer requires Type 1 or 1-D			

Apply curing compounds at a rate of not be less than 1 gallon per 150 square feet.

00440.41 General Surface Finish - Give concrete surfaces a general surface finish, according to 00540.53(a), in addition to the finish specified for a particular item of work.

00440.42 Replacement or Price Reduction - Remove concrete represented by cylinders that fail to meet the minimum strength requirement and replace at no additional cost to the Agency. If the Engineer determines that the low-strength concrete is suitable for the purpose intended, the Contractor may accept a price reduction established by the Engineer instead of removal and replacement.

Measurement

00440.80 Measurement - No measurement of quantities will be made for CGC.

Payment

00440.90 Payment - No separate or additional payment will be made for CGC. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00442 - Controlled Low Strength Materials

Description

00442.00 Scope - This work consists of furnishing and placing controlled low-strength materials (CLSM).

00442.01 Definition - Controlled low-strength material is highly flowable lean concrete mix; a mixture of fly ash, cement, fine aggregates, water and admixtures, if necessary.

Materials

00442.10 Materials - Furnish materials meeting the following requirements and as modified in the Special Provisions:

Admixtures 02040
Fly Ash 02030.10
Portland Cement 02010.10

00442.11 Fine Aggregates - Furnish fine aggregates that are commercial quality concrete sand.

00442.12 Proportioning of CLSM Mixture - Furnish the following, to the Engineer, prior to using any CLSM on the Project:

- Written certification of proposed CLSM materials proportions and compressive strength.
- 28-day cylinder reports from a trial CLSM batch based on above certification. Include evidence that compressive strength requirements for specific applications are met.

00442.13 Compressive Strength - CLSM shall attain a 28-day compressive strength of 100 psi - 200 psi.

00442.14 Acceptance - Acceptance will be based on the Engineer's review and approval of written certification and trial batch cylinder reports as required by 00442.12.

Measurement

00442.80 Measurement - No measurement of quantities will be made for CLSM.

Payment

00442.90 Payment - No separate or additional payment will be made for CLSM. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00445 - Sanitary, Storm, Culvert, Siphon, and Irrigation Pipe

Description

00445.00 Scope - This work consists of constructing or reconstructing culvert, siphon, sanitary sewer, storm sewer, and irrigation pipes in the kinds, sizes, and lengths and at the locations shown or as directed to the lines and grades established. The work includes furnishing and constructing joints and connections to other drainage structures or systems, as necessary, for complete installation.

00445.01 Definitions and Descriptive Terms - The following terms have the meanings presented below when used in this Section:

Aluminum, Concrete, Steel and Polyethylene - The basic material of the pipe

Concrete Block - Encasements, thrust blocks, anchor blocks, plugs and cutoff diaphragms

Culvert - Concrete, corrugated metal, ductile iron ~~or~~, polyethylene, steel reinforced polyethylene, or polypropylene pipe

Flexible Pipe - Pipes constructed of corrugated or spiral rib metal, PVC, ~~and~~ polyethylene, steel reinforced polyethylene, or polypropylene. For the purposes of these Specifications, all potable water pipes are considered to be flexible pipes.

HDPE - High Density Polyethylene

Irrigation Pipe - Gravity or low-pressure transmission pipe. Refer to Section 01120 for sprinkler~~-~~-type irrigation pipe.

Joint - The place where the ends of sections or modified sections of pipe contact one another

Metal - Aluminum and steel

Pavement - Pavement as defined in Section 00110, as well as driveways, curbs, gutters, walks, dikes, walls and other similar asphalt or portland cement concrete structures

Pipe - All pipe, regardless of kind, size, shape or use

Plain - Unreinforced concrete

PVC - Polyvinyl Chloride

Rigid Pipe - Pipes, other than potable water pipes, constructed of concrete and ductile iron

Sanitary Sewer Pipe - Concrete, PVC, solid wall HDPE or ductile iron pipe

SDR (Standard Dimensional Ratio) - The pipe's minimum outside diameter divided by its wall thickness

Section - The individual pieces in which the furnished pipe is manufactured

Siphon, Storm Sewer, and Irrigation Pipe - Concrete, PVC, HDPE, ductile iron or metal pipe

Steel - The base metal for galvanized sheets and aluminum coated sheets

Steel Reinforced Polyethylene - Steel reinforced ribbed high density polyethylene

00445.02 Contractor's Options - If the Contractor has an option of using different kinds of pipe, the option and its installation and other limits will be shown on the plans or on a "Pipe Data" sheet in the plans.

The limiting factors and requirements shown on the plans or on the Pipe Data sheet are minimums. The Contractor may substitute stronger, larger, and higher quality material at any installation site, provided the substitution is approved and is made at no additional cost to the Agency.

00445.03 Size Determination - The nominal size of pipe will be determined according to AASHTO tolerances for pipe dimensions for the appropriate kind or class of pipe.

Materials

00445.10 General - The manufacturer or fabricator shall furnish appropriate certification, based on the manufacturer's quality control tests, that the materials used in the production of the pipe meet these Specifications. Materials and strength shall be as specified for the particular kind of pipe and fittings required.

Use flexible elastomeric gasket joints on all pipes and fittings. Furnish caps or plugs with each fitting, outlet or stub as required, with the same type gasket or joint as the pipe.

For sanitary sewers provide tee or wye fittings in the main of the same materials as the pipe. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.

Cap or plug all fittings and provide with gaskets of the same material as used in the pipe joint. Fit with an approved mechanical stopper, or install an integrally cast knockout plug. The cap or plug shall be capable of withstanding test pressures without leaking and, when later removed, shall permit continuation of piping with jointing similar to joints in the installed line.

00445.11 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete in Blocks 00440
Corrugated or Spiral Rib Aluminum Alloy Pipe.....02420.40
Corrugated or Spiral Rib Steel Pipe and Pipe Arches 02420.10
Corrugated Polyethylene Pipe.....~~02410.60~~02415.10
Ductile Iron Pipe. 02420.11
Metal Reinforcement in Blocks.....02510.10
Nonreinforced Concrete Pipe 02410.10
Polypropylene Pipe 02415.40
Polyvinyl Chloride ~~(PVC)~~ Pipe.....~~02410.70~~02415.50
Protective Coatings 02420.20
Reinforced Concrete Pipe 02410.10
Rubber Gaskets 02440.40
Solid Wall ~~HDPE02410.65~~Polyethylene Pipe 02415.20
Steel Reinforced Polyethylene Pipe 02415.30

(a) Pipe Anchors - Use pipe anchors conforming to the Standard Drawings and as shown. Metal bands shall conform to the material Specifications for the metal pipe to which they are attached.

(b) Slip Joints - Construct slip joints according to the details shown. The outer sleeve and tapered section shall conform to the material Specifications for the metal pipe with which they are installed.

(c) Safety End Sections - Use safety end sections conforming to 02420.10 and the Standard Drawings. Provide safety bars unless otherwise indicated on the plans.

(d) Cleanouts - Construct cleanouts of the same materials as the adjacent pipe.

(e) Tracer Wire - Use 12-gauge stranded or solid copper insulated high molecular weight polyethylene (HMW-PE) tracer wire. The HMW-PE insulated cover shall be green and a minimum 45 mil thick. The wire shall be UL rated for 140 °F.

(f) Fittings for Concrete Pipe - Where fittings are fabricated by inserting a stub into a hole cut in the pipe, grout with a non-shrinking grout. Coat surfaces to receive grout with an epoxy bonding agent prior to grouting. Fitting stubs shall not protrude inside of the sewer pipe.

(g) Solid Wall Polyethylene Pipe - Use solid wall polyethylene pipe with a minimum SDR of 26.

00445.12 Asphalt Mastic - Furnish the asphalt mastic specified in 00445.47 for aluminum and concrete contact surfaces that consists of a mixture of asphalt, mineral stabilizer, and fillers meeting the requirements of AASHTO M 243 or ASTM D 4586. An approved product from the QPL may be used.

00445.15 Quality Control - Provide quality control according to Section 00165.

Labor

00445.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT and CDT technical certifications.

~~• CEBT~~
~~• CDT~~

Construction

00445.40 General - Construct culvert, siphon, sanitary sewer, storm sewer, and irrigation pipe according to the following:

(a) Trench Work - Excavate trench, prepare bedding, pipe zone material and trench backfill, and dispose of excavated material according to Section 00405 for pipes 72 inches and less in diameter and Section 00510 for pipes over 72 inches in diameter.

(b) Line and Grade - Centerline and grade control will be established prior to the start of construction. The Special Provisions will indicate whether it will be done by the Agency or the Contractor.

Do not vary from established line and grade by more than 1/32 inch per inch of pipe diameter. Variance shall not exceed 1/2 inch, subject to the following limitations:

- The variation does not result in a level or reverse sloping invert.

- The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed 1/64 inch per inch of pipe diameter, or 1/2 inch maximum.

(c) Pipe Distribution and Handling - Unload pipe only by approved means.

Inspect the pipe and fittings prior to lowering into the trench to ensure no cracked, broken or otherwise defective materials are used. Clean the ends of the pipe thoroughly, remove foreign matter and dirt from the inside of the pipe, and keep the pipe clean during laying and joining.

(d) Laying Pipe on Curves - Lay pipe on horizontal or vertical curves as shown or approved. When deflecting the pipe from a straight line, either in the vertical or horizontal plane, or when long radius curves are shown, the amount of deflection allowed shall not exceed that recommended by the pipe manufacturer.

(e) Concrete Closure Collars - Use concrete closure collars only when approved, and only to make connections between dissimilar pipe or where standard rubber gasketed joints or transition couplings are not available. Place the collars using an approved commercial concrete bonding agent applied to all surfaces in contact with the collar. Where concrete closure collars are necessary to join PVC pipe, first prepare the PVC surface for bonding to the concrete by applying a dense coating of clean mortar sand to the pipe using PVC solvent cement. After the cement has cured, apply an approved commercial concrete bonding agent to the sand surface prior to placement of the concrete.

(f) Installation of Sanitary Sewer Service Tees and Wyes - Provide a compacted base of pipe bedding material under all tees, wyes and branch fittings, extending to the springline of the fittings.

Cap all service lines for sanitary sewers with watertight plugs or caps suitable for resisting the pressures of hydrostatic or air testing.

The maximum line or grade change accomplished with any one fitting shall not exceed 45 degrees and shall be accomplished with long radius curves or bends.

(g) Pipe Anchors - Construct metal or concrete pipe anchors as specified or as shown. Install anchors on runs of pipe located on slopes 20~~%~~ percent or greater.

00445.41 Installing Pipe under Railroad - Prior to beginning any under-track work, submit plans of construction, and details of the methods and equipment proposed to be used, to the Engineer for submittal to the Railroad. Do not begin under-track work until Railroad approval is obtained.

Within the limits indicated on the plans, do not install the pipe under the railroad tracks by the open trench method. Within these limits install the pipe by tunneling, jacking, boring or similar methods, approved by the Railroad, as the Contractor elects, according to Section 00406. Install the pipe to the lines and grades established and backfill completely all voids around the installation with specified material, to the satisfaction of the railroad.

00445.42 Laying Pipe - Begin pipe laying at the downstream end of the pipe line with the lower segment of the pipe in contact with the shaped bedding throughout its full length and as follows:

- **Elliptical Pipe** - Place with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the pipe.

- **Flexible Pipe** - Place with longitudinal laps or seams at the sides. At circumferential lap joints, place pipe so that the downstream piece is outside.

- **Paved Invert or Partially Lined Pipe** - Place with longitudinal centerline of paved segment coinciding with flow line.

- **Rigid Pipe** - Place with bell or groove ends facing upstream.

- **Round Elliptically Reinforced Concrete Pipe** - Place so that the manufacturer's marks designating the top and bottom of the pipe are within 5 degrees of a vertical plane through the longitudinal axis of the pipe.

00445.43 Placing and Joining Pipe:

(a) General - Lay pipe proceeding upgrade with spigot ends in the direction of flow. Assemble joints according to the recommendations of the manufacturer for the type of joint used. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.

Prevent excavated or other foreign material from getting into the pipe. Plug or close off pipes that are stubbed off for future connection. When cutting or machining of the pipe is necessary, use only the tools and methods recommended by the pipe manufacturer. All field joints shall:

- Provide equal or greater strength than the adjoining pipe.
- Fit close and tight.
- Provide a smooth and uniform interior surface.
- Secure and hold adjoining sections to each other.
- Fasten securely to adjoining structures and special sections.

(b) Concrete Pipe - Lay elliptical reinforced pipe so that the top or bottom marks are not more than 5 degrees from vertical. Provide all rigid non-reinforced pipe entering or leaving manholes with flexible joints within 18 inches of the manhole structure and placed on firmly compacted bedding.

(c) ~~PVC~~Polyvinyl Chloride Pipe - Install PVC pipe and fittings according to the manufacturer's recommendations.

Cut the pipe in a neat manner, at right angles to the axis of the pipe, and dress the cut end.

(d) Polyethylene Pipe - Install solid wall HDPE and corrugated polyethylene pipe and fittings according to the manufacturer's recommendations.

Assemble and join solid wall HDPE pipe at the site using the thermal butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints are not allowed. All equipment and procedures used shall be in strict compliance with the manufacturer's recommendations. Use personnel certified as fusion technicians by the manufacturer of the pipe or fusing equipment to accomplish the fusing.

Provide joints for corrugated polyethylene pipe made with either bell and bell or bell and spigot coupling.

~~(e~~(e) Steel Reinforced Polyethylene Pipe - Install steel reinforced polyethylene pipe and fittings according to the manufacturer's recommendations.

(f) Polypropylene Pipe - Install polypropylene pipe and fittings according to the manufacturer's recommendations.

Provide joints made with either bell and bell or bell and spigot coupling.

When the ambient air temperature is less than 10 °F, do not install, move, cover, bury, or otherwise handle the polypropylene pipe. All polypropylene pipe handled at temperatures below 10 °F will be rejected and not allowed to be used on the Project

(g) Metal Pipe - Install metal pipe and fittings according to the manufacturer's recommendations.

(~~f~~h) Pipe Joints - Construct field joints, suitable for testing, for siphons, sanitary sewers, irrigation, and other installations as specified.

Construct watertight field joints for storm sewers and culverts with elastomeric joint material. Test joints according to 00445.72.

(~~g~~i) Inspection - After the pipe is laid and joined, and before any backfilling over it, the installation will be inspected. Take up and relay or replace any pipe found to be out of alignment, unduly settled, or damaged.

00445.44 Strutting Metal Pipe - When the plans or Special Provisions call for metal pipe to be installed in a tied or strutted condition, place the ties or struts before backfilling, conforming to the details shown. Strutting with timber is not allowed in pipe furnished with paved inverts or with centrifugally applied bituminous inner linings. Remove the ties and struts after the embankment over the pipe is completed and compacted.

00445.45 Backfilling:

(a) General - After the pipe is installed and inspected, backfill pipe zone and trench according to Section 00405 for pipes 72 inches and less in diameter, and according to Section 00510 for pipes over 72 inches in diameter.

(b) Exposed Pipe - When the top 25~~%~~ percent of the pipe is exposed above the top of the trench, place and compact embankment materials in layers according to the requirements of the plans for the Pipe Zone.

Do not cross any pipe with tractors or other heavy equipment until it has been bedded and backfilled as specified, and is protected by at least a 4 foot cover of compacted fill.

(c) Elliptical Pipe - Where elliptical shaped metal pipe is furnished, place backfill in a manner that will maintain a vertical elongation between 4~~%~~ and 6~~%~~ percent greater than the indicated normal diameter, and fill up to the minimum cover above the top of the pipe indicated on the fill height table included with the plans.

When elliptical shaped metal pipe 48 inches and larger in size is furnished, install and maintain suitable tell-tales throughout the length of the pipe at intervals not exceeding 14 feet. Hang the tell-tales from the crown of the pipe and use as a progressive check on the pipe deflection during backfilling and filling.

Remove tell-tales after the entire fill over the pipe has been completed.

00445.46 Concrete Blocks - When called for by the plans or directed, construct concrete blocks, with commercial grade concrete according to Section 00440.

00445.47 Contact Surfaces, Aluminum to Concrete - Where uncoated aluminum pipe or aluminum coated steel pipe will be touching portland cement concrete, give the contact surfaces of the pipe a coating of asphalt mastic applied at a rate which will give a minimum dry film thickness of 50 mils.

Do not place concrete on contact surfaces until the mastic coating has dried to practical hardness. The coating is considered to have reached practical hardness when firm pressure between the thumb and fingers shows a slight tacky condition, but the film is not ruptured, and none of the coating adheres to the fingers.

00445.48 Tracer Wire - Install tracer wire in all trenches for sanitary and storm sewers. Place the tracer wire directly over the pipe centerline and on top of the pipe zone material. Place a branch tracer wire over each pipe connected to the main sewer.

Make tracer wire splices using a solderless connection kit that effectively moisture seals two or more conductors for direct burial and securely join the wires both mechanically and electrically. Insulate splices to be moisture and waterproof. Splices wrapped with tape will not be accepted as waterproof. Have all splice kits approved prior to installation.

Test all tracer wire with locating equipment prior to acceptance.

Finishing, ~~Clean~~Cleaning Up, and Testing

00445.70 General:

(a) Storm Sewer and Culvert Installations - Inspect storm sewer systems and culverts to assure that the lines are free of obstructions and leakage. Perform video and deflection testing.

(b) Siphon, Irrigation and Sanitary Sewer Installations - After laying and joining pipe for siphons, irrigation and sanitary sewers, and backfilling trenches, test the installations for watertightness, including inlet and outlet connections, to the Engineer's satisfaction. Perform video, deflection, hydrostatic, and low-pressure air testing.

00445.71 Requirements Prior to Tests:

(a) General - All sanitary gravity systems, siphon systems and irrigation systems and appurtenances shall successfully pass a hydrostatic or air test prior to acceptance and shall be free of visible infiltration of water. Test manholes as specified in Section 00470.

On pipe 30 inches in diameter and larger, individual joints may be tested by an approved joint testing device. All details of the testing procedure shall meet the approval of the Engineer.

(b) Plugging Tees, Wyes, Stubs and Service Connections (Sanitary Only) - Plug all wyes, tees, stubs and service connections with gasketed caps or plugs securely fastened or blocked to withstand test pressures.

(c) Testing Equipment - Furnish all necessary testing equipment and perform the tests in a manner that provides observable and accurate measurements of either air or water leakage under the specified conditions. Calibrate and certify gauges at the direction of the Engineer. Provide the certification with the gauge.

(d) Cleaning - Prior to the testing and inspection of the system, flush and clean all parts of the system and remove all debris.

00445.72 Pipe Testing:

(a) General - After completing installation of the system, including all service connections, backfilling and compaction, and prior to wearing surface paving, conduct a low-pressure air test or a hydrostatic test. Provide all equipment and personnel for the test. Conduct tests during normal working hours. The Engineer may require testing of manhole-to-manhole sections as they are completed in order to expedite the acceptance of the system and allow connections.

The method, equipment and personnel used in testing shall be subject to approval of the Engineer. The Engineer may, at any time, require a calibration check of the instrumentation used.

(1) Safety Precautions - Only qualified personnel will be allowed to conduct the test. All plugs used to close the system for the testing shall be capable of resisting the expected internal pressures. Securely brace plugs, if necessary.

(2) Ground Water - The presence of ground water will affect the results of the test. Determine the average height of groundwater over the lines immediately before starting the test, using an approved method.

(b) Hydrostatic Testing - Pipe and joints shall sustain losses not exceeding 0.04 gallons per hour per inch diameter per 100 feet of pipe when field tested by exfiltration methods, except 0.3 gallons per hour may be used in arid climate zones if approved by the engineer.

The hydrostatic head for test purposes shall exceed the maximum estimated ground water level in the section being tested by at least 72 inches of water column and in no case shall be less than 72 inches of water column above the inside top of the highest section of pipe in the test section, including service connections. The engineer shall make the final decisions regarding test height for the water in the pipe section being tested. The length of pipe tested by exfiltration shall be limited so that the pressure on the invert of the lower end of the section shall not exceed 28 feet of water column.

The pipe test section may be filled 24 hours prior to time of exfiltration testing, if desired, to permit normal absorption into the pipe walls to take place.

All service connection footage shall be taken into account in computing allowable leakage.

(c) Air Testing - The pressure gauge used in air testing shall have minimum divisions of 0.1 psi and an accuracy of 0.0625 psi. All air testing shall be by the Time Pressure Drop Method. The test procedure is as follows:

(1) The Contractor may wet the lines prior to testing.

(2) Determine the average height of the groundwater over the line. The test pressures required shall be increased 0.433 psi for each foot of average water depth over the exterior crown of the pipe.

(3) Add air slowly to the section of system being tested until the internal air pressure is raised to 4 psi greater than the average back pressure due to groundwater.

(4) After the test pressure is reached, allow at least ~~two~~ 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.

(5) After the temperature stabilization period, disconnect the air supply.

(6) Record the time in seconds that is required for the internal air pressure to drop from 3.5 psi to 2.5 psi greater than the average backpressure due to groundwater.

The tested section will be acceptable if the time recorded in paragraph (6) above is not less than the time in seconds (T) computed by the formula:

$$T = K/C$$

Where:

K = the sum of the computations ($0.011\ d^2L$) for each size of pipe and its length in the section

C = the sum of the computations (0.0003882 dL) for each size of pipe and its length in the section, except that the minimum value for C shall be 1

d = inside diameter of the pipe in inches

L = length of pipe in feet

(d) Individual Joint Testing:

(1) General - The Contractor may test each individual joint for leakage using a pneumatic joint testing apparatus. The method, equipment and personnel used in individual joint testing shall be as approved. The Engineer may, at any time, require a calibration check of the instrumentation used. The pressure gauge used shall have minimum divisions of 0.1 psi and have an accuracy of 0.0625 psi. All air used shall pass through a single control panel.

(2) Method - All air testing shall be by the Time Pressure Drop Method. The test procedure is as follows:

a. Determine the average height of the groundwater over the line. The test pressures required below shall be increased 0.433 psi for each foot of average water depth over the exterior crown of the pipe.

b. Add air slowly to the section being tested until the internal air pressure is raised to 4 psi greater ~~then~~than the average backpressure due to ground water.

(3) Acceptance - The joint shall be considered acceptable if the pressure drops less than 1 psi within ~~five~~ 5 seconds.

00445.73 Deflection Testing for Flexible Pipe - Conduct deflection tests of sanitary and storm sewers constructed of flexible pipe prior to wearing surface paving. Conduct the testing by pulling an approved mandrel through the completed pipeline. Use a mandrel having at least 6 vanes and a diameter 95~~%~~ percent of the pipe's initial inside diameter.

Conduct testing on a manhole-to-manhole basis after the line has been completely flushed out with water. Conduct the tests not less than 30 days after the trench backfill and compaction have been completed. Tests may be conducted sooner if approved by the Engineer. The tests may be conducted concurrently with video inspection. If conducted concurrently, pull the mandrel in front of the camera so that the deflection testing is clearly recorded on the video tape unless approved by the Engineer. Provide a water depth gauge, located on the video camera side of the mandrel with the following characteristics:

- Graduated with marks at 0.50 inch increments clearly visible during video inspection.
- Capable of measuring water depth in 0.50 inch increments from 0.50 inch to 2.50 inches.

- Designed so that it will remain plumb regardless of the rotation of the mandrel or video camera.

00445.74 Video Inspection of Sanitary and Storm Sewers - ~~After laying~~ Perform pre-construction video and ~~joining~~ post-construction video inspections of sanitary and storm sewer pipe ~~installations from 6 inches~~according to ~~72 inches in diameter, including~~Section 00415. Conduct the post-construction video inspection after backfill and compaction ~~of trenches~~is complete, but before any finish surfacing or final paving~~, conduct a video inspection and make a written report of all sanitary sewer pipes and storm sewer pipes~~ is performed.

~~The video inspection shall be conducted by a technical service that is equipped to make audio-visual recordings.~~

~~The audio-visual recordings shall:~~

- ~~Be in color format.~~
- ~~Be clear and usable.~~
- ~~Include a visual footage reading on the recording.~~
- ~~Include a voice recording of suspected deficiencies.~~
- ~~Identify groundwater infiltration sources associated with construction or materials defects.~~

~~Submit the audio-visual recordings and written report to the Engineer for review. Correct all deficiencies that are revealed in the recording and written report. Make an additional video inspection of repaired pipes at no additional cost to the Agency.~~

~~All recordings and written reports shall become the property of the Agency.~~

00445.75 Repairs - Locate and repair any sections failing to pass the required tests and inspections. Repeat the specified tests and inspections on those sections at no additional cost to the Agency.

Following a successful hydrostatic or air test, visible infiltration of ground water in any section will be considered evidence that the original test was in error or that failure of the section has occurred. Correct such failures and retest the repaired sections, at no additional cost to the Agency.

Measurement

00445.80 Measurement - Pipes and related work performed under this Section will be measured according to the following:

(a) Pipes - The quantities of pipe of the various kinds, types, and sizes, will be measured on the length basis, and will be determined by the length and depth of installation as follows:

- **Length** - The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, special sections, or the ends of pipe, whichever is applicable.

- **Depth** - The depth will be used to determine the maximum depth range and pay item for each pipe. The maximum depth range, to the flow line, for each pipe will be "5 feet", "10 feet", "20 feet", and "over 20 feet" as applicable.

  The depth in excavation areas will be the maximum measured vertical distance between the pipe flow line and the surface of the original ground or subgrade, whichever is less, or the slopes of other areas outside the subgrade limits.

The depth in embankment areas will be the maximum measured vertical distance between the pipe flow line and the surface of the constructed embankment as determined in 00330.42(c-6).

(b) Tee and Wye Fittings - The quantities of tee and wye fittings will be measured on the unit basis. No deduction will be made from measurement of pipe for the length of the fitting.

(c) Slip Joints - The quantities of slip joints will be measured on the unit basis.

(d) Sloped and Skewed Ends - The quantities of sloped ends, skewed ends, or sloped and skewed ends will be measured on the unit basis.

(e) Safety End Sections - The quantities of safety end sections will be measured on the unit basis.

(f) Concrete Pipe Anchors - The quantities of concrete pipe anchors will be measured on the unit basis.

(g) Concrete Closure Collars - The quantities of concrete closure collars will be measured on the unit basis.

(h) Concrete in Blocks - The quantities of concrete used in blocks will be measured on the volume basis, in place.

(i) Reinforcement - The quantities of reinforcement used in blocks will be measured on the lump sum basis or on the weight basis according to 00530.80.

~~**(j) Video Inspection** - The quantities of video inspection will be measured on the length basis, to the nearest foot, The length will be measured, with no deduction for structures or fittings, along the pipe flow line from center to center of manholes, inlets, special sections, or the ends of pipe, whichever is applicable. Pipes with sloped ends will be measured from the top of the sloped end section.~~

~~(k~~(j) **Installation Under Railroad** - No measurement will be made for additional work necessary to install pipe under railroads. Pipe installed under railroads will be separately measured according to 00445.80(a).

Excavation and backfill for pipes greater ~~that~~than 72 inches in diameter will be measured according to Section 00510.

Video pipe inspection will be measured according to 00415.80.

Trench resurfacing will be measured according to 00495.80.

Payment

00445.90 General - The Contract unit price for each pay item reflects plan requirements or the Contractor's choice from the applicable options listed on the Pipe Data Sheets (if shown).

00445.91 Payment - The accepted quantities of pipe and related work items performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement

(a) ____ inch _____ Pipe, _____ Depth ..... Foot
(b) ____ inch _____ Pipe ..... Foot
(c) Pipe Tees, _____ inch ..... Each
(d) Pipe Wyes, _____ inch ..... Each
(e) Slip Joints, _____ inch ..... Each
(f) Sloped End Sections, _____ inch ..... Each
(g) Safety End Sections, _____ inch ..... Each
(h) Concrete Pipe Anchors ..... Each
(i) Concrete Closure Collars ..... Each
(j) Concrete in Blocks ..... Cubic Yard
(k) Reinforcement in Blocks ..... Lump Sum or Pound
~~(l) Video Inspection ..... Foot~~
~~(m~~ (l)Installing _____ inch Pipe Under Railroad Lump Sum

In item (a), the nominal pipe diameter will be inserted in the first blank. The type of pipe will be inserted in the second blank. The appropriate flow line depth range will be inserted in the third blank.

Item (a) includes pipe 72 inches and smaller in diameter.

In item (b), the nominal pipe diameter will be inserted in the first blank. For arch type pipe, the nominal diameter of circular metal pipe from which the pipe arch is formed, or reformed, will be inserted in the first blank. The type of pipe will be inserted in the second blank.

Item (b) includes pipe larger than 72 inches in diameter.

In items (c) and (d), the nominal pipe size will be inserted in the blank.

In item (e), the outer sleeve slip joint size will be inserted in the blank. The inner sleeve will be included in payment made for the smaller pipe.

Item (g) includes safety bars when required.

Item (j) includes reinforcement if there is no item listed for reinforcement in blocks in the Contract Schedule of Items.

In item (~~m~~l), the nominal pipe diameter will be inserted in the blank.

Item (~~m~~l) includes all additional work involved in placing pipe under existing railroad tracks as specified within the limits shown.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Excavation and backfill for pipes greater ~~that~~than 72 inches in diameter will be paid for according to Section 00510.

Video pipe inspection will be paid for according to 00415.90.

Trench resurfacing will be paid for according to 00495.90.

No separate or additional payment will be made for:

- trench excavation, bedding, pipe zone material, and trench backfill for pipes 72 inches and less in diameter
- pipe plugs, stoppers, and other required fittings
- metal pipe anchors
- tracer wire
- hydrostatic, air, joint, and deflection testing

When the Contract Schedule of Items does not indicate payment for pipes or other work under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00446 - Trench Drains

Description

00446.00 Scope - This work consists of constructing trench drain systems and constructing joints and connections to other drainage structures at locations shown or directed.

00446.01 Definitions:

Type 1 Trench Drain - A trench drain installation in which any part is constructed in a Traveled Way.

Type 2 Trench Drain - A trench drain installation that is constructed in a paved Shoulder and paved or unpaved Multi-Use Path.

Materials

00446.10 Materials - Furnish commercial grade concrete meeting the requirements of Section 00440.

00446.11 Trench Drains - Furnish trench drains from the QPL or that meet the following requirements:

- Trench drains that have smooth interior surfaces below the level of the frame, grate, and associated connections.
- Trench drain sections, excluding the frame and grate, that are manufactured of monolithic polymer concrete composed of aggregate and polyester resin or vinylester resin that when complete, meet the following requirements:

Property	ASTM Test Method	Value
Tensile Strength (min. psi)	C 307	1,500
Compressive Strength (min psi)	C 579	12,000
Bending Strength (min psi)	C 580	2,900
Moisture Absorption (max. %)	C 140	0.5
Chemical Resistance	C 267	Pass
Freeze/Thaw (min. number of cycles without weight loss)	C 666	1,600

00446.12 Frames and Grates - Furnish frames and grates from the QPL or that meet the following requirements:

- One piece frames and grates for type 1 trench drains meeting the requirements of AASHTO M 306, H25 loadings. Secure them to the surrounding concrete to provide a minimum pullout resistance of 500 pounds per foot of length of trench drain.
- Either one-piece or removable grate type frames and grates for type 2 trench drains meeting the requirements of AASHTO M 306, H20 loadings. Provide tamper resistant locking devices for removable grates.

Provide American with Disabilities Act certified grates that are placed within designated pedestrian paths of travel.

Construction

00446.40 General - Construct trench drains according to the following:

(a) Trench Work - Excavate trench and prepare bedding according to the manufacturer's recommendations. Provide an additional minimum of 4 inches on both sides and the bottom of the trench drain system for the commercial grade concrete.

(b) Line and Grade - Establish the centerline and grade control prior to the start of construction.

Do not vary from established line and grade by more than 1/32 inch per inch of inside trench drain width, subject to the following limitations:

The variation does not result in a level or reverse sloping invert.

The variation in the invert elevation between adjoining sections of trench drain does not exceed 1/64 inch per inch of inside trench drain width.

(c) Trench Drain System Installation - Install trench drain systems according to the following:

- Follow the manufacturer's installation recommendations.
- Locate maintenance access for Type 1 trench drains outside of the Traveled Way.
- Securely support all channel units at the correct line and grade during the concrete pour. Texture the surface of concrete with a broom or burlap drag to produce a skid-resistant surface.

Finishing and Cleaning Up

00446.70 General - Remove all debris from the finished trench drain then flush with water.

Measurement

00446.80 Measurement - The quantities of trench drains will be measured on the length basis. Measurement will be from the beginning of the trench drain to the center of the receiving structure.

Payment

00446.90 Payment - The accepted quantities of trench drains will be paid for at the Contract unit price, per foot, for the item "Trench Drain, Type _____".

The type of trench drain will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00450 - Structural Plate Shaped Structures

Description

00450.00 Scope - This work consists of constructing structural plate pipe, pipe arches, plate arches, horizontal ellipses, vehicular underpasses and special shaped structures.

00450.01 Definitions:

Structural Plate Pipe - Built-up pipe with a circular cross section of the type, thickness and diameter specified. It is fabricated with the vertical diameter about 5~~%~~ percent greater than the nominal diameter shown on the plans.

Structural Plate Pipe Arch - Built-up pipe with a cross section made up of a multi-centered shape of four circular arcs, tangent to each other at their junctions, symmetrical about the vertical axis, and of the type, thickness and span specified. The size is designated by span and rise, measured from the inside crests of corrugations.

Structural Plate Arch - Single or multiple radius structures comprised of a number of curved metal plates that form an arch shape when assembled. The structure is designed to be supported along its lower edges on separately constructed reinforced concrete foundations, and of the design, type, thickness and span as shown. This size is designated by span and rise measured from the inside crests of corrugations.

Structural Plate Horizontal Ellipse - Built-up pipe in an elliptical shape with the horizontal diameter approximately 20~~%~~ percent greater than the nominal diameter. The size is designated by span and rise, measured from the inside crests of corrugations.

Structural Plate Vehicular Underpass - Built-up pipe in a high arch shape with large radius sides and invert, and small radius corners between sides and invert. The size is designated by span and rise, measured from the inside crests of corrugations.

Materials

00450.10 Materials - Furnish materials meeting the following requirements:

Aluminum Alloy Structural Plates 02430.20
Bolts, Nuts, and Washers.....02430.90
Commercial Grade Concrete.....00440
Galvanized Structural Plates 02430.10
Reinforcement.....00530

Construction

00450.40 Trench Work - Excavate trench, prepare bedding, backfill and dispose of excavated material according to Section 00510 and the following:

(a) Trenches In Unstable Areas - Excavate unstable materials under the pipe or pipe arch and to a width of at least one-half the diameter or span width on each side of the structure, to depths below the established elevation for the bases or foundation of the structure, as directed. Unless otherwise directed, backfill with granular structure backfill. Bring the backfill material to the moisture content required for compaction and place in 6 inch layers. Compact each layer according to 00330.43. Bring the backfill material to the elevation established.

(b) Trenches in Unyielding Material - When rock, hardpan or other unyielding material is encountered, remove it below the designated grade, as ordered, to a depth under the pipe or pipe arch equal to at least 1/2 inch per foot of fill height over the top of the pipe, but not less than 8 inches, nor more than three-fourths the vertical dimension of the structure. Unless otherwise directed, backfill with granular structure backfill.

00450.41 Installation in Paved Areas - If structures are installed within paved areas to be preserved, resurface according to Section 00495.

00450.42 Erection:

(a) General - Assemble corrugated metal plates at the site of installation to the lines and grades shown or directed. Connect the plates at longitudinal and circumferential seams with bolts. Stagger joints so that no more than three plates come together at any one point. Each plate shall be curved to one or more circular arcs as required, and according to 02430.10, to provide an assembled structure of specified dimensions and design.

Retain any camber specified for the invert when assembling and erecting the structures. Do not create an adverse grade in the structure.

(b) Plate Thickness - The thickness of the respective top, corner and bottom plates in any one structure shall be as shown.

(c) Bolts - Use at least 4 bolts per foot of longitudinal seam. Space bolts ~~at circumferential seams not more than 12 inches apart~~and bolt holes according to AASHTO M 167. Use additional bolts for special conditions of installation if called for in the Special Provisions or by the plans. Unless otherwise allowed, place all bolts with nuts on the inside of the structure.

(d) Assembly - Assemble structural plate structures according to the manufacturer's assembly instructions and the following:

- Hold the unsupported edges of all plates in position by temporary props.
- Extend each row of side plates far enough to support the plate above until the first complete ring has been assembled.
- Progressively install enough bolts to hold the plates in position. Do not tighten bolts until tightening will not interfere with adjusting and matching of additional plates and sections.
- Do not damage the galvanizing or other protective coating when using drift pins or pry bars. Repair any damage at no additional cost to the Agency.
- After all plates are in place, progressively and uniformly tighten the bolts from one end of the structure to the other end of the structure.
- Tighten bolts to at least 100 foot pounds of torque for plates 0.188 inch thick or less, and 150 foot pounds of torque for plates more than 0.188 inch thick.
- Recheck and retighten as necessary before backfilling.
- Do not torque bolts above 300 foot pounds during tightening.

(e) Damaged Coating - Repair damaged galvanizing according to 02420.10(d).

00450.44 Arch Substructures and Headwalls - Rest each side of each arch in a groove formed in the concrete, or rest on a galvanized angle or channel securely anchored to or embedded in the substructure. If the span of the arch is greater than 15 feet or the skew angle is more than 20 degrees, provide a metal bearing surface having a width at least equal to the depth of the corrugation.

Metal bearings may be either rolled, structural, or cold-formed galvanized angles or channels, and shall be at least 3/16 inch thick. Anchor the horizontal leg securely to the substructure on 24 inches centers or less. When the metal bearing is not embedded in a groove in the substructure, punch one vertical leg and bolt to the bottom row of plates.

00450.45 Strutting - If strutting is required, place and remove according to 00445.44.

00450.46 Backfilling - Backfill and compact the trench according to 00510.48(d) and the following:

(a) General - Perform backfilling so that a vertical elongation between 4~~%~~ and 6~~%~~ percent greater than the indicated normal diameter is maintained. Place backfill material evenly on both sides of the structure at least up to the three-quarter point of the structure. Fill above the top of the pipe with minimum cover as indicated on the fill height table included with the plans.

(b) Exposed Pipe - Place and compact embankment materials at exposed pipes according to Section 00445.

(c) Tell-Tales - Install and remove tell-tales according to Section 00445.

(d) Arches And Horizontal Ellipses - In addition to the other provisions of this subsection, exercise care as follows:

(1) Before Headwalls Are Placed - If backfilling pipes before headwalls are built, place the first backfill material midway between the ends, forming as narrow a ramp as possible until the top of the pipe is reached. Build the ramp evenly from both sides, and compact the backfill material as it is placed. After the ramps have been built to the top on each side of the pipe, deposit the remainder of the backfill evenly on both sides from the top of the pipe both ways from the center to the ends.

(2) After Headwalls Are Placed - If headwalls are built before the pipe is backfilled, place the first backfill material adjacent to one headwall until the top of the pipe is reached. Then deposit backfill material evenly on both sides from the top of the pipe toward the other headwall.

In multiple installations, follow the above procedures. Use care to place and bring the backfill up evenly on each side of each pipe to avoid unequal pressure.

Compact the backfill material thoroughly, but not excessively. Using water to hydraulically consolidate the backfill by ponding or jetting the backfill material is not allowed.

00450.47 Footings and Headwalls - Construct footings and headwalls for arches according to the design shown and the requirements of Sections 00440 and 00530.

00450.48 Contact Surfaces, Aluminum to Concrete - Where uncoated aluminum pipe will be in contact with portland cement concrete, give the contact surfaces of the aluminum pipe a coating of asphalt mastic according to 00445.47.

00450.49 Work Quality - The following defects constitute poor work and the presence of any in an individual culvert plate or in a shipment will be cause for rejection:

- Dents or bends in the metal itself
- Illegible brand

- Loose or unevenly lined or spaced bolts
- Ragged edges
- Unrepaired, bruised, scaled or broken spelter coating
- Uneven laps
- Variation from the specified alignment
- Wrong plate location

Measurement

00450.80 Measurement - The quantities of structural plate pipes, pipe arches, arches, horizontal ellipses, and vehicular underpasses will be measured on the length basis, excluding overlaps and the lip of plates at structure ends. Pipe arches and arches will be measured along the bottom centerline of the structures. The length of structural plate pipes, horizontal ellipses, and vehicular underpasses will be the average of the top and bottom centerline measurements.

Concrete for footings and headwalls will be measured on the volume basis, and will be the volume within the neat lines of the structure as shown or directed.

Excavation and backfill for pipes greater ~~that~~than 72 inches in diameter will be measured according to Section 00510.

Trench resurfacing will be measured according to 00495.80.

Reinforcement for footings and headwalls will be measured on the weight basis according to 00530.80.

Payment

00450.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	_____ inch Structural Plate Pipe	Foot
(b)	____ inch x ____ inch Structural Plate Pipe Arch	Foot
(c)	____ inch x ____ inch Structural Plate Arch	Foot
(d)	____ inch x ____ inch Structural Plate Ellipse	Foot
(e)	____ inch x ____ inch Structural Plate Vehicular Underpass	Foot
(f)	Structural Plate Concrete Footings and Headwalls	Cubic Yard

In item (a), the nominal size diameter of the pipe will be inserted in the blank.

In items (b), (c), (d) and (e), the size of the span and rise of the structures will be inserted in the applicable blanks.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Excavation and backfill for pipes greater ~~that~~than 72 inches in diameter will be paid for according to Section 00510.

Trench resurfacing will be paid for according to 00495.90.

Reinforcement for footings and headwalls will be paid for according to 00530.90.

No separate or additional payment will be made for trench excavation, bedding, pipe zone material, and trench backfill for pipes 72 inches and less in diameter.

Section 00460 - Paved Culvert End Slopes

Description

00460.00 Scope - This work consists of constructing portland cement concrete paved culvert end slopes at locations indicated on the plans or where designated.

Materials

00460.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete.....00440
Curing Compound 02050
Welded Wire Fabric.....02510.40

Construction

00460.40 General - Construct paved culvert end slopes according to Section 00440 and the following:

- Shape the base on which the concrete is to be placed to the lines and grades established. Water and compact the areas before placing concrete.
- Finish the surface of the paved culvert end slopes to a smooth, uniform texture by troweling and floating and then brush the surface with a broom or burlap, as directed.

Measurement

00460.80 Measurement - The quantities of paved culvert end slopes will be measured on the area basis. Measurement will be based on the paved end slope area table identified on the plans. No actual field measurement will be made, except to check the work, unless changes are ordered. No allowance will be made for paved culvert end slopes which are constructed on a skew.

If changes are ordered and made in the work, those paved culvert end slopes that are changed will be measured in the field. Measurements will be based on the actual surface area of the paved culvert end slope (not including the culvert opening) plus the face area of the cut-off wall.

Payment

00460.90 Payment - The accepted quantities of paved culvert end slopes will be paid for at the Contract unit price, per square foot, for the item "Paved Culvert End Slopes".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00470 - Manholes, Catch Basins, and Inlets

Description

00470.00 Scope - This work consists of constructing manholes, catch basins, inlets, siphon boxes, slope protectors, and other similar structures. Construct the structures of commercial grade concrete, corrugated metal, or other material, with necessary frames, covers, gratings, and other fittings and hardware.

References to manholes, inlets, siphon boxes, and slope protectors refer to standard structures of specific design and use, and are identified on the plans. The term "concrete" refers to commercial grade concrete.

00470.01 Cast-in-Place and Precast Construction - Concrete manholes shall be cast-in-place or precast, as shown or specified. Concrete inlets and siphon boxes may be either cast-in-place or precast.

Materials

00470.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete	00440
Concrete Drain Tile	02410.~~40~~10
Corrugated Metal Pipe	02420.10, 02420.40
Joint Material	02440.40, 02440.50, 02440.60
Metal Frames, Grates, Covers, and Ladders	02450.30
Nonreinforced Concrete Pipe	02410.10
Polyethylene Pipe	~~02410.60~~02415.10
Polyvinyl Chloride ~~(PVC)~~ Pipe, Schedule 40	~~02410.70~~02415.50
Precast Concrete Manholes, Catch Basins and Inlets	02450.10, 02450.20
Reinforcement	02510.10, 02510.40

00470.11 Precast Concrete Manholes and Bases - Furnish cones with the same wall thickness and reinforcement as riser sections.

Prior to delivery of precast manhole sections to the job site, yard permeability tests may be required at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material to be supplied to the Project. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C 497.

Precast manhole sections shall consist of circular sections in one of the following standard nominal inside diameters:

42 inch	54 inch	72 inch	96 inch	132 inch
48 inch	60 inch	84 inch	120 inch	144 inch

Heights of sections shall be multiples of 6 inches, except heights of manhole sections 72 inches through 96 inches in diameter shall be as required to fit site conditions.

00470.12 Cap Screws - Cap screws and washers for watertight manhole covers shall be stainless steel with 60,000 psi minimum tensile strength conforming to the requirements of ASTM A 453.

00470.13 Inside Drop Manhole Connectors - Furnish stainless steel anchor bolts and anchor straps for inside drop pipe connections.

00470.14 Pipe and Fittings - Furnish pipe and fittings as specified and conforming to the applicable portions of Section 00445. Use tees, ells and other fittings for drop manholes made from the same material as the pipe connecting to the manhole.

00470.15 Pipe Stubouts for Future Sanitary Sewer Connections - Pipe stubouts shall be the same type and strength classification as approved for use in the lateral, main or trunk sewer construction. Where there are two different classes of pipe at a manhole, the higher strength pipe will govern strength classification. Furnish watertight plugs with each stubout and adequately brace against hydrostatic or air test pressures.

00470.16 Sanitary Sewer Manhole Carry-Through - All sanitary sewer carry-through pipes and fittings through storm sewer manholes shall be ductile iron conforming to Section 02420.

00470.17 Base Drain Backfill - Furnish aggregate base or selected granular backfill material that is free from silts or other fines.

Construction

00470.40 General:

(a) Excavation, Backfill and Foundation Stabilization - Excavate and backfill according to Section 00405. When specified, or as directed, remove unstable material that will not support the manhole or other structure, excavate below grade and backfill with trench foundation stabilization material according to Section 00405.

(b) Pipe Connections - Place connecting pipe at the required alignment and grade. Set the connecting pipe through the full thickness of the wall flush with the inner face of the wall. Ensure that pipe connections to the structure are completely watertight. Connect all pipe to manholes according to the manufacturer's recommendations.

Grout concrete pipe connections to manholes so they are watertight, using non-shrink grout conforming to 02440.50. When grouted into the manhole section, the pipe section shall not extend more than 18 inches outside the manhole. If an approved flexible connection for concrete pipe is provided at the manhole, full or partial pipe sections may be stubbed into the manhole as required.

Connect flexible pipe to ~~sanitary~~ manholes using an ~~approved~~ adapter specifically manufactured for the intended service. ~~Use only flexible~~Flexible pipe adapters ~~from~~are required to be watertight after installation. Follow the ~~QPL~~manufacturer's recommendations. Do not use field-fabricated waterstops or improvised adapters. Adapters requiring the use of grout for installation shall be anchored and finished using non~~-~~-shrink grout conforming to 02440.50.

00470.41 Precast Concrete Manholes - Precast manhole components may be used to construct standard, drop and carry-through manholes.

(a) Bases - If bases are cast in place, consolidate the concrete by mechanical vibration. Screed off the concrete so that the first manhole section to be placed has a level, uniform bearing for the full circumference.

If bases are precast, carefully place the base section on the prepared bedding so as to be fully and uniformly supported at true grade and alignment.

Construct the invert to match that of the sewer pipe. Where the size of the sewer pipe is changed at the manhole, construct the invert to form a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of concrete sewer pipe is laid through

the manhole, break out the top to the springline of the pipe for the full width of the manhole, and completely cover the exposed edge of the pipe with mortar. During construction divert existing flows of water or sewage away from new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.

(b) Precast Manhole Sections - Thoroughly wet all lift holes, completely fill with nonshrink grout, and smooth and point both inside and out to ensure watertightness.

(1) Sanitary Manholes - Use preformed plastic or rubber gaskets on all joints between manhole sections.

(2) Storm Manholes - Non-shrink grout is allowed on joints, and on extension rings above the cone. In roadways and other areas intended for traffic, a minimum of one diameter precast riser is required between the cone and manhole cover frame.

When grout is used do the following:

- Clean and wet the surfaces to be joined with water.
- Apply non-shrink grout to the lower portion of the bell or groove of the section already laid and to the upper portion of the spigot or tongue of the section being laid.
- Clean the joint recesses, fill completely with non-shrink grout and wipe to a smooth finish both inside and out.
- Do not allow free water to come in contact with grout joints within 24 hours after the mortared joints are finished.
- Protect the completed joints against rapid drying.

(c) Grates, Frames, Covers and Fittings - Set metal frames for manholes on full non-shrink grout beds to prevent infiltration of surface water or groundwater between the frame and the concrete of the manhole section. If concrete is to be poured around the frames, coat the portion of the frame that will contact the concrete with hot asphalt before placing the concrete. Set frames, covers and grates true to the locations and grades established. Clean bearing surfaces and provide uniform contact. Secure all fastenings. Construct all mortared, sanitary sewer manhole necks and all riser ring joints made with non-shrink grout using an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted.

00470.42 Precast Concrete Catch Basins and Inlets - Install precast catch basins and inlets to the specified line and grade.

00470.43 Cast-in-Place Concrete Construction:

(a) General - Construct cast-in-place manholes, inlets, siphon boxes and concrete slope protectors according to Section 00440. Finish all inside surfaces smooth and free of depressions or protrusions. Form exterior surfaces with steel, plywood or other approved materials. Form other surfaces with matched boards, plywood, or other approved material. Do not cast directly against trench walls, rock, or earth.

(b) Cast-in-Place Catch Basins and Inlets - Construct forms for both the inside and outside walls of cast-in-place catch basins. Forms shall be tight and well braced, with chamfered corners. Remove all water and debris prior to placing concrete.

Consolidate the concrete immediately after placement with an approved vibrator. Limit vibration time to that necessary to produce satisfactory consolidation without causing segregation. Screed the top surface and trowel exposed surfaces to a smooth finish, free from marks or

irregularities. Radius exposed edges with a steel edging tool. After forms are removed, patch any defects in the concrete with an approved mortar mix.

Immediately after removal of forms and final finishing, cure according to 00440.40(e).

00470.45 Steps and Ladders - Fasten steps and ladders to the manhole walls according to the manufacturer's recommendations and as shown.

00470.46 Corrugated Pipe Slope Protectors - Construct corrugated metal slope protectors according to the plans and the applicable requirements of Section 00445.

00470.47 Concrete Inlet Base Drains - Provide concrete inlets with base drains leading from abutting aggregate base or selected granular backfill material.

Use nonreinforced concrete pipe, concrete drain tile, polyethylene pipe or polyvinyl chloride (PVC) plastic pipe for basin drains. Place and compact backfill without damaging pipe or inlet.

~~Maintenance, Clean~~Finishing, Cleaning up, and Testing

00470.70 Cleaning - Upon completion, clean each structure of accumulated silt, debris or foreign matter of any kind and keep clean until final acceptance of the work.

00470.71 Sanitary Manhole Acceptance Testing - Field test all sanitary sewer manholes for acceptance by either hydrostatic or vacuum testing after completion of backfilling, compaction and surface restoration, including paving. If the manhole fails the test, make necessary repairs by an approved method, and retest the manhole. Repair and retest the manhole until a satisfactory test is obtained.

(a) Hydrostatic Testing - Perform hydrostatic testing according to ASTM C 497. Plug all inlets and outlets and fill the manhole with water. Fill each manhole to the rim at the start of the test. Leakage in each manhole shall not exceed 0.3 gallons per hour per foot of head above the invert. Determine leakage by refilling to the rim using a calibrated container. Manholes may be filled 24 hours prior to the time of testing to permit normal absorption into the manhole walls.

(b) Vacuum Testing - Perform vacuum testing according to ASTM C 1244. Plug and brace all pipes entering the manhole. Place the test head in or on top of the manhole ring. Draw a vacuum of 10 inches of mercury on the manhole, close the valve on the vacuum line of the test head, and shut off the vacuum pump. Measure the time for the vacuum to drop to 9 inches of mercury. The manhole is acceptable if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the following table:

Minimum Test Times For Various Manhole Diameters

	Diameter (inches)								
	30 or less	**33**	**36**	**42**	**48**	**54**	**60**	**66**	**72**
Depth * (feet)	**Time ** (s)**								
8 or less	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	35	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

* Depth is measured from the top of the manhole to the lowest invert.
** Test times for manhole depths between those shown in this table may be calculated by interpolation.

Measurement

00470.80 Measurement - The quantities of manholes, inlets, catch basins, siphon boxes, slope protectors, and other structures will be measured on the unit basis.

Payment

00470.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	**Unit of Measurement**
(a)	Concrete Sanitary Sewer Manholes	Each
(b)	Concrete Storm Sewer Manholes	Each
(c)	Concrete Manholes, _____	Each
(d)	Concrete Inlets, Type _____	Each
(e)	Concrete Siphon Boxes	Each
(f)	Concrete Diversion Boxes	Each
(g)	Concrete Irrigation Boxes	Each
(h)	Concrete Junction Boxes	Each
(i)	Concrete Monument Boxes	Each
(j)	Manhole Slope Protectors	Each
(k)	Catch Basins, _____	Each

In items (c), (d) and (k) the type of structure will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- earthwork not covered as trench or ditch excavation
- pipe connections
- rock backfill
- aggregate base backfill
- drain tile
- acceptance testing

Section 00475 - Drain Wells

Description

00475.00 Scope - This work consists of drilling 8 inch diameter drain wells, including furnishing and installing steel well casings, at the locations and to the depths shown, for the purpose of intersecting large voids in underlying rock.

Materials

00475.10 Well Casing - Furnish NPS 8 inch, Schedule 40 black steel well casing pipe meeting the requirements of ASTM A 53.

Construction

00475.40 General - Drill the drain wells at the locations and to the depths directed, before constructing manholes and inlets.

Test each drain well by running water into it to determine if the well has sufficient capacity. The well shall have a capacity of at least 400 gallons per minute for ~~eight~~ 8 continuous minutes.

Measurement

00475.80 Measurement - The quantities of drain wells will be measured on the unit basis.

The quantities of drain wells deeper than 100 feet will be measured on the length basis, for the amount greater than 100 feet.

The quantities of steel well casings will be measured on the length basis.

Payment

00475.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) 8 Inch Drain Wells	Each
(b) Extra for 8 Inch Drain Wells Deeper Than 100 Feet	Foot
(c) NPS 8 Inch Steel Well Casing	Foot

Item (a) includes all costs involved in drilling 8 inch drain wells up to 100 feet in depth.

Item (b) includes all extra costs involved in drilling in excess 100 feet in depth. The Contractor will not be entitled to extra or additional payment if it is not necessary to drill deeper than 100 feet.

Item (c) includes all costs involved in furnishing and installing steel well casings.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for testing drain wells or for the water or other materials used in the work.

Section 00480 - Drainage Curbs

Description

00480.00 Scope - This work consists of constructing mechanically extruded curbs using either commercial grade concrete (CGC) or asphalt concrete material.

Construct the curbs at the locations and to the lines, grades and dimensions shown on the plans or as directed.

Materials

00480.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete.....00440
Emulsified Asphalt.....~~02710~~00730.11
Epoxy Bonding Agent.....02070.10
Preformed Expansion Joint Filler 02440.10

00480.11 Asphalt Concrete - Furnish a ~~dense graded,~~ Level 2, 1/2 inch asphalt concrete mixture meeting the requirements of Section 00744. The mixture may be varied when conditions require it, if approved by the Engineer. The mixture will be accepted visually by the Engineer.

Construction

00480.40 Preparation of Base - Clean pavements upon which drainage curbs are to be constructed so that they are free of dirt, dust, oil, grease or other extraneous matter.

00480.41 Bonding Material Application:

(a) CGC Curbs - Bond CGC curbs to underlying pavements with an epoxy bonding agent from the QPL or conforming to 00480.10. Apply according to the manufacturer's recommendations and at a rate that provides a thorough coating to the surface with all voids and depressions filled. Place the new curb on the epoxy bonding agent within 15 minutes after spreading, or before it loses its tackiness, whichever is sooner.

(b) Asphalt Concrete Curbs - Bond asphalt concrete curbs to underlying pavement with either:

- An epoxy bonding agent meeting the requirements of 00480.10 or from the QPL, applied in the manner specified in 00480.41(a), or
- An emulsified asphalt of the type designated by the Engineer and conforming to 00480.10. Apply emulsified asphalt at a rate of 0.05 to 0.10 gallons per square yard of curb. Place the new curb on the emulsified asphalt after the asphalt separates from the water (breaks), but before it loses its tackiness.

00480.42 Commercial Grade Concrete Curbs:

(a) Placing and Finishing - Feed concrete into the extruding machine at a uniform rate and operate the machine under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete. Perform finishing work as required to present a smooth, dense surface.

Remove and replace honeycombed sections. Repair of honeycombed and other defective sections by plastering will not be allowed.

(b) Transverse Expansion Joints - Space expansion joints as shown. The width of the joint and thickness of the filler shall not be less than 1/2 inch. Construct each expansion joint at right angles to the curb alignment, normal to the surface of the curb and provide complete separation of new concrete.

Firmly support the adjacent portions of the curb with close fitting shields if expansion joints are sawed before the concrete has hardened.

Mortar the joint filler in place if sawing is performed after the concrete has hardened.

(c) Transverse Contraction Joints - Space contraction joints as shown. Form the joints by grooving, by inserting and removing plates or other devices, by inserting and leaving in place preformed expansion joint fillers or by other approved means.

Make joints no wider than 1/4 inch, and deep enough so that at least one-third of the cross-sectional area of the curb is severed. Tool the edges of joints. Clean unfilled grooves and fill with joint filler flush with the surface of the concrete.

(d) Curing - Begin curing curbs immediately after completing machine or hand finishing of the fresh concrete, according to 00440.40(e).

00480.43 Asphalt Concrete Curbs - Construct asphalt concrete curbs by the mechanical extrusion method. Produce a well compacted mass of asphalt concrete with a uniform texture finish.

00480.44 Line and Grade - Place a 12 foot straightedge on the top or face of curb. The curb surface shall not vary more than 1/4 inch from the edge of the straightedge, except at grade changes or curves.

Measurement

00480.80 Measurement - The quantities of drainage curbs will be measured on the length basis, for each continuous run measured along the line and grade of the curb.

Payment

00480.90 Payment - The accepted quantities of drainage curbs will be paid for at the Contract unit price, per foot, for the item "Drainage Curbs".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00490 - Work on Existing Sewers and Structures

Description

00490.00 Scope - This work consists of joining new work to existing work, repairing or abandoning of sewer lines and structures, and adjusting existing manholes, inlets, boxes and other similar structures. Remove and dispose of pipe, manholes and catch basins that are scheduled for removal according to Section 00310.

00490.01 Descriptive Terms:

Adjust - To raise, lower or reconstruct structures to a new top elevation flush with the surrounding surface.
~~surface.~~

Box - Valve box, meter box, monument box or other similar structure with a removable cover.

Bypass Pumping - The process of pumping sanitary sewer or storm flows around a manhole or pipeline during the construction or rehabilitation of those facilities.

Inlet - Structure designed to receive surface water through a grate or orifice and to discharge water through pipes.
~~water through pipes.~~

Manhole - Manhole or similar structure designed to permit entry and working space, usually at intersections of sewer pipes.

Manhole Neck - The upper portion of a manhole, having vertical walls and a uniform diameter or dimension just sufficient to receive and support the metal frame.

Materials

00490.10 Materials - Furnish materials of either existing materials in a condition suitable for reuse and meeting current design, or new materials meeting the following requirements:

Commercial Grade Concrete	00440
Joint Materials	02440.40, 02440.50, 02440.60
Metal Frames, Covers, Grates, and Ladders	02450.30
Precast Concrete Sections	02450.10, 02450.20
Reinforcement	02510.10

00490.11 High Early Strength Concrete - Furnish high early strength concrete meeting the requirements of commercial grade concrete, except it shall contain a minimum of 705 pounds per cubic yard of Type III or Type IIIA cement or an approved Type C or Type E admixture with a minimum of 592 pounds per cubic yard of Type I or Type II cement.

Construction

00490.40 General - Excavate and backfill according to Section 00405. Remove and dispose of old concrete and other materials according to Section 00310.

Obtain approval before reusing salvaged metal frames, covers, grates and fittings on structures to be adjusted.

When concrete is poured around frames, paint the portion of the frame that will contact the concrete with hot asphalt before the concrete is poured.

Provide high early strength concrete when shown on the plans, or when traffic is required to traverse the structure due to staging requirements. The Engineer will determine the length of curing time.

New construction shall conform to Section 00470.

Repair, replace or restore to existing condition any manhole or similar structure backfill, inlet base drain, aggregate base or pavement disturbed or fouled by the adjustment work as directed.

Bypass pump sanitary sewer and stormwater flows around the pipe section or manhole being repaired or replaced by plugging an existing upstream manhole and pumping the flow around the work to a downstream manhole. Submit a bypass pumping plan to the Engineer at least 48 hours before beginning bypass pumping. Use a pump with adequate capacity to handle existing flows and additional flow due to rain. Pumps shall not exceed a noise level of 86 dB at a distance of 50 feet. Do not operate bypass pumps at night except in an emergency. Do not discharge raw sewage onto private property or city streets, or into storm drain systems.

00490.41 Manholes over Existing Sewers:

(a) General - Construct manholes according to Section 00470. Test all sanitary sewer manholes according to Section 00470.

Prevent material or debris from entering the line.

When required, provide all diversion facilities and perform all work necessary to maintain flow in existing lines. Obtain the Engineer's approval prior to diverting flows.

(b) Manholes over Existing Rigid Pipe Sewers - Construct manholes over existing rigid sewers after first cleaning and applying an approved commercial concrete bonding agent to all surfaces of the pipe that will be in contact with the manhole.

If the top of the existing rigid pipe is to be cut out, cut it to the springline for the full width of the manhole. Smooth and point the exposed edge of pipe with mortar.

Make rigid sewer pipe connections using an acceptable pipe connection according to Section 00470.

(c) Manholes over Existing Flexible Pipe Sewers - Construct manholes over existing flexible sewers systems with approved water stops, watertight fittings or boots at connections with the existing flexible sewer.

If approved, manholes may be constructed over existing PVC sewers and sealed at the manhole wall using the following method:

- Apply a coating of PVC solvent to the pipe that will be in contact with the manhole.
- Apply a dense coating of clean mortar sand over the PVC solvent cement.
- After the cement has cured, apply a commercial concrete bonding agent to the sand prior to placement of concrete.

(d) Manhole Connections - Core or sawcut openings in the existing manhole base or barrel as required. Construct connections that are watertight and that will provide a smooth flow into and

through the manhole. All sanitary sewer pipe connections, including those at invert level as well as penetrations for drop connectors, conduits and carry-throughs, shall conform to the requirements of Section 00470.

00490.42 Service Line Connections to Existing Sanitary Sewers - Make connections of service lines to existing sewers watertight. Make connections, where possible, to existing tees or wyes that have been previously installed and plugged. Remove the plug and make the connection according to Section 00445. Make transition couplings between dissimilar pipe materials using approved commercial adapters with stainless steel bands.

Where tees or wyes for connection are absent or unusable, connect service lines with approved commercial taps. Do not backfill any tap until it is inspected and approved by the Engineer.

Install taps by coring without protrusion into, or damage to, the existing sewer. Support the sewer and replace bedding material, as necessary, to prevent settlement of the sewer grade.

00490.43 Abandoning Pipe in Place - Drain abandoned pipes and plug watertight. Plug abandoned pipes with gasketed mechanical plugs or grout seals, as directed. Where abandoned pipes connect to sewer manholes, install the plugs or seals from the inside of the manhole and reshape the channel to conform to the Standard Drawings.

Fill abandoned pipes greater than 12 inches diameter with sand, controlled low-strength material meeting the requirements of 00442, or other approved material.

00490.44 Filling Abandoned Pipes, Manholes and Catch Basins - Cap or plug all connecting pipes to manholes and catch basins that are scheduled to be abandoned. Remove the manhole cone or flat top and manhole sections, or the catch basin frame, to a minimum depth of 3 feet below finish grade and fill the remaining manhole barrel or catch basin with granular material meeting the requirements of Section 02630. Compact the granular material to 90~~%~~ percent of maximum density according to AASHTO T 99. When in landscaped or unimproved roadway sections, backfill with approved materials meeting the requirements of 00330.13. Place topsoil meeting the requirements of 00330.11 for the last 1 foot of backfill.

00490.45 Salvaging Manhole Frames, Covers and Grates - Remove manhole frames, covers and grates scheduled for salvage and store in an approved location. Frames, grates and covers meeting Specifications may be salvaged from structures to be adjusted and may be reused in the work if of suitable size and condition. Replace, at no additional cost to the Agency, all items damaged or lost by the Contractor with similar items that are comparable in all respects with those they are to replace, and which are adequate for the intended purpose.

Clean salvaged components to be reused of foreign material by methods that will not harm the components.

00490.46 Adjusting Manholes:

(a) Metal Steps and Ladders - If existing manholes or similar structures have metal steps or metal ladders, provide new steps or new ladder extensions in the adjusted structure, in kind. Construct according to the Standard Drawings.

(b) Concrete and Masonry Manholes - Manholes may be raised or lowered as specified below or as shown.

(1) Minor adjustments of manholes are those that require adding or removing precast grade rings or metal rings as approved.

(2) Major adjustments of manholes are those that infringe into the cone or flat top section. Remove the cone or flat top, add or remove sections, and replace the cone or flat top. Use risers to attain desired grade.

Precast sections removed in the adjusting work may be reused in other adjusting work or in new construction provided they are in good condition and otherwise conform to the Specifications. ~~Precast~~Dispose of precast items~~ that are~~, not ~~used in~~reused on the ~~work become the property of the Contractor~~Project, according to 00290.20.

(c) Raising Tops of Manholes - The top of the manhole may be raised by the use of riser rings or by reconstructing the neck. Fabricated metal rings and plates may be furnished and used in the adjustment work, provided that:

- The metal and its fabrication provide at least the strength and support required for covers or grates.
- Uniform bearing of bearing surfaces is assured.
- Positive safeguards are made against displacement when in service.

Do not exceed 24 inches total distance from the top of the metal frame at its new adjusted grade to the top of the cone. Riser rings and repairs shall conform with the requirements of Section 00470. Extend manhole barrels of brick, block or concrete in kind.

(1) Concrete Manholes - Reconstruct the neck of the manhole as follows:

- Remove existing frames, covers and grates.
- Chip away the exposed top surface on which new mortar or concrete is to be placed, to a depth of 1 1/2 inches or until firm concrete is exposed.
- Clean the new surface by brushing, and moisten with water at the time of placing new concrete.
- Place new concrete to the required grade and cure at least ~~three~~ 3 days when using commercial grade concrete, and as directed when using high early strength concrete.
- Seat the frame in fresh mortar and bring to the proper grade.

(2) Masonry Manholes - Reconstruct masonry manholes of bricks or concrete blocks as follows:

- Raise with new bricks, blocks, precast components, mortar or combinations thereof, or with concrete, as conditions warrant.
- Do not place mortar for building up existing masonry to a depth of more than 3 inches.
- Do not place concrete to a depth of less than 3 inches.
- To conform to these requirements, cut down as necessary the existing shells or walls of structures to be adjusted to provide space for the new construction.

(d) Lowering Tops of Manholes (Minor Adjustment) - When the adjustment does not require removal of the cone or flat top, proceed as follows:

- Expose the top of the structure to the required depth.
- Cut off or remove elements of the structure to an elevation below that established for the bottom of the metal frame or cover.
- Build up with mortar, concrete, brick or concrete blocks to the required elevation.
- Join new material to old as specified in above under (a) through (c).

(e) Metal Manholes - Adjust metal manholes to grade by resetting the entire structure on a firm foundation, by adding extensions of like design and material, or by severing the barrel in an acceptable manner. ~~Salvaged~~Dispose of salvaged structures, not reused on the Project ~~become the property of the Contractor~~, according to 00290.20.

00490.47 Adjusting Catch Basins and Inlets:

(a) Cast-in-Place Concrete Catch Basins and Inlets:

- After existing frames and grates or covers have been removed, chip away the exposed top surface to expose firm concrete. Provide at least 1 inch clearance below the frame to be placed.
- Clean the new surface by brushing and moistening with water at the time of placing new concrete.
- Provide the necessary forms to maintain existing structure dimensions in the new work.
- Place new concrete according to Section 00440 to the required grades. The frame may either be preset in the form or placed in the fresh concrete to the required grades.
- Finish the concrete top surfaces as required to match the grades required.
- Grout existing and new inside surfaces as required to attain a uniform surface transition.

(b) Precast Concrete Catch Basins and Inlets - The entire precast structure may be reset to a new grade when the nature of the structure and conditions permit.

Precast concrete sections may be added or removed as required to obtain proper grade.

Precast structures may be raised by using precast sections provided that:

- The material conforms to the general requirements of the existing structure.
- Sections are set and joined to each other and to existing sections.
- Uniform bearing of bearing surfaces is assured.
- Positive safeguards are made against displacement when in service.

(c) Catch Basin Connections - Adjust as follows:

- Place connecting pipe at the required line and grade.
- Set the connecting pipe through the full thickness of the wall flush with the inner face of the wall.
- Connect to the structure with a watertight joint.

00490.48 Adjusting Boxes, Cleanout Lids and Similar Structures - Raise or lower boxes, lids and similar structures by one of the following methods:

- Resetting the entire structure on a firm foundation.
- Adding extensions of like material below the original structure if raising the structure to a point where it would not enclose or protect its contents.
- Placing precast box extensions, or cast-in-place concrete.
- Complete replacement of the structure with a new structure of adequate design approved by the Engineer.

00490.49 Finish Grade - Center a 12 foot straightedge, as far as practical, over the center of the cover of manholes and boxes. The final grade of the pavement surface and adjusted manholes and boxes shall not vary more than 1/4 inch from the finish grade and cross section at any point along the straightedge.

Measurement

00490.80 Measurement - The quantities of adjusted and reconstructed manholes inlets, boxes, and other similar structures will be measured on the unit basis.

The quantities of manholes over existing sewers, connections to existing structures, and filling abandoned structures will be measured on the unit basis.

Payment

00490.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Minor Adjustment Of Manholes	Each
(b)	Major Adjustment Of Manholes	Each
(c)	Adjusting Inlets	Each
(d)	Adjusting Boxes	Each
(e)	Adjusting Catch Basins	Each
(f)	Manholes Over Existing Sewers	Each
(g)	Connection To Existing Structures	Each
(h)	Filling Abandoned Structures	Each

Item (a) applies to manholes adjusted by adding or removing precast or metal grade rings.

Item (b) applies to manholes adjusted by:

- removing and reconstructing part or all of the cone or flat top
- removing and replacing the entire cone or flat top
- adding precast risers below the cone of precast manholes

Item (f) applies to manholes that are installed over existing sewers.

Item (h) applies to filling abandoned pipes, manholes, inlets, boxes and other similar structures.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- earthwork
- backfill
- protective coatings
- replacement of manhole or similar structure backfill
- base drains
- aggregate bases
- pavements

- connections
- structure abandonment
- removing and disposing of existing structures and pipe
- bypass pumping

Section 00495 - Trench Resurfacing

Description

00495.00 Scope - This work consists of resurfacing pipe trenches, including replacement of pavement, curbs, sidewalks, rock surfacing, topsoil, landscaping and other features removed or damaged during pipe trenching operations.

Materials

00495.10 Materials - Furnish trench resurfacing materials that either match existing material removed from pipe trenches, or new materials meeting the following requirements:

Aggregate.....00641
Asphalt Concrete Pavement (ACP).....00744 and 00745
Concrete Paving.....00756
Concrete Sidewalks, Curbs, and Driveway 00759
Emulsified Asphalt Concrete (EAC).....00735
Emulsified Asphalt Prime Coat.....00705
Emulsified Asphalt Surfacing.....00710
Emulsified Asphalt Tack Coat 00730
~~Hot Mixed Asphalt Concrete (HMAC).....00745~~
Rock Surfacing.....00641
Topsoil, Planting, and Seeding.....01040

Furnish sand used for edge sealing that is clean sand with no visible sign of silts or organic materials.

Construction

00495.40 General - The following construction requirements are for resurfacing trenches in various locations. Refer to Section 00405 for trench surface removal requirements.

(a) ~~Hot Mixed~~ Asphalt Concrete ~~(HMAC)~~ Paving - Place ~~HMAC paving~~ACP according to ~~Section~~ Sections 00744 and 00745, as applicable.

(b) Emulsified Asphalt Concrete ~~(EAC)~~ Paving - When temporary surfacing is required prior to placing permanent surfacing, place EAC paving a minimum of 1 inch thick. The temporary paving shall be smooth with surface variations not greater than 1/2 inch from the existing surfacing. Where the temporary patch adjoins existing surfaces the joint shall not be greater than 1/4 inch high. Maintain the temporary surfacing until the permanent surfacing is placed. ~~HMAC~~ACP mix may be used if approved.

(c) Emulsified Asphalt Prime Coat - Construct emulsified asphalt prime coat according to Section 00705.

(d) Emulsified Asphalt Surfacing - Construct emulsified asphalt surfacing treatment according to Section 00710.

(e) Edge Sealing Tack Coat Application - Seal all adjoining asphalt concrete pavement surfaces with an edge sealing tack coat. Place sufficient tack coat to seal the adjoining surfaces. After the tack coat has been placed, place clean sand over the tack coat. Reapply additional tack coat and sand cover to any edges that are not completely sealed in the first application.

(f) Aggregate Base - Place aggregate base according to Section 00641.

(g) Concrete Sidewalk, Curb and Driveway - Construct concrete sidewalk, curbs and driveways according to Section 00759.

(h) Concrete Paving - Construct concrete paving according to Section 00756.

(i) Rock Surfacing - Construct rock surfacing according to Section 00641.

(j) Topsoil - Place topsoil according to Sections 00405 and 01040.

(k) Landscaping - Place landscaping according to the requirements of Section 01040.

Measurement

00495.80 Measurement - The quantities of trench resurfacing will be measured on the area basis. The length will be measured horizontally along the centerline of the installed pipe from edge to edge of the surface replaced. The width will be ~~measured from edge to edge~~the nominal inside diameter of the ~~top of the trench.~~pipe plus:

- 24 inches for pipes less than 36 inch in diameter
- 48 inches for pipes between 36 inch and 72 inch, inclusive

When the pipe is installed under pavement by tunneling, boring, or jacking methods, the work will be measured according to 00406.80.

Payment

00495.90 Payment - The accepted quantities of trench resurfacing will be paid at the Contract unit price, per square yard, for the item "Trench Resurfacing".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for replacement of disturbed landscape items.

When the pipe is installed under pavement by tunneling, jacking, or boring methods, the work will be paid for according to 00406.90.

When the Contract Schedule of Items does not indicate payment for trench resurfacing or other work under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

PART 00500 - BRIDGES

Section 00501 - Bridge Removal

Description

00501.00 Scope - This work consists of removing and disposing of existing bridges or portions of existing bridges as shown or specified.

Construction

00501.40 Removal and Disposal - Perform removal and disposal work according to Section 00290 and Section 00310.

Measurement

00501.80 Measurement - No measurement of quantities will be made for bridge removal work performed under this Section.

Payment

00501.90 Payment - The accepted quantities of bridge removal work will be paid for at the Contract lump sum amount for the item "Bridge Removal Work".

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00503 - Bridge Deck Cold Plane Pavement Removal

Description

00503.00 Scope - This work consists of removing existing pavement from bridge deck surfaces.

Equipment

00503.20 Equipment for Grinding on Bridge Decks - To remove pavement from bridge decks, use ~~power-operated diamond grinders,~~ micro-milling equipment~~, or hydroblast machines capable~~ consisting of ~~uniformly removing the existing surface to the depths required.~~

~~**(a) Diamond Grinders** - Diamond grinders shall be power-driven self-propelled units with cutting heads made up of diamond cutting blades.~~

~~**(b) Micro-milling** - Micro-milling equipment shall consist of the following:~~

~~**(1) Cold Plane or Rotomill Grinders** - Cold~~either cold plane or rotomill grinding machines ~~using~~that have carbide cutting tools in a rotary drum. Provide equipment with a tooth spacing of not more than 1/4 inch, capable of leaving a smooth, uniform pattern of striations. Limit machines to a gross operational weight of no more than 35 tons and a forward speed to 2.5 feet per minute. Operate at a drum speed of at least 120 RPM.

~~**(2) Shot-Blasters** - Mono-directional or bi-directional electric-powered shot blast machines with single or multiple blast wheels.~~

~~Machines shall cover at least 2.5 feet per pass, and shall conform to EPA air pollution requirements by containing dust and steel abrasive media. If the equipment is not equipped for simultaneous bi-directional blasting, make separate passes in opposite directions to ensure equal cleaning on all sides of the exposed aggregate. Limit forward speed to 2.5 feet per minute.~~

~~**(c) Hydroblasting** - Hydroblasting equipment shall be capable of removing concrete at a rate and volume acceptable to the Engineer without leaving a striated surface. Remove the entire original deck surface to a minimum depth of 0.125 inch. Demonstrate the removal rate and accuracy of the equipment to the Engineer prior to commencing work.~~

Construction

00503.40 Pavement Removal on Bridges - Remove pavement from bridges according to the following:

(a) General:

- Before removing the wearing surfaces, do the following:
  - Determine the actual depth of pavement to be removed.
  - Block all deck drains and all catch basins. Do not allow any grinding, chipping, sweeping, flushing, or shot blasting material to enter them.
- Remove material that is within 12 inches of all joints in a manner acceptable to the Engineer. Do not damage any joints.
- Remove AC, laitance, and residual film by approved hand methods in areas that cannot be reached by grinding machines.
- ~~Hydroblast all deck surfaces before placing high performance concrete.~~

- Repair all damage to abutting concrete surfaces or other surfaces that are damaged by the Contractor's operations at no additional cost to the Agency.

(b) AC Surfacing - Do not grind into the existing concrete bridge deck.

(c) PCC Surfacing - If ~~diamond,~~ cold plane~~,~~ or rotomill grinders are used, clean the entire surface with a shot blaster after completion of the diamond grinding operation. Provide a final surface that is free of cement paste and sand and has a minimum 0.125 inch depth of exposed large aggregate.

(d) Scheduling - Schedule the work so the full width and length of travel lane pavement can be removed during the same shift. Remove the shoulder area within 24 hours after removing the travel lane pavement.

If the depth of the existing pavement to be removed is over 2 inches, then within the same day construct a wedge of asphalt concrete, at a slope of 1V:10H or flatter along each exposed longitudinal drop-off, and 1V:50H or flatter along each exposed transverse drop-off. Place wedges completely across the milled area at joints, deck drains, catch basins, and other structures. Maintain wedges as long as the area remains under traffic or until pavement is replaced. Remove and dispose of wedges before placing new surfacings.

00503.41 Surface Tolerance - Test with a 12 foot straightedge furnished and operated by the Contractor, as directed. The variation of the top of the ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed 1/4 inch.

00503.42 Disposal of Materials - ~~Materials removed under this Section that are not used on the Project become the property of the Contractor at the point of origin. Dispose of the material according to 00290.20 unless special sites are specified in the Special Provisions~~. Dispose of all materials according to 00290.20.

00503.43 Maintenance Under Traffic - If the cold planed pavement surface will be exposed to traffic, sweep and clean prior to allowing traffic to use the roadway.

Measurement

00503.80 Measurement - The quantities of bridge deck cold plane pavement removal will be measured on the area basis. ~~The area will be determined by measuring the width and length of the bridge deck surface, measured to the nearest 0.1 foot, and calculated to the nearest square yard.~~

When the depth of pavement to be removed is variable, the depth is an estimate and will be considered approximate only. No guarantee is made that the actual depth will be the same as the estimated depth.

Payment

00503.90 Payment - The accepted quantities of bridge deck cold plane pavement removal will be paid for at the Contract unit price, per square yard, for the item "Bridge Deck Cold Plane Pavement Removal, _____ Deep".

The depth will be inserted in the blank. If the depth is variable, the depth range will be inserted in the blank.

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for removing asphalt concrete surfacing from bridge decks for the preparation ~~of~~for concrete and crack sealing, multi-layer polymer concrete overlays, premixed polymer overlays, silica fume concrete overlays, latex modified concrete overlays, waterproofing ~~membrane~~membranes, or for constructing, maintaining, and removing temporary wedges.

Section 00510 - Structure Excavation and Backfill

Description

00510.00 Scope - This work consists of excavating, backfilling and disposing of materials in connection with the construction of bridges, grade separation structures, rigid frame structures, and other major structures. Other major structures under this Section are retaining walls, reinforced concrete box culverts, headwalls, structural plate structures, and pipe culverts, sewers, siphons and irrigation pipes greater than 72 inches in diameter.

This work does not include any earthwork covered under any sections of Parts 00300 or 00400, or any earthwork that may be specifically included and provided for as incidental work for particular items or parts of the work. The construction, measurement, and payment of embankment at bridge ends and engineered fills will be according to Section 00330.

00510.01 Lines, Grades, and Cross Sections - Perform the work to the lines, grades and cross sections shown or as established.

00510.03 Cofferdam Plans, Calculations, and Construction Inspection - Submit stamped cofferdam plans and design calculations according to 00150.35 except as modified by this subsection.

Design cofferdams according to the ODOT Bridge Design and Drafting Manual.

Submit a Cofferdam Design Summary and complete a Cofferdam Design Checklist prepared by the cofferdam design engineer, to accompany the plans and calculations. Include the following in the summary:

- A list of cofferdam members with their capacities and design stresses
- Design loading assumptions for each member
- Design ~~references~~specifications
- Subsurface materials and conditions used in design

Complete the checklist included in the Special Provisions.

Submit five sets (nine sets if railroad approval is required) of the plans, and three copies (five copies if railroad approval is required) of the calculations, summary, and checklist.

The Engineer will provide a list of construction concerns at least ~~two~~2 days prior to the cofferdam design engineer's inspection. Upon completion of the cofferdam construction and immediately after dewatering, the cofferdam design engineer of record, accompanied by the Engineer, shall inspect the cofferdam. Do not continue construction until:

- The cofferdam design engineer furnishes the Engineer a written statement that the cofferdam conforms to the design and will serve the intended purpose, and
- The Engineer agrees in writing that all construction concerns have been addressed and the cofferdam will serve the intended purpose.

00510.04 Shoring Plans, Calculations, and Construction Inspection - Submit stamped shoring plans and design calculations according to 00150.35 except as modified by this subsection.

Design shoring according to the ODOT ~~Bridge~~Geotechnical Design~~ and Drafting~~ Manual.

Submit a Shoring Design Summary and complete a Shoring Design Checklist prepared by the shoring design engineer, to accompany the plans and calculations. Include the following in the summary:

- A list of shoring members with their capacities and design stresses
- Design loading assumptions for each member
- Design ~~references~~specifications
- Subsurface materials and conditions used in design

Complete the checklist included in the Special Provisions.

Submit five sets (nine sets if railroad approval is required) of the plans, and three copies (five copies if railroad approval is required) of the calculations, summary, and checklist.

The Engineer will provide a list of construction concerns at least ~~two~~2 days prior to the shoring design engineer's inspection. Upon completion of the shoring construction, the shoring design engineer of record, accompanied by the Engineer, shall field inspect the shoring. Do not continue construction until:

- The shoring design engineer furnishes the Engineer a written statement that the shoring conforms to the design and will serve the intended purpose and;
- The Engineer agrees in writing that all construction concerns have been addressed and the shoring will serve the intended purpose.

Materials

00510.10 Selected General Backfill - Furnish soil selected from roadbed, ditch, trench, or structure excavations meeting the requirements of 00330.13.

00510.11 Selected Granular Backfill - Furnish granular material selected from roadbed, ditch, trench or structure excavations meeting the requirements of 00330.14.

00510.12 Granular Wall Backfill - Furnish granular wall backfill meeting the requirements of 02630.11.

00510.13 Granular Structure Backfill - Furnish granular structure backfill meeting the requirements of 02630.10.

00510.15 Quality Control - Provide quality control according to Section 00165.

Labor

00510.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT and CDT technical certifications.

~~• CEBT~~
~~• CDT~~

Construction

00510.40 Clearing, Grubbing, and Removal Work - In the absence of pay items under Section 00310 and Section 00320, the provisions of those sections apply when applicable. Perform such work as incidental work for which no separate payment will be made.

Clearing, grubbing, and removal limits shall be at least 10 feet outside of the entire structure, including the ends of the structure but within the right-of-way.

00510.41 Structure Excavation - Structure excavation includes:

- Removal of all material necessary for the construction of foundations and substructures as shown or specified.
- Placement of all backfill except granular wall backfill and granular structure backfill.
- Disposal of excavated material not required or suitable for backfill according to 00330.41(a-5).
- Correction, according to recognized practice, of conditions detrimental to the work, including removal of excess water.

Shore, brace, or use cofferdams to protect excavations unless open excavation would not be detrimental to adjacent structures, roadways, or waterways.

If the plans show concrete in footings placed against undisturbed material, make excavation for footings as nearly as possible to neat lines of the footings. Where such material will not stand vertically after excavation and the excavation does not exceed 1 foot outside the footing dimensions, fill all space between the footing and remaining undisturbed material to the top of the footing with footing concrete or granular structure backfill material, as directed. Compact the granular structure backfill to 97~~%~~ percent of maximum density, according to 00330.43.

Concrete placed against steel sheet piles in cofferdams or cribs will be considered placed against undisturbed material, whether or not the steel sheets are later removed.

Where practical, excavate rock materials using pavement breakers, rippers, backhoes, other excavation equipment or non-explosive means that preclude breakage of rock materials below and outside of the structure excavation limits. If blasting is required, perform such work in a manner that avoids disturbing rock outside the structure excavation limits. Use controlled blasting techniques for all structure excavation requiring blasting according to Section 00335. Backfill and repair as directed, at no additional cost to the Agency, any excavation, shattered rock, void, fault, or unstable condition caused by the Contractor outside the limits of structure excavation. Backfill and repair of voids, faults or unstable condition not caused by the Contractor or covered elsewhere in the Specifications will be paid for according to ~~Section 00196~~00195.20.

Consider the elevations of the bottoms of footings or foundations shown as approximate only. The Engineer may order, in writing, changes in elevations of footings necessary to secure a satisfactory foundation.

00510.42 Structure Excavation and Backfill Below Elevations Shown - Excavate soft, unstable or unsuitable material below footings or bases of structures, including bedding, if any, to elevations as directed.

Perform one of the following as directed:

- Increase the length of columns or walls until the bottom of the footing is at the new established elevation.
- Increase the thickness of footings until the bottom of the footing is at the new established elevation
- Backfill the subexcavated area to the plan elevation according to 00510.46(a).

00510.43 Preservation of Channel - Do not excavate outside of caissons, cribs, cofferdams, sheet piling or sheeting, or disturb the natural streambed unless specified or allowed. Where such

excavation is allowed, comply with Section 00405. Do not sidecast any excavated material into the stream.

When allowed, the necessary excavation for placement of riprap outside the perimeter of the footing may be made without the use of cofferdams or cribs, and disposed of according to 00330.41(a-4).

00510.44 Cofferdams and Cribs - Design and construct cofferdams and cribs when shown, specified or determined by the Contractor to be necessary for performing the work in the dry inside them as follows:

- Prepare and submit plans, calculations, summary and checklist for cofferdams or crib designs according to 00510.03.
- Provide interior dimensions for cofferdams and cribs to give sufficient clearance for the inspection of forms.
- When weighted cribs are used to partially overcome the hydrostatic pressure acting against the bottom of the foundation seal, provide an appropriate special anchor system such as dowels or keys to transfer the entire weight of the crib into the foundation seal.
- Do not leave cofferdam or crib timber or bracing extending into the substructure concrete.
- Place and cure seal concrete according to 00540.48(e).
- Vent or port, at low water level, any cofferdam that is to remain in place.
- Unless otherwise directed, remove cofferdams or cribs, including all sheeting and bracing, after the completion of the substructure. Do not disturb or damage the finished concrete.

00510.45 Pumping - No pumping of water from the interior of any foundation enclosure will be allowed during the placing of concrete or for a period of at least 24 hours thereafter unless an effective means of eliminating moving water through fresh concrete is employed. Water may then be pumped, if approved.

Do not pump to dewater a sealed cofferdam until the seal concrete meets the requirements of 00540.48(e).

00510.46 Preparation of Foundations - Do not place concrete on prepared foundations without prior approval. Construct foundations as follows:

(a) Backfilled Foundations - Construct the top surface of the foundation fill at least 3 feet beyond the area to serve as a foundation unless otherwise shown or directed. Use selected granular backfill or granular structure backfill as directed. Place in 6 inch layers and compact to not less than 95~~%~~ percent of maximum density according to 00330.43.

(b) Undisturbed Soil Foundations - Do not disturb the sides or bottoms of foundation excavations. Place concrete against undisturbed soil when shown. Concrete may be used as backfill, subject to 00540.45(a). If soil is disturbed, compact all disturbed material to 95~~%~~ percent of maximum density according to 00330.43.

(c) Formed Foundations on Soil - Do not disturb the bottoms of foundation excavations. If soil is disturbed, compact all disturbed material to 95~~%~~ percent of maximum density according to 00330.43.

(d) Rock Foundations - Before placing concrete:

- Clean all rock surfaces and remove loose material
- Clean seams and fractures according to 00510.41, and seal with grout

- Level, step or roughen the rock surface as shown or as directed

Construct formwork, if allowed or required, and place concrete as soon as practical following the removal of material, to the specified elevation.

00510.47 Embankment Construction at Bridge Ends - Construct embankments at bridge ends according to 00330.42(c-7) and, when shown, engineered fills according to 00330.42(c-8).

00510.48 Backfill:

(a) General - Prepare for, place and compact backfill according to 00330.42 and 00330.43, if it becomes a part of a roadway embankment or is to support a roadway, bridge approach end panel, rock slope protection or slope paving, and is not covered by 00510.41, 00510.42, 00510.46, or 00510.47.

Do not place backfill that will cause unbalanced loading on the concrete until the concrete has been in place ~~seven~~7 calendar days and test cylinders show the concrete strength to be 100~~%~~ percent of design strength according to 00540.17(c).

Do not place backfill against any other concrete until the concrete has been in place ~~three~~ 3 calendar days, and test cylinders show the concrete strength to be 40~~%~~ percent of design strength according to 00540.17(c).

Place backfill and riprap in a manner that will not damage the concrete footings, drain pipes, and other permanent work. Do not jet or puddle the backfill unless approved in writing. Prevent large lateral or wedging compaction forces from occurring directly against the concrete.

Dispose of excess materials according to 00330.41(a-4).

(b) Bridge Abutments and Retaining Walls - Backfill at abutments and retaining walls with granular wall backfill to the upper pay limits shown or as directed, and as follows:

- Do not place backfill until superstructure elements are set, pinned and tensioned.
- Place backfill required at the front face of retaining walls before backfilling behind the wall.
- For single span bridges with abutments, keep the backfill heights within 2 feet of each other.
- Place granular wall backfill at all weep holes.

(c) Pier and Column Footings - Backfill piers and columns as follows:

- Use either selected general backfill, selected granular backfill, riprap or other materials as shown or directed.
- Deposit backfill around piers and columns on all sides to approximately the same elevation at the same time.
- Place backfill up to the original ground surface, the upper limits of pay excavation, or as shown or directed.

(d) Reinforced Concrete Box Culverts, Structural Plate Structures and Pipe Culverts Over 72 Inches in Diameter - Provide bedding, if required, according to 00405.12. Use backfill materials conforming to 00510.12 or 00510.13 unless otherwise specified. Place and compact as shown and according to 00405.46. Place backfill up to the surrounding ground surface, to the top of trench, or the upper backfill pay limits shown or as directed.

Measurement

00510.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Shoring, Cribbing and Cofferdams - No measurement of quantities will be made for shoring, cribbing, and cofferdams.

(b) Structure Excavation - Structure excavation will be measured according to the following:

(1) Lump Sum - Under this method, no measurement will be made. Estimated quantities of structure excavation will be listed in the Special Provisions.

(2) Volume - Under this method, structure excavation will be measured on the volume basis in original position (position before excavating).

Quantities will be limited to the neat lines shown, or if not shown, will be limited to the following:

a. Lower Limit - The lower limit will be the elevations shown for the bottoms of structure footings or bases, including bedding, if any.

b. Upper Limits - The upper limit will be determined as follows:

1. Within Embankments - The planes of the new embankment at the elevation specified or established.

2. Within Roadbed or Channel Change Excavations - The planes of the bottoms and side slopes of the excavations.

3. All Other Cases - The ground surface immediately before starting the excavation.

c. Horizontal Limits - The horizontal limits will be the vertical planes parallel to and 1 foot outside the neat lines of the footings or bases of all structures, except for structural plate structures and pipe culverts over 72 inches in diameter, which will be as shown.

When the Engineer approves or directs, structure excavations less than the specified horizontal limits, the measured limits will be the actual excavation made.

(c) Structure Excavation Below Elevations Shown - Structure excavation below elevations shown will be measured according to the following:

(1) Lump Sum - When structure excavation is lump sum basis and when the Engineer requires structure excavation below the elevations shown, measurement to extend the excavations will be made as follows:

- **0 to 3 Feet Below Elevations** - For excavation 0 to 3 feet below elevations shown, measurement will be determined according to 00190.10(~~f~~h) and based on a theoretical unit price of the lump sum structure excavation item.

- **More than 3 Feet Below Elevations** - For excavation more than 3 feet below elevations shown, measurement will be determined according to ~~Section 00196~~00195.20.

(2) Volume - When structure excavation is volume basis and when the Engineer requires structure excavation below the elevations shown, measurement to extend the excavations will be made on the volume basis.

Quantity limits will be from the bottom limit described in 00510.80(b-2-a) to the new lower limits of the excavation for the footing or base of the structure, including bedding, if any, established by the Engineer. The horizontal limits will be vertical extensions of the quantity limits established according to 00510.80(b-2-c).

(d) Granular Wall/Structure Backfill - Granular wall backfill and granular structure backfill will be measured on the volume basis, of material used in backfilling as determined by cross section measurement of the materials in place. The quantities will be limited to the quantities placed according to the plans and specifications or as directed. When backfilling excavated areas, the quantities will be limited to the pay limits of the excavation for the part of excavated areas backfilled with the specified granular backfill material.

Payment

00510.90 Payment - The accepted quantities of work performed under this Section will be paid for as follows:

(a) Shoring, Cribbing and Cofferdams - Shoring, cribbing, and cofferdams will be paid for at the Contract lump sum amount for the item "Shoring, Cribbing and Cofferdams".

No separate or additional payment will be made for maintaining and removing all materials.

No separate or additional payment will be made for clearing and grubbing, preparing foundations, pumping, and cleaning up.

If the Engineer orders excavations that extend below the elevation shown, the Contractor will be compensated to extend shoring, cribbing, and cofferdams as follows:

Footing Elevation Changes	Compensation
0 to 3 feet below	No extra payment
More than 3 feet below	~~Section 00196~~00195.20

When the Contract Schedule of Items does not indicate payment for shoring, cribbing and cofferdams, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

(b) Structure Excavation - Structure excavation will be paid for at the Contract lump sum amount or the Contract unit price, per cubic yard, for the item "Structure Excavation".

Except for granular wall backfill, no separate or additional payment will be made for backfilling and compacting to the elevation specified.

(c) Structure Excavation Below Elevations Shown - Structure excavation below elevations shown will be paid for as follows:

(1) Lump Sum - For excavation 0 to 3 feet below elevations shown, payment will be determined and made according to 00190.10(~~f~~h). For excavation more than 3 feet below elevations shown, payment will be determined and made according to ~~Section 00196~~00195.20.

(2) Volume - For excavation 0 to 3 feet below elevations shown, payment will be made at the Contract unit price, per cubic yard, for the item "Structure Excavation".

For excavation more than 3 feet below elevations shown, payment will be made at the Contract unit price, per cubic yard, for the item "Structure Excavation Below Elevations Shown". If the Contract Schedule of Items does not indicate payment for this work, payment will be determined according to ~~Section 00196~~00195.20.

(d) Granular Wall/Structure Backfill - Granular wall backfill and granular structure backfill will be paid for at the Contract unit price, per cubic yard, for the item "Granular Wall Backfill" or "Granular Structure Backfill", as applicable.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- removing material forced up between foundation piles during driving or of material used in backfilling around piles, should subsidence occur during driving
- bedding
- excavations made below the elevations established for the bottoms of the footings or bases, including bedding, if any, or for any other unauthorized excavations. Backfill, seal, or otherwise repair these unauthorized excavations with concrete or other material acceptable to the Engineer according to 00510.46 at no additional cost to the Agency.
- water removed from excavations and water used in compaction or other items of work

Section 00512 - Drilled Shafts

Description

00512.00 Scope - This work consists of excavating and constructing drilled, cast-in-place, reinforced concrete shafts, according to these Specifications and the plans.

00512.01 Definitions:

Drilled Shafts - Reinforced concrete sections, cast-in-place against in situ soil, rock, or a casing.

Permanent Casing - Casing designed as part of the drilled shaft and intended to remain in place after concrete placement is completed.

Temporary Casing - Casing installed to facilitate drilled shaft construction only and removed during or after concrete placement.

00512.02 Subsurface Investigation - The Soils and Geological Exploration Logs are available for review through the Engineer's office. The data shown for each test boring or test pit applies only to that particular boring or test pit. Subsurface conditions may vary between borings or test pits. Core samples and laboratory test results, if obtained and performed for the Project, are available for review by contacting the Engineer.

The Foundation Data shown in the plans is a compilation of pertinent information including, but not limited to, the Soils and Geological Exploration Logs.

Materials

00512.10 ~~General~~Materials - Furnish materials meeting the following requirements:

(a) Reinforcement - Use reinforcement complying with Sections 00530 and 02510.

(b) Concrete - Use Class 4000 structural concrete according to Section 02001, except as modified in this Section.

00512.12 Concrete Mix Design - Design the drilled shaft concrete ~~mix~~ for minimum segregation. Use ~~a pre~~ The Engineer's reviewed and approved mix design ~~that meets the slump requirements of Section 02001~~.

~~Mix a trial batch and take test cylinders for one seven-day and two 28-day test breaks prior~~ Add water to ~~placing~~the concrete ~~in the completed shaft excavations.~~

- ~~Water may be added~~mix at the Project Site only if allowed by the approved mix design ~~and if approved.~~. Accurately measure water added at the site by water meters, buckets or other approved devices ~~and limit it~~. Limit the addition of water at the Project Site to 1~~.0~~ gallon per cubic yard. ~~Retarding or water-reducing agents may be used to maintain specified slump ranges and to facilitate temporary casing extraction. To allow for adequate concrete workability throughout the duration of concrete placement and prior to temporary casing extraction, provide a concrete mix having a slump loss characteristic such that a minimum slump of 4 inches is maintained for the entire duration of the pour. Admixtures may be used if tested and certified in the mix design and if approved.~~
- Provide concrete having the appropriate initial slump according to Table 02001-3. Use chemical admixtures from the QPL to control and maintain slump and to facilitate temporary casing extraction.

- Design the concrete mix to maintain at least 4 inches of slump after placement and throughout the entire duration of the pour including during temporary casing extraction.

00512.13 Steel Casing - Furnish temporary casing meeting the requirements of ASTM A 252 or ASTM A 36. Furnish permanent casing meeting the requirements of ASTM A 36 with the application of supplemental requirement S5. Test each heat of steel at 40 °F with a minimum absorbed energy requirement of 15 foot pounds. Do not use previously used casing for permanent casing. Use casing of sufficient strength to resist handling, transportation and installation stresses and the external stresses of the subsurface materials. Ensure that the casing is clean and watertight prior to placement in the drilled shaft excavation. ~~Use casing with an outside diameter not less than the specified drilled shaft diameter.~~

00512.14 Drilling Slurry - Furnish drilling slurry meeting one of the following requirements:

(a) Mineral Slurry - Use mineral slurry conforming to the following requirements:

Property	Test	Requirement
Density	Mud Density API * 13B-1, Section 1	64 - 75 lb./cu. ft.
Viscosity	Marsh Funnel and Cup API * 13B-1, Section 2.2	26 - 50 sec./qt.
pH	Glass Electrode, pH Meter, or pH Paper	8 - 11
Sand Content	Sand API * 13B-1, Section 5	4.0 % max.

Maintain slurry temperature at 40 °F or more during testing.

* American Petroleum Institute

(b) Synthetic Slurries - Select synthetic slurries from the QPL. Use synthetic slurries according to the manufacturer's recommendations and the Contractor's quality control plan. The sand content of synthetic slurry shall be less than 2.0 percent (API 13B-1, Section 5) prior to final cleaning and immediately prior to concrete placement.

(c) Water Slurry - Water may be used as slurry when casing is used for the entire length of the drilled shaft. Use of water slurry without full-length casing will only be allowed with the Engineer's approval. Use water slurry conforming to the following requirements:

Property	Test	Requirement (Maximum)
Density	Mud Weight (Density) API 13B-1, Section 1	70 lb./cu. ft.
Sand Content	Sand API 13B-1, Section 5	2.0 %

Do not use blended slurries.

00512.15 Crosshole Sonic Log ~~(CSL)~~ Access Tubes - Furnish steel crosshole sonic log (CSL) access tubes meeting the following requirements:

- Steel access tubes shall be at least 1 1/2 inch inside diameter Schedule 40 pipe conforming to ASTM A 53, Grade A or B, Type E, F, or S.

- Use access tubes having a round, regular inside diameter free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of the source and receiver probes used for the testing. Ensure that access tubes are watertight, free from corrosion with clean internal and external faces to ensure good bonding between the drilled shaft concrete and the access tubes. Fit the access tubes with watertight caps on the top and bottom.
- Access tube acceptance will be based on manufacturer's certification that the furnished material meets the requirements of this Specification.

00512.18 Crosshole Sonic Log Cement Grout - Furnish non-epoxy grout or tendon grout from the QPL or furnish a pumpable CSL cement grout consisting of neat cement and water that has a water cement ratio between 0.38 and 0.45. The portland cement for the pumpable CSL cement grout ~~meeting~~shall meet the requirements of Section ~~02080~~ 02010.

00512.19 Quality Control - Maintain and be responsible for quality control of the drilled shaft work throughout the construction operation. The Engineer will inspect all drilling operations and verify the suitability of all drilled shaft construction procedures. Provide lights, mirrors, weighted tape, weighted probe, personnel, and all assistance required for the Engineer to perform inspection during drilled shaft construction.

Labor

00512.30 Personnel Qualifications - Perform the drilled shaft construction work using a company and personnel experienced in drilled shaft construction work. Submit a list to the Engineer for approval identifying the on-site supervisors and drill rig operators assigned to the Project and the companies experience relevant to the Project. Experience shall be relevant to the anticipated subsurface materials, groundwater conditions, shaft size, depth and any special construction techniques required. Also provide the experience qualifications of the company performing the CSL testing. Before the preconstruction conference, provide the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the drilled shaft construction and CSL testing:

- Submit a project reference list of at least three separate foundation projects, successfully completed in the last ~~five~~5 years, with drilled shafts of diameters and depths equal to or larger than those shown in the plans and in ground conditions similar to those indicated. Include a brief description of each project and the owner's contact person's name and current phone number for each project listed.
- On-site supervisors shall have at least ~~two~~ 2 years experience in supervising construction of drilled shaft foundations of similar size (diameter and depth) and scope to those shown in the plans and in similar geotechnical conditions to those described in the geotechnical report. Experience shall include the direct supervisory responsibility for the on-site construction operations.
- Drill operators shall have at least ~~one~~1 year experience in the construction of drilled shaft foundations.
- Perform CSL testing using an independent testing organization retained by the Contractor and approved by the Agency. Furnish personnel experienced in operating the CSL testing equipment. Submit the CSL testing firm qualifications according to 00512.40(a). The CSL testing firm shall have successfully performed CSL testing on a minimum of five projects during the last ~~three~~ 3 years. CSL testing personnel shall be trained in the operation of the CSL equipment and have at least ~~one~~1 year of experience in operating CSL testing equipment on a minimum of 10 shafts.

The Engineer will respond within 21 calendar days after receipt of the submittal. Do not begin work on any drilled shafts until the qualifications have been approved. The Engineer may suspend the

drilled shaft construction if the Contractor substitutes unapproved personnel during construction. Submit requests for substitution of either on-site supervisors, drill operators, or CSL testing personnel to the Engineer, who will have ~~seven~~7 calendar days to respond to each request. Additional costs resulting from the suspension of work due to the changing of personnel is the Contractor's responsibility, and no adjustment in Contract Time resulting from the suspension of work will be allowed.

Construction

00512.40 Submittals - Provide the following submittals to the Agency for review and approval:

(a) Drilled Shaft Installation Plan - At least 21 calendar days before beginning shaft construction, submit the following:

- The sequence of drilled shaft construction as it relates to the overall construction plan.
- A review of equipment suitability based on the Contractor's understanding of the site subsurface conditions. Include a project history of the drilling equipment that demonstrates the successful use of the equipment for drilled shafts of equal or greater size in similar subsurface conditions.
- Details of shaft excavation methods, including proposed drilling methods and a disposal plan for excavated material. Include details of methods used to perform final cleaning of the excavation. Include details of the methods and materials used to fill or eliminate all voids between the plan shaft diameter and excavated shaft diameter, or between the casing and surrounding soil, if permanent casing is specified. Include a disposal plan for any water or contaminated concrete expelled from the top of the shaft (if applicable).
- Details of the proposed ~~method(s)~~methods for ensuring drilled shaft stability during excavation and concrete placement.
- Details for the use of drilling slurry including mix design, slurry head requirements, mixing methods, maintaining, and disposing of the slurry (if applicable). Include a discussion of the suitability of the proposed drilling slurry in relation to the anticipated subsurface conditions.
- A plan for quality control of all drilling slurries, if their use is proposed. In the quality control plan, include property requirements, required tests and test methods to ensure the slurry performs as intended. Submit to the Engineer the name and current phone number of synthetic slurry manufacturer's representatives who will provide technical assistance during construction. Provide the ~~name(s)~~names of the Contractor's personnel assigned to the Project and trained by the synthetic slurry manufacturer in the proper use of synthetics slurries.
- Unstamped reinforcing steel shop drawings and details of reinforcement placement, including bracing, splicing, centering, and lifting methods and the method for supporting the reinforcement ~~on the bottom of the shaft excavation~~ according to 00150.35. Include details on the type, number, and placement of spacers and other devices for ensuring the reinforcing cage position is maintained during construction. Include details for attaching the CSL test access tubes to the reinforcing cage (if applicable).
- Evidence that the proposed materials and concrete mix design conform to all applicable Specifications.
- Documentation that the workability and slump retention properties of 00512.12 are met.
- Details of concrete placement, including proposed operational procedures for pumping and tremie methods. Include details for grout placement in the crosshole sonic logging test access tubes after testing is completed (if applicable).

- Detailed procedures for permanent casing installation and temporary casing installation and removal. Include casing diameters, dimensions, and depths and the methods and equipment for casing installation and removal.
- CSL testing company performing the CSL testing work, including documentation demonstrating that the company, and company personnel, meets the required qualifications.
- Confinement methods required to contain drilling fluids, spoils, waste concrete and other products from contacting sensitive environmental areas according to Section 00290 and all applicable regulatory permits.
- Methods for protecting existing structures according to 00170.82.

The Engineer will approve or reject the drilled shaft installation plan within 21 calendar days after receipt of all submissions. Provide any additional information and submit a revised plan, if requested, for review and approval. All procedural approvals given by the Engineer will be subject to trial in the field and will not relieve the Contractor of the responsibility to satisfactorily complete the work. Submit requests for modification of adopted procedures to the Engineer. Allow 21 calendar days for approval of modifications. Do not begin drilled shaft construction work until all drilled shaft submittals have been approved.

(b) Drilled Shaft Repair Plans - For any shaft determined to be unacceptable, submit a repair plan to the Engineer for approval. Furnish all materials and work, including engineering analysis and design, needed to correct unacceptable drilled shafts, at no additional cost to the Agency. Do not begin repair operations before remedial procedures or designs are approved. Any modifications to the dimensions or material of the drilled shafts shown on the plans that are proposed in the repair plan will require stamped calculations and working drawings according to 00150.35.

(c) Drilled Shaft Inspection Reports - Provide the Engineer with a completed Drilled Shaft Inspection Report for each drilled shaft, detailing the actual location, alignment, elevations, dimensions, and quantities of the shafts.

Submit the report within 21 calendar days after the completion and acceptance of each shaft. A "Drilled Shaft Inspection Report" form is available from the Engineer.

(d) Concrete Placement Logs and Volume Curves - Measure and record all concrete placed into drilled shafts using standard ODOT forms designated for this purpose or other forms approved by the Engineer. Provide the Engineer with a completed Drilled Shaft Concrete Placement Log and Concrete Volume Curve Form for each drilled shaft within 24 hours after completion of shaft concrete placement.

00512.41 ~~Drill~~Drilled Shaft Coordination Meeting - Hold a drilled shaft coordination meeting at least ~~seven~~ 7 calendar days before beginning any shaft construction work at the site to discuss construction procedures, schedules, staging, personnel, equipment to be used, and other elements of the approved shaft installation plan as specified in 00512.40. If synthetic slurry is used to construct the shafts, the frequency of scheduled site visits to the project site by the synthetic slurry manufacturer's representative will be discussed. Those attending the meeting include:

- **Representing the Contractor** - The superintendent, on-site supervisors, and all supervisors in charge of excavating the shaft, placing the casing, mixing and installing slurry (as applicable), placing the steel reinforcing bars, and placing the concrete. If synthetic slurry is used to construct the shafts, the slurry manufacturer's representative and a Contractor's employee trained in the use of the synthetic slurry shall also attend.

- **Representing the Contracting Agency** - The Project Engineer, key inspection personnel, and designers of record or their appointed representatives.

If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved shaft installation plan, hold an additional meeting before any additional shaft construction operations are performed.

00512.42 Construction Tolerances - Excavate drilled shafts as accurately as possible at the locations shown and within the specified tolerances listed below. Determine the drilled shaft dimensions and alignment with approved methods. The following construction tolerances apply to drilled shafts unless otherwise stated:

- **Horizontal Position (At the Plan Elevation of the Top of Shaft):**
  - **Shaft Diameter Less Than or Equal to 6 Feet** - 3 inch horizontal tolerance from the location shown.
  - **Shaft Diameter Greater Than 6 Feet** - 6 inch horizontal tolerance from the location shown.
- **Top Elevation of Shaft Concrete:**
  - **Top Elevation Above Water** - Minus 3 inches to plus 1 inch from the plan top of shaft elevation.
  - **Top Elevation Under Water** - Minus 3 inches to plus 6 inches from the plan top of shaft elevation.
- **Vertical Alignment in Soil** - May not vary from the plan alignment by more than 1.5~~%~~ percent of the shaft length.
- **Vertical Alignment in Rock** - May not vary from the plan alignment by more than 2~~%~~ percent of the shaft length.
- **Top of Steel Reinforcement** - Plus or minus 6 inches from the plan top of steel reinforcement elevation.

Frequently check the plumbness, alignment, and dimensions of the shaft during construction. Correct all out-of-tolerance shaft excavations and completed shafts to the satisfaction of the Engineer. Materials and work necessary to complete corrections for out-of-tolerance drilled shafts will be at the Contractor's expense, and no extension of the Project completion date will be granted. Materials and work necessary to complete corrections for out-of-tolerance drilled shafts resulting from the removal of unexpected drilled shaft obstructions will be paid for ~~as Extra Work~~according to 00195.20.

00512.43 Drilled Shaft Excavation - Perform drilled shaft excavation according to the following:

(a) General - Excavate drilled shafts to the dimensions and elevations shown or as directed. Provide and maintain stabilized drilled shaft sidewalls and bottoms for the full depth of the excavation, using approved materials, equipment and methods. If caving or other unstable conditions occur during any construction procedure, stop further construction, notify the Engineer, and stabilize the shaft excavation by approved methods and submit a revised installation plan which addresses the problem and prevents further instability. Do not continue with shaft construction until any damage which occurred has been repaired according to the Specifications and until receiving the Engineer's approval of the revised shaft installation plan.

If the Engineer has reason to believe that the drilled shaft excavation techniques or workmanship have been deficient, so that the integrity of any excavation is in question, work on that drilled

shaft may be stopped. Drilled shaft excavation will not be allowed to resume until the deficient excavation techniques or workmanship have been changed to the Engineer's satisfaction.

Dispose of materials removed from the shaft excavations according to 00290.20.

Do not leave partially completed shaft excavations open overnight unless they are cased full depth or otherwise stabilized with approved methods. If approved by the Engineer, a partially excavated shaft may be left open overnight, provided that the excavation is:

- ~~Is stabilized~~Stabilized at the bottom, sides and surface to prevent soil caving or swelling or a reduction of soil strength~~, and~~.
- ~~Is covered~~Covered at the surface to protect the public.

Extend the drilled shaft excavation if the Engineer determines that the subsurface materials encountered are not capable of providing the required bearing resistance or differ from those anticipated in the design of the drilled shafts.

(b) Protection of Existing Structures - Control shaft construction operations to prevent damage to existing structures and utilities. Preventive measures include, but are not limited to, selecting construction methods and procedures that will prevent caving of the shaft excavation and monitoring and controlling the vibrations from construction activities such as the driving and vibrating of casing or sheeting, drilling of the shaft, or from blasting, if blasting is allowed. Repair all damage caused to existing structures, utilities or other facilities, resulting from drilled shaft construction activities, at no additional cost to the Agency.

(c) Temporary Casing - Provide temporary casing according to the approved installation plan and of sufficient quantities to meet the needs of the anticipated construction method.

Where the peak horizontal ground acceleration coefficient for the 1,000 year return period used for seismic design of the structure is less than or equal to 0.~~10,~~16 g (acceleration due to gravity), temporary telescoping casing may be used for the drilled shafts, subject to the following conditions:

- Submit the request to use temporary telescoping casing to the Engineer for approval. Specify the diameters and lengths of the temporary telescoping casing and the shafts where use is requested.
- The minimum diameter of the shaft shall be as shown on the plans.
- Backfill all voids between the temporary telescoping casing and the plan shaft dimensions with a material that approximates the geotechnical properties of the subsurface soils, or with concrete as approved.
- Use temporary telescoping casing material conforming to 00512.13.

(d) Unexpected Drilled Shaft Obstructions - Remove any natural or manmade object encountered that was not revealed by the Agency's site investigation, and that would cause a significant decrease in the rate of advancement if removed using the techniques and equipment used successfully to excavate the shaft. The Engineer will be the sole judge of the significance of any reduced rate of shaft advancement and the classification of any unexpected obstructions. Removal of unexpected obstructions from the shaft excavation will be paid ~~as Extra Work~~according to 00195.20.

(e) Lost Tools - Promptly remove drilling tools lost in the excavation. Lost tools will not be considered unexpected obstructions and shall be removed without additional compensation. Drilling tools lost during the course of removing unexpected drilled shaft obstructions will be paid ~~as Extra Work~~according to 00195.20.

(f) Drilling Slurry Installation - If synthetic drilling slurry is selected, provide a manufacturer's representative to provide technical assistance at the site prior to use of the slurry, who shall remain at the site during construction and completion of a minimum of one drilled shaft to adjust the slurry mix for the specific site subsurface conditions. After the manufacturer's representative is no longer at the site, provide the approved personnel trained in the use of the synthetic slurry for the remainder of the shaft slurry operations to supervise the proper slurry mix design and quality control procedures.

All in-hole drilling slurry shall meet the required slurry specifications during excavation and prior to concrete placement. Clean, recirculate, de-sand or replace the slurry to maintain the required slurry properties.

Unless otherwise approved, maintain the level of slurry in the excavation at not less than 5 feet above the groundwater level for mineral slurries or 10 feet above the groundwater level for synthetic or water slurries. Maintain the slurry level a sufficient distance above all unstable zones to prevent bottom heave, caving or sloughing.

Maintain the required slurry properties and levels at all times during shaft construction, including work stoppages, unless other approved stabilization methods are applied.

Feed slurry continuously into the shaft excavation as drilling progresses so that a stable excavation is maintained. Use a self-priming pump to reclaim the slurry. Keep a standby pump available during the drilling operation.

(g) Drilling Slurry Inspection and Testing - Mix and thoroughly hydrate all drilling slurries in an appropriate storage facility. Collect sample sets from the storage facility and perform tests to ensure the slurry conforms to the specified material properties before introduction into the drilled shaft excavation. A sample set shall be composed of samples taken at mid-depth and within 24 inches of the bottom of the storage facility.

Sample and test all slurry in the presence of the Engineer, unless otherwise directed. The sample sets of slurry within the excavation shall consist of samples taken at mid-depth of the excavation and within 24 inches of the bottom of the excavation. Collect and test sample sets during the drilling operation as necessary to ensure the specified properties of the slurry are maintained. Clean, recirculate, de-sand, or replace the slurry as necessary to maintain the specified slurry properties. Final cleaning of the excavation and placement of concrete will not be allowed until the test results indicate the slurry properties are as specified.

Perform a minimum of two sets of slurry tests per ~~eight~~ 8 hour work shift, the first test being done at the beginning of the shift. Field conditions may require more frequent testing to ensure acceptable slurry properties.

Make copies of all slurry test results available to the Engineer on request.

(h) Clean Out - Use appropriate means, such as a cleanout bucket, pump or air lift, to clean the bottom of the drilled shaft excavations. No more than 2 inches of loose or disturbed material will be allowed at the bottom of the excavation for end-bearing drilled shafts. No more than 6 inches of loose or disturbed material will be allowed at the bottom of the excavation for side friction drilled shafts. Assume end-bearing shafts unless otherwise shown or specified. Shaft cleanliness will be determined by the Engineer.

Notify the Engineer of completion of each drilled shaft excavation to permit inspection before proceeding with construction. Measure final shaft depths with a suitable weighted tape or other approved method after final cleaning to determine that the shaft bottom meets the requirements

in the Contract. Do not proceed with shaft construction until the bottom cleanliness requirements have been met and the bottom (shaft tip) elevation is approved.

00512.45 Reinforcing Steel - Furnish and place reinforcing steel as shown and according to the following:

(a) Placement - Do not place reinforcing steel in the shaft excavation until the Engineer has approved the final elevation of the bottom of the shaft.

In each shaft, place reinforcing steel extending from 6 inches above the bottom of the shaft excavation to the elevation shown. The reinforcing cage may be supported on the bottom of the shaft excavation if approved. Support the reinforcing cage to prevent distortion or settlement during concrete placement. If concrete placement does not immediately follow cage placement, remove the reinforcing cage from the excavation and rectify the integrity of the excavation prior to reinstallation of the cage.

(b) Bracing - Rigidly brace the reinforcing cage to retain its shape for lifting. Lift the cage in a manner that does not cause permanent racking or distortion. Show bracing and any extra reinforcing steel required for fabrication of the cage on the submitted shop drawings. Remove cross bracing during cage placement unless otherwise approved.

(c) Splicing - Splice all drilled shaft reinforcement using approved mechanical splicer's unless otherwise shown or approved.

(d) Concrete Cover - Maintain the required concrete cover shown ~~on the plans~~ by placing concentric spacer bars or other approved devices around the reinforcing cage. Place spacing devices on maximum 10 foot vertical spacing the full length of the shaft. At each 10 foot level, place spacers on a maximum 30 inch circumferential spacing with at least three spaces per level. Do not use wood spacers or concrete dobies. Provide details of the proposed centering method on the shop drawings submitted according to 00512.40.

00512.46 Crosshole Sonic Log Test Access Tubes - Furnish and install access tubes for CSL testing as shown. Attach CSL access tubes securely to the interior of the reinforcement cage as near to parallel as possible in each drilled shaft and in the pattern shown. Extend the access tubes from the bottom of the reinforcement cage to at least 24 inches above the top of the shaft. Joints required to achieve full-length access tubes shall be watertight. Do not damage the access tubes during reinforcement cage installation and concrete placement. Fill the tubes with potable water, according to 02020.10(b), as soon as possible, but no more than ~~one~~1 hour after concrete placement and reinstall the top watertight caps. Check water level and top off as needed.

Replace all access tubes that the test probe cannot pass through to the full depth of the shaft at no additional cost to the Agency. Replace all damaged access tubes with 1.5 inch to 2.0 inch diameter holes cored through the concrete for the entire length of the shaft. Unless otherwise directed, locate replacement core holes approximately 6 inches inside the reinforcement. Do not damage the shaft reinforcement during coring operations.

Fill the access tubes with grout only after all CSL testing has been completed and the shaft has been accepted.

00512.47 Concrete - Furnish and place concrete according to the following:

(a) Concrete Placement - Place concrete immediately after completion of the shaft excavation and with the approval of the Engineer. Prior to concrete placement, ensure the shaft clean~~-~~-out requirements are met according to 00512.43(h) and the properties of the slurry (if used) conform

to specifications. Shaft concrete may be placed without mechanical vibration in those areas of the drilled shaft that are not formed or are below the ground line or the water surface.

Place concrete continuously until concrete at the top of the shaft or at the top of the first construction joint, is free of water, soil, and debris, and uncontaminated concrete extends to the plan top-of-shaft elevation~~.~~ or to the top of the construction joint, as applicable. For shafts with a non-contact splice, clean and roughen the surface of the shaft construction joint according to the applicable portions of 00540.43(a). Dispose of all contaminated concrete expelled from the top of the shaft in an approved manner. Remove waste concrete from the site. If a delay in concrete placement occurs because of a delay in concrete delivery or other factors, reduce the placement rate to maintain a flow of fresh concrete into the shaft excavation.

Unless otherwise approved by mix design, allow a maximum of 60 minutes between concrete placements and use no concrete older than 90 minutes from batch time. Use procedures for concrete placement which ensure that the concrete within the shaft becomes a monolithic, homogeneous unit.

Place concrete using hoses or pipes having watertight joints. For concrete placement by gravity tremie, use hose or pipe having an inside diameter of at least 8 inches. For placement by concrete pump, use hose with inside diameter of at least 4 inches. Provide an alternate delivery system that can be used in case of failure of the primary delivery system. Place concrete only against the bottom of the drilled shaft or into fresh concrete.

If caving occurs during concrete placement, the shaft may be rejected.

(b) Dry Shaft Concrete Placement - Concrete may be placed by free-fall if all of the following conditions are met:

- ~~no~~No more than 3 inches of water is present in the bottom of the excavation at the beginning of the pour.
- ~~groundwater~~Groundwater seepage into the excavation is at a rate of no more than 12 inches per hour.
- ~~shaft~~Shaft diameter is greater than or equal to 3 feet.

Under free-fall placement, deposit concrete through the center of the reinforcement cage by a method which prevents segregation of aggregates and splashing of concrete on the reinforcement cage. Place concrete so that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars or steel cage bracing.

(c) Wet Shaft Concrete Placement - If the drilled shaft excavation does not meet the requirements for dry concrete placement, stabilize water inflow and place the concrete under water or slurry with a tremie pipe or pump hose according to 00540.48(e). Place concrete continuously from the bottom of the shaft to the top-of-shaft elevation shown. Use a plug in the tremie pipe or pump hose to force water or slurry ahead of the advancing flow of fresh concrete. Dispose of all displaced water, slurry, or waste concrete according to 00290.20. When groundwater, the drilling water or slurry in the shaft excavation is to be removed by pumping during concrete placement, have a standby pump available.

Place concrete in a continuous operation so that the concrete always flows upward within the shaft. Withdraw the delivery hose or pipe slowly as the elevation of the fresh concrete rises in the shaft. Keep the discharge end of the pipe or hose at least 5 feet below the surface of the concrete after the concrete has reached a depth of 5 feet. Maintain sufficient concrete inside the hose or pipe to prevent drilling fluid from entering. During concrete placement, provide and maintain markings on the tremie pipe or pump hose, or a sounding device or other appropriate

method to determine the relative elevations of the fresh concrete surface and the bottom end of the pipe or hose. Raise the bottom end of the pipe or hose only when the pipe or hose has a sufficient head of fresh concrete to prevent the formation of a void at the bottom.

(d) Concrete Curing and Cleaning - Allow the exposed top of concrete to cure a minimum of ~~seven~~ 7 calendar days by covering with wet burlap overlain with plastic sheets or by keeping top of concrete under water. Keep the burlap wet during the concrete cure.

Prior to placing any fresh concrete on top of a completed shaft, clean the upper surface of the concrete by removing all scum, laitance, loose gravel, and sediment and chip off any high spots on the upper surface that would prevent the steel reinforcing bar cage from being properly placed in the position shown on the plans. Remove all loose material and poor quality concrete at the top of the shaft down to sound concrete prior to performing any required CSL testing.

(e) Casing Removal - Remove all temporary casing during or after completion of concrete placement. Do not start temporary casing removal until the level of fresh concrete within the casing has reached a depth of at least 10 feet or the level necessary to adequately counteract the external hydrostatic pressure head. As the temporary casing is withdrawn, maintain a minimum 5 feet head of concrete above the bottom of the casing. A slight downward movement of the casing while exerting downward pressure, or hammering or vibrating the casing will be allowed to facilitate extraction. Extract the casing so that concrete is cast directly against the surrounding in~~-~~-situ material. Check the elevation of the top of the reinforcing cage before and after temporary casing extraction for conformance with the construction tolerance criteria of 00512.42. Casing that cannot be extracted during, or immediately after, the concrete placement operation may be cause for rejection of the shaft.

Remove the tops of permanent casing to the top of the drilled shaft or the finished groundline, whichever is lower, unless otherwise shown or directed. Remove the tops of permanent casing for shafts constructed in a permanent body of water to the low water elevation, unless otherwise shown or directed.

00512.48 Drilled Shaft Testing and Acceptance - Acceptance of drilled shafts will be based on the Engineer's review of the results of CSL, or other, integrity testing (if conducted), field inspection reports and visual observations during drilled shaft construction. The Engineer has final authority on the approval of drilled shafts. For shafts that are integrity tested, the Engineer will determine final acceptance of each tested shaft, based on the integrity test results and inspection reports and will provide a response to the Contractor within ~~five~~5 calendar days after receiving the CSL test report.

(a) Crosshole Sonic Log Testing - Provide crosshole sonic log testing equipment and perform crosshole sonic log testing and analysis on the first drilled shaft completed at each structure and subsequent shafts as specified or designated for testing by the Engineer. Provide CSL testing equipment conforming to the requirements of ASTM D 6760 and approved by the Engineer. Provide all necessary access and other support to the CSL testing firm necessary to do the CSL testing work.

~~Unless otherwise directed, perform~~Perform one CSL test on each shaft designated for testing. A single CSL test consists of all ultrasonic profile combinations in a given shaft. Test completed drilled shaft foundations using Ultrasonic Crosshole Testing methods (Crosshole Sonic Log (CSL) Testing) according to ASTM D 6760. Inform the Engineer of scheduled CSL testing at least ~~three~~ 3 calendar days prior to the testing. Perform all CSL testing using the Contractor's CSL technician in the presence of the Engineer.

Allow at least ~~three~~3 calendar days of curing time before testing unless otherwise approved. Additional curing time beyond ~~three~~3 calendar days may be required if the shaft concrete contains admixtures such as set retarding admixture or water reducing admixture. Additional

CSL testing required due to the CSL testing being conducted on concrete that has not cured sufficiently is at no additional cost to the Agency. Additional curing time required due to concrete admixtures will not be grounds for additional compensation or time extensions.

For drilled shafts constructed using non-contact splice methods, perform CSL testing after the initial pour to the bottom of the splice region and before placement of the column reinforcement and pouring of the splice region.

(b) Contractor's ~~CSL~~Crosshole Sonic Log Test Reports - Provide a brief summary report of the data, with interpretation of the test results, to the Engineer at the completion of each test. Provide copies (either hardcopies or electronic files) of the raw test data as requested. Mark the test data files to identify, as a minimum, the structure, bent and shaft number, the date of CSL testing, depths of testing and any other pertinent information.

Submit three copies of a final CSL Test Report for each shaft tested according to ASTM D 6760. Provide electronic file copies of the raw CSL data measurements~~ (compatible with the Cross Hole Ultrasonic Monitor (CHUM) program),~~. if requested. The report shall summarize the CSL testing performed, data analysis, and interpretation of CSL data with special attention made to the identification and location of any anomalies or possible defects. Provide interpretation of the CSL test data in terms of overall shaft integrity and acceptance. Submit all reports to the Engineer within ~~five~~ 5 calendar days of the performance of the tests.

(c) Additional Testing and Investigation - Conduct additional testing or investigation necessary to identify the location, extent and condition of possible shaft defects if requested by the Engineer. Additional testing and investigation may include, but is not limited to, additional CSL testing, excavation work or core drilling.

If requested by the Engineer, drill a core hole in any questionable quality shaft to explore the shaft condition. The number, location and depths of the core holes will be determined by the Engineer. Submit the method and equipment used to drill and remove cores from the shaft to the Engineer for review and approval prior to drilling. Use a coring method that provides complete core recovery and minimizes abrasion and erosion of the core. If a defect is confirmed, as determined by the Engineer, all investigation costs associated with identifying the defect will be at no additional cost to the Agency and no extension of the Project completion date will be granted, regardless of whether the identified defect is repaired or not.

If no defect is identified in the investigation work, and the CSL tubes were satisfactorily installed according to ASTM D 6760 and accepted, the Agency will pay for all coring and excavation costs associated with the additional investigation and grant an appropriate time extension, if required, according to Section 00190 and Section 00195. If it is determined by the Engineer that the CSL tubes were not installed properly thus invalidating the CSL test results, all coring, excavation, and other investigation and evaluation costs will be at no additional cost to the Agency and no extension of the Project completion date will be granted.

Fill all core holes with grout only after the evaluation process is completed and the shaft is accepted and approved.

(d) Drilled Shaft Repair - Repair all defects and rejected shafts according to 00512.40(b). Perform additional CSL testing, or other investigation required, as directed by the Engineer, to confirm the quality of the completed shaft repair work at no additional cost to the Agency with no time extension granted.

For temporary casing not extracted from the shaft excavation, submit a repair plan or a structural evaluation to the Engineer for approval according to 00512.40. If caving occurs during concrete placement submit a repair plan to the Engineer for approval.

00512.49 Scheduling and Restrictions - Unless otherwise approved, do not proceed with construction of subsequent shafts until the CSL testing has been completed on the first drilled shaft and the results have been approved and accepted, in writing by the Engineer. Approval to proceed with the construction of subsequent shafts, before receiving approval of the first shaft will be based on the Engineer's observations of the Contractor's workmanship during construction of the first shaft and the Engineer's review and assessment of the following:

- The Contractor's conformance with the approved shaft installation plan.
- The Contractor's daily reports and inspector's daily logs of excavation, rebar, and concrete placement.
- The concrete placement logs and volume curves.

Written notification will be provided to the Contractor on whether or not to proceed with subsequent shaft construction within 24 hours after completion of the first shaft. If the Engineer determines the first shaft to be of questionable quality, discontinue all shaft construction until the CSL test results of the first shaft are received and reviewed and the shaft accepted, in writing, by the Engineer.

Denial of permission to proceed with subsequent shaft construction will not be cause for contract time extension.

Do not proceed with the third drilled shaft until the final CSL test results from the first drilled shaft has been received and reviewed and the shaft accepted, in writing, by the Engineer. Allow 5 calendar days for the Engineer to review.

After the first drilled shaft on the Project has been accepted, make no significant changes in construction methods, equipment, or materials used to construct subsequent shafts, unless otherwise approved.

Measurement

00512.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Furnish Drilling Equipment - No measurement of quantities will be made for furnishing drilling equipment.

(b) Permanent Casing - Permanent shaft casing will be measured on the length basis.

(c) Drilled Shaft Excavation - Drilled shaft excavation will be measured on the length basis by the vertical excavated length from the bottom of the shaft to the ground surface or to the mudline if under water. If the top of the shaft is located below the original ground surface, measurement will be made to the top of the shaft as shown or directed. If directed to excavate drilled shafts below the elevations shown, the drilled shaft excavation will be measured from the revised bottom of shaft.

(d) Drilled Shaft Concrete - No measurement of quantities will be made for drilled shaft concrete. Estimated quantities of concrete will be listed in the Special Provisions.

(e) Drilled Shaft Reinforcement - No measurement of quantities will be made for drilled shaft reinforcement. Estimated quantities of reinforcement will be listed in the Special Provisions.

~~**(f) Crosshole Sonic Log Equipment Mobilization** - CSL testing equipment and operating personnel mobilization will be measured on the unit basis for each time the Contractor mobilizes equipment and personnel to the Project for CSL testing as required by the Engineer.~~

(~~g~~f) Crosshole Sonic Log Test Access Tubes - CSL access tubes will be measured on the length basis of the number of tubes installed in the shafts.

Grout used to fill the access tubes after the completion of CSL testing will not be measured.

(~~h~~g) Crosshole Sonic Log Tests - CSL tests will be measured on the unit basis for each CSL test completed, reported, and accepted. No~~ separate~~ measurement will be made for CSL equipment and operating personnel or for CSL tests performed at the Contractor's option.

Payment

00512.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Furnish Drilling Equipment	Lump Sum
(b)	Permanent Shaft Casings	Foot
(c)	Drilled Shaft Excavation, ____ Diameter	Foot
(d)	Drilled Shaft Concrete	Lump Sum
(e)	Drilled Shaft Reinforcement	Lump Sum
(f)	CSL ~~Equipment Mobilization~~	~~Each~~
~~(g)~~	~~CSL~~ Test Access Tubes	Foot
(~~h~~g)	CSL Tests	Each

Item (a) includes furnishing and moving the drilling equipment to the Project, setting up the equipment at the various locations on the Project and removing the equipment from the Project.

Partial payments for item (a) will be made as follows:

- When drilling equipment is on the job, assembled and ready to excavate the shafts 60%
- When all shafts have been excavated and shaft concrete has been placed and accepted ...40%

In item (c), the diameter of the shaft will be inserted in the blank. Item (c) includes excavating the shafts and disposing of the excavated material and for furnishing, placing, splicing, and removing temporary shaft casing and forms.

Item (e) includes all reinforcement within the drilled shaft plus the reinforcement shown which is to be embedded in the shaft and extends above the top of the drilled shaft including the continuous vertical and spiral reinforcement extending from the bottom of the shaft to the elevation shown. No separate or additional payment will be made for bracing, mechanical splices, centering devices, and support for the bottom of the reinforcement cage.

Item (f) includes ~~each time the Contractor mobilizes all testing equipment and personnel onto the Project as required for CSL testing. Once CSL equipment and personnel are mobilized onto the Project, no separate or additional payment will be made for equipment mobilization required to access test shafts at different locations within the Project limits.~~

~~Item (g) includes~~ filling the tubes with grout after completion of CSL testing.

Item (~~h~~g) includes mobilization of all CSL testing equipment and personnel to and from the site, all CSL testing, interpretation, analysis, electronic data, and final report for each tested and accepted shaft.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

If the Contractor chooses to use a larger shaft diameter casing than the shaft diameter shown, no additional payment will be made for the larger casing, or for the additional excavation, concrete, and reinforcement.

Section 00520 - Driven Piles

Description

00520.00 Scope - This work consists of furnishing and driving piles of the type and dimensions shown or specified, including cutting off or building up piles when required.

Materials

00520.10 ~~General~~Materials - Furnish materials meeting the following requirements:

Preservative Treatment of Timber	02190
Prestressed Concrete Piles	02520.20
Reinforced Pile Tip	02520.10
Steel Piles	02520.10
Steel Reinforcement for Concrete	00530
Timber Piles	02120.20
Timber Pile Straps	02120.30

00520.11 Engineer's Estimated Length List - Furnish steel piles of sufficient length to attain the penetration and bearing resistance specified, and to extend into the cap or footing as shown. The Contractor may, at no additional cost to the Agency, drive test piles, make borings, and perform other investigations the Contractor considers necessary. The "Engineer's Estimated Length" of steel piles will be listed in the Special Provisions.

00520.12 Pile Order List - Furnish prestressed concrete and timber piles according to the pile order list in the Special Provisions, which will list the type, number, and length of piles. The pile order length includes an allowance for variation. The Contractor may increase the order lengths as necessary to suit pile driving operations at no additional cost to the Agency.

00520.13 Test Piles - Furnish test piles according to the test pile length list in the Special Provisions. When test piles are required, the production pile lengths shown or specified in the Special Provisions are estimated lengths only. The actual lengths to be furnished for production piles will be determined by the Engineer after the test piles have been driven. This applies for all pile types.

00520.14 Unused Piles - Acceptable full length piles furnished according to the estimated length list, order list, or revised pile order list, but not incorporated in the work, will be handled according to one of the following:

- Mark and identify piles for the Contractor's own use.
- Return piles to the supplier with the Agency paying transportation and restocking charges.
- The Agency will purchase from the Contractor piles that are stockpiled at a location on the Project selected by the Engineer according to 00195.80.

Equipment

00520.20 Equipment for Driving Piles - Provide pile driving equipment meeting the following requirements:

(a) Impact Pile Hammers - Provide a striking part of the hammer not less than one-third the weight of the helmet and pile being driven, but never less than 2,750 pounds.

(1) Air-Steam Hammers - Provide power plant and equipment for air-steam hammers with sufficient capacity under working conditions to maintain the volume and pressure at the

hammer specified by the manufacturer and with accurate pressure gauges easily accessible to the Engineer.

(2) Open-End Diesel Hammers - Provide open-end (single-acting) diesel hammers equipped with a device which allows the Engineer to visually determine hammer stroke at all times during pile driving operations. Provide the Engineer with the hammer manufacturer's chart equating stroke and blows per minute.

(3) Closed-End Diesel Hammers - Provide closed-end (double-acting) diesel hammers equipped with a bounce chamber pressure gauge, mounted near ground level so the Engineer can easily read it. Before driving, provide the Engineer a chart calibrated within ~~six~~6 months before first use on the Project to actual hammer performance, equating bounce chamber pressure to either equivalent energy or stroke.

(4) Gravity Hammers - Provide gravity hammers that have a ram weighing between 2,000 pounds and 5,000 pounds and a drop height of not more than 10 feet. The weight of gravity hammers shall not be less than the combined weight of helmet and pile.

(5) Hydraulic Hammers - Provide either single or double acting hydraulic hammers equipped with monitoring systems to measure impact velocity and determine equivalent energy and stroke. Locate monitoring systems for easy access by the Engineer.

(b) Vibratory Hammers - Control installation of production piles with vibratory hammers according to the power consumption, rate of penetration, specified tip elevation, or other acceptable means which assure the pile resistance equals or exceeds the required nominal pile bearing resistance. After driving piles with a vibratory hammer, verify pile resistance (see 00520.42) by driving them with an impact hammer of suitable energy. Do not use vibratory hammers to drive test piles or when preboring or jetting.

(c) Driving Components:

(1) Pile Cushion - Protect the heads of prestressed concrete piles with a pile cushion made of wood or other approved material.

The pile cushion shall be:

- Equal to or greater in cross-sectional contact area than the pile head.
- In full contact with the pile head.
- No less than 4 inches thick, before driving begins, if made of plywood.

Provide a pile cushion for each pile. Replace the pile cushion if, during the driving, the cushion is either compressed to less than one-half the original thickness or begins to burn.

(2) Helmet - Equip piles driven with impact hammers with an adequate metal helmet. The helmet shall:

- Fit around the pile top.
- Be axially aligned with the hammer and pile.
- Distribute the hammer energy to the total cross section of the pile head.
- Be guided by leads.

(3) Hammer Cushion - Equip impact pile driving equipment with a suitable thickness of hammer cushion material to prevent damage to the hammer or pile and to ensure uniform driving performance. Provide hammer cushions of durable manufactured materials according to the hammer manufacturer's guidelines. Do not use wood, wire rope, or asbestos hammer cushions.

Place a striker plate, as recommended by the hammer manufacturer, on the hammer cushion to ensure uniform compression of the cushion material.

Inspect the hammer cushion in the presence of the Engineer at the beginning of pile driving at each structure or after each 100 hours of use during pile driving, whichever is less. Replace the hammer cushion when its thickness becomes less than 75~~%~~ percent of its original thickness.

(4) Followers - Use a follower between the pile hammer and the pile to transmit energy when the pile head is below the reach of the hammer, if allowed by the Special Provisions or approved in writing. If a follower is allowed, drive the first pile in each bent, and every tenth pile driven after that, full length without a follower. Before additional piles are installed, verify that the first two piles installed with followers in each substructure unit meet the position and alignment criteria of 00520.41(f).

(5) Leads - Support piles in line and position while driving. Construct pile hammer leads to give the hammer freedom of movement while maintaining alignment of the hammer and the pile to ensure concentric impact for each blow. Leads shall be fixed unless the Engineer approves the use of swinging leads. Fit swinging leads, when used, with a pile gate at the bottom of the leads. To maintain alignment of batter piles, use horizontally braced swinging leads, adequately embedded in the ground, or rigidly attached to prevent movement during pile driving.

(d) Approval of Pile-Driving Equipment:

(1) General - Before beginning test pile or production pile driving, obtain approval in writing of pile driving equipment.

To obtain approval, complete and submit the Agency's "Pile and Driving Equipment Data" form at least 14 calendar days before pile driving begins. This form is available from the Engineer. Within 14 calendar days of receiving the form, the Engineer will notify the Contractor of approval or rejection of the pile-driving equipment.

During pile-driving operations, no changes to the approved equipment will be allowed without the Engineer's written permission. Submit a request for change on a "Pile and Driving Equipment Data" form. The Engineer will give notification of approval or rejection within ~~seven~~ 7 calendar days of receiving the form. Time required for resubmission and review of a Contractor's equipment change request is not a basis for a Contract Time extension request unless the Engineer does not respond in ~~seven~~7 calendar days.

(2) Standard Evaluation Method - The standard method of evaluating driving equipment requires that the field-measured hammer energy be within the range of energy levels given in Table 00520-1 corresponding to the nominal pile bearing resistance shown.

Table 00520-1 Pile Hammer Requirements [1]

Nominal Pile Bearing Resistance (kips)	Minimum Field Energy (foot-pounds)
≤ 180	6,500
> 180 and ≤ ~~280~~	~~11~~300 13,000
> ~~280~~300 and ≤ ~~420~~400	20,000
> ~~420~~400 and ≤ 500	30,000
> 500 and ≤ 600	~~35~~40,000
over 600	Wave Equation required

[1] ~~Using~~ Requirements are based on the FHWA Gates equation (see 00520.42(b)), except all driving criteria for double acting and differential hammers both air~~,~~ /steam and diesel will be by the wave equation analysis.

If during the pile-driving operation, the Engineer determines the hammer is not operating properly and is unable to drive the piles to the required resistance, do not use the hammer until repaired to the Engineer's satisfaction.

The required number of hammer blows indicated by the FHWA Gates equation at the nominal pile bearing resistance shall be at a rate between ~~3~~2 and ~~15~~10 blows per inch.

(3) Wave Equation Method - Select a suitable hammer for driving piles and perform wave equation analyses. Use the 1987 or newer version of the Wave Equation Analysis Program (WEAP). Conduct the wave equation analyses using personnel qualified by training and experience to perform this type of work.

Submit the WEAP analysis concurrent with the Pile and Driving Equipment Data Form. The Engineer will approve or reject the pile driving equipment submittal after a review of the wave equation analysis conducted by the Contractor.

Provide pile hammers meeting the following requirements based on wave equation analysis:

- The energy of the submitted hammer shall produce a wave equation predicted blow count between ~~3~~2 and ~~15~~10 blows per inch for the nominal resistances, pile lengths and other conditions specified.
- The pile stresses indicated by the wave equation at the nominal resistance shall not be greater than the stress at the point of impending damage to the pile as follows:
  - **Steel Piles** - Tensile and compressive stresses in the pile of 90~~%~~ percent of the pile material's yield strength for the grade of steel specified at any time during the pile installation.
  - **Prestressed Concrete Piles:**
    - A tensile stress of $(.095\sqrt{f'_c})$ + effective prestress
    - A compressive stress of $(0.85\ f'_c)$ - effective prestress

      Where: f'_c = concrete compressive strength (ksi)
  - **Timber Piles** - A compressive driving stress of three times the allowable static design stress.

Hammers not meeting these requirements will be rejected. Replace rejected hammers with suitable hammers.

Use input values for the wave equation analyses provided in the Special Provisions and according to the following:

Use the following settings and default values as input to the wave equation analysis program:

- Output option (IOUT) zero (normal option).
- R_N is the nominal pile bearing resistance.
- Smith damping.
- Do not use residual stress option.
- Default hammer efficiency values. Do not ~~adjustment~~adjust the hammer's efficiency outside of the wave equation program recommended (default) values without prior concurrence of both the pile hammer manufacturer and the Engineer.
- % skin is the percent skin friction.

A Pile Driving Analyzer (PDA) test may be required prior to approval of non-default wave equation input values.

At a minimum, provide the following information and documentation:

- A written summary of how the proposed hammer and associated equipment meets the specifications regarding blow count criteria and allowable pile stresses.
- Electronic and paper copies of the wave equation input and output files. Output files shall be in the standard WEAP output format.
- WEAP analysis demonstrating that for the required nominal bearing resistances and conditions provided, the hammer will produce pile stresses less than those described above for the range of hammer strokes expected in the field.
- The "Pile and Driving Equipment Data" form.
- WEAP hammer input files for hammers not in the wave equation default hammer files.

For Agency reviewing and approving of the wave equation analysis submittals, the following will be taken into consideration:

- The pile length for use in the WEAP analysis will be the total pile length at the end of driving, including all pile length above the ground surface. This length may be longer than the Engineers Estimated length depending on the site conditions, equipment used, pile hammer access limitations and other factors.
- The properties and thicknesses of the hammer and pile cushion materials.
- Various hammer types such as direct-drive diesel, standard diesel, air/steam or hydraulic hammers have major effects on predicted stresses and blow counts.
- Changes in pile type or size will affect the blow count rate and pile stresses.
- Battered piles may effect hammer energy transfer and blow counts.

Failure to address these issues may be cause for rejection of the proposed pile hammer.

The size of the pile hammer selected according to the above specification may have significant impacts on the size and capacity of associated equipment including the leads and crane. This

equipment, in turn, may have significant impacts on the size and capacity of work bridges, shoring required for existing structures or other aspects and elements of construction.

Failure of a previously approved hammer to operate properly during construction will be cause for rejection.

Construction

00520.40 Preparation for Driving:

(a) Excavation - Unless otherwise provided or authorized, do not drive piles until after excavation is complete. Remove to the correct elevation any material forced up by pile driving before concrete for the foundation is placed, at no additional cost to the Agency.

(b) Embankments - Unless otherwise provided or authorized, do not drive piles until the roadway embankment at bridge ends is in place according to 00330.42. Drive piles completely through roadway embankments to the required penetration and bearing in the underlying material.

00520.41 Driving:

(a) General - Drive piles as specified with approved pile driving equipment to the required penetration depth and to the required nominal pile bearing resistance as shown or specified.

(b) Installation Sequence - Unless otherwise shown or specified, install individual piles in pile groups starting from the center of the group and proceeding outward in either direction, or as approved.

(c) Minimum Penetration - Unless otherwise specified or approved, drive piles at least 12 feet below the footing or pile cap, 12 feet below the groundline at trestle pile locations, and completely through embankments at bridge ends. When shown or specified drive piles to a greater minimum penetration. If the required penetration cannot be attained with a hammer complying with 00520.20(d), provide a larger hammer, prebore or jet holes, or use other approved methods as necessary to attain the required penetration.

(d) Preboring - Use augering, wet-rotary drilling or other methods of preboring only when specified or with written approval. When allowed, prebore holes at pile locations and to the depths shown or directed. Make prebored holes smaller than the diameter or diagonal of the pile cross section, but sufficient to allow penetration of the pile to the specified depth. If subsurface obstructions, such as cobbles, boulders or rock layers are encountered, the hole diameter may be increased to the least dimension which is adequate for pile installation. The use of a reinforced section (spud) to loosen the subsurface material at pile locations will not be allowed unless otherwise approved.

Perform preboring in a manner that will not impair the bearing or lateral capacity of the piles already in place or the safety of existing adjacent structures. When it is determined that preboring has disturbed the load bearing resistances of previously installed piles, restore those piles that have been disturbed to conditions meeting the requirements of this Specification by redriving or by other acceptable methods. The Contractor shall be responsible for the costs of any necessary remedial measures unless the preboring method was specifically included in the Contract Documents and properly executed by the Contractor.

(1) End-Bearing Piles - For end-bearing pile as classified by the Engineer, preboring may be carried to the surface of the end-bearing foundation material. Following that, drive pile with an approved impact pile hammer to the specified blow count.

(2) Other Piles - For other piles, extend preboring to the minimum pile penetration depth and then drive pile with an approved impact pile hammer to the specified blow count.

After completion of driving, fill any void space remaining around the pile with sand or other approved material.

(e) Jetting - Jetting may only be used when allowed in the Contract Documents or if approved in writing. When jetting is not required in the Contract Documents, but approved at the Contractor's request, determine and submit for review the number of jets and the volume and pressure of water at the jet nozzles necessary to freely erode the material adjacent to the pile without affecting the lateral stability of the final in-place pile. The Contractor shall be responsible for all damage caused by unapproved or improper jetting operations, unless the jetting method was specifically included in the Contract Documents and properly executed by the Contractor. Control, treat if necessary, and dispose of all jet water in a satisfactory manner. Drive all jetted pile with an approved impact hammer.

(f) Location and Alignment Tolerance - Place the tops of piles at plan cutoff elevation and horizontally within 6 inches of plan locations. No pile shall be nearer than 4 inches from any edge of the cap. Any increase in cap size to meet this edge distance requirement will be at no additional cost to the Agency.

Install piles so the axial alignment of the top 10 feet of the pile is within 5 inches of the specified alignment. For piles that cannot be inspected after installation, make an alignment check before installing the last 5 feet of pile. The Engineer may require that driving be stopped to check the pile alignment. Pulling laterally on piles to correct misalignment or splicing a properly aligned section onto a misaligned section will not be allowed.

If the specified location or alignment tolerances are exceeded, the effect of the pile misalignment on the substructure design will be investigated. If the Engineer determines corrective measures are necessary, implement suitable measures and pay all costs and delays associated with the corrective action.

(g) Heaved Piles - Make elevation readings on piles during pile driving operations to check on pile heave. Take elevation readings after each pile has been driven and again after piles within a radius of 15 feet have been driven. Redrive to the required penetration and resistance all piles that have risen more than 1/2 inch, at no additional cost to the Agency. Continue readings until the Engineer determines that such checking is no longer required. If pipe piles which have been filled with concrete subsequently heave, redrive them to original position, after the concrete has attained specified strength, with an approved hammer-pile cushion system.

(h) Test Piles - When specified, furnish and drive test piles at the locations and to the lengths directed. All test piles shall be of the kind and size specified for the permanent foundation piles unless otherwise directed. Drive all test piles with approved pile driving equipment. The specified length of test piles will be greater than the estimated length of production piles to provide for variation in soil conditions. Drive test piles using driving equipment identical to that which the Contractor proposes to use on the production piling. Excavate to the elevation of the bottom of the footing before driving test piles. (see Section 00510)

Drive test piles to or below the required minimum tip elevation and to a hammer blow count established by the Engineer. Allow test piles which do not attain the hammer blow count specified at the minimum tip elevation shown to "set up" for 24 hours, or less if directed, before being redriven. (see 00520.42(d)) If the tops of test piles reach plan grade without attaining the required pile bearing resistance, splice them and drive until the required bearing resistance is attained.

Remove test piles that are not to be incorporated in the completed structure to at least 2 feet below the surface of the ground and backfill the remaining hole with acceptable material.

Do not order piling to be used in the permanent structure until test pile data has been reviewed and the production pile order lengths are determined. The Engineer will provide the Engineer's estimated length list or pile order list within ~~seven~~7 calendar days after completion of all test pile driving specified in the Contract.

00520.42 Nominal Pile Bearing Resistance:

(a) General - Drive piles with approved pile driving equipment to the lengths necessary to attain the required penetration and nominal pile bearing resistance. Adequate pile penetration will be considered reached when the piles are driven to or below the minimum penetration depth and the specified ~~equation~~bearing resistance ~~value~~ is achieved. If piles do not achieve the specified resistance when driven to order length or estimated length, splice and drive them to penetrations established by the Engineer. The pile blow count shall be at a rate of between ~~3~~2 and ~~15~~10 blows per inch at the required nominal pile bearing resistance. The required number of hammer blows per inch at final penetration shall be maintained for 3 consecutive inches unless "refusal" driving is first obtained. "Refusal" driving is defined as 20 blows per 1 inch or as determined by the Engineer.

If water jets are used with the driving, the bearing value shall be determined by the specified equation from the results of driving after the jetting has been completed according to 00520.42(e).

(b) FHWA Gates Equation - Unless otherwise specified, the Engineer will determine nominal pile bearing resistance of the driven pile by the FHWA Gates equation:

$$R_n = 1.75 \left(\sqrt{E} \right) \log_{10}(10N) - 100$$

where:

R_n	=	Nominal Pile Bearing Resistance (kips)
E	=	W x H (Hammer energy (foot-pounds) at the ram stroke observed in the field)
W	=	Weight (pounds) of striking parts of hammer
H	=	Height of fall (feet) of the ram measured during pile driving in the field
$\text{Log}_{10}(10N)$	=	Logarithm to the base 10 of the quantity 10 multiplied by N
N	=	Number of hammer blows per inch at final penetration to be sustained for 3 consecutive inches

$$N = 10^{\left[\frac{R_n + 100}{1.75 \sqrt{E}} - 1 \right]}$$

or N = 10 to the power in brackets

The FHWA Gates equation is applicable only if:

- The hammer is in good condition and operating in a satisfactory manner
- The hammer has a free fall
- A follower is not used
- The head of the pile is not broomed or crushed

If the Engineer determines that the hammer being used may not be attaining the specified bearing resistance when the above equation is applied, the Engineer may order the Contractor, at no additional cost to the Agency, to verify the bearing resistance values obtained by the use of a different hammer.

(c) Wave Equation Analysis - If specified, the Engineer will determine nominal pile bearing resistance based on wave equation analysis.

(d) Set Period and Redriving - If piles do not attain the required nominal bearing resistance when driven to the specified length, and if allowed or required, allow the piles to stand for a "set period" without driving. The "set period" shall be a minimum of 24 hours~~ unless otherwise approved by the Engineer.~~. After the set period, perform check driving on either two piles in each bent or on one pile in every 10 piles, whichever is more. The Engineer will designate the piles on which check driving is to be performed. Do not use a cold hammer for redriving. Warm up the hammer before redriving begins by applying at least 20 blows to another pile. Redriving shall consist of driving the pile to the required bearing resistance with a maximum of 15 blows. If the specified hammer blow count is not attained on redriving, the Engineer may direct the Contractor to drive all of the remaining pile length and repeat the set period and redriving procedure. Splice those piles driven to plan grade that do not attain the hammer blow count required, and drive until the required bearing resistance is attained. If the required bearing resistance is attained for each pile that is redriven, then the remaining piles in that bent will be considered satisfactory when driven to at least the same penetration and resistance as the redriven piles.

(e) Jetted Piles - The nominal pile bearing resistance of jetted piles will be based on impact driving blow count after jetting has been completed. Jet pipes may be removed when the pile tip is at the required minimum pile tip elevation and before the pile is driven to the required bearing resistance. For piles that are jetted at the Contractor's request and do not attain the required nominal bearing resistance at the ordered length, splice, as required, and drive with a specified impact pile hammer until the required nominal bearing resistance is achieved according to appropriate criteria in 00520.42. Regardless of Agency approval, the Contractor shall pay all costs of splicing and driving piles beyond the order length if jetting is requested by the Contractor.

(f) Followers - The required nominal pile bearing resistance of piles driven with followers will only be considered acceptable when the follower-driven piles attain the same tip elevation as piles driven without followers. (see 00520.20(c-4))

(g) Vibratory Hammers - The nominal bearing resistance of piles driven with vibratory hammers will be based on impact driving blow count after the vibratory equipment has been removed. When vibratory installation of the piles is approved by the Engineer and the vibrated piles do not attain the required nominal bearing resistance at the specified length, splice them as required, at no additional cost to the Agency, and drive with a specified impact pile hammer until the required nominal bearing resistance is achieved, according to 00520.42.

(h) Load Tests:

(1) Static Load Test - Perform static load tests on foundation or test piles when specified or required. Conduct static load tests according to ASTM D 1143 using the quick load test method to plunging failure or the capacity of the loading system. Use testing equipment and measuring systems capable of applying 150~~%~~ percent of the nominal pile bearing resistance or 1,000 tons, whichever is less.

(2) Dynamic Load Tests - Take dynamic load test measurements during the driving of piles designated as dynamic load test piles as specified. Perform dynamic testing according to ASTM D 4945.

Drive the pile to such depth that the dynamic load test equipment indicates that the nominal pile bearing resistance shown has been achieved, unless otherwise directed. Monitor the stresses in the piles during driving with the dynamic test equipment to ensure the values do not exceed the values in 00520.20(d-3). If necessary, reduce the driving energy by using additional cushions or reduce the energy output of the hammer to stay below the values in 00520.20(d-3). If non-axial driving is indicated by dynamic test equipment measurements, immediately realign the driving system.

00520.43 Steel Piles:

(a) General - Unless otherwise specified, furnish standard steel piles in the longest practical lengths.

(b) Storage and Handling - Store and handle steel piles in ways that protect them from damage. Bent or kinked piles will be rejected.

(c) End Treatment - Cut pile ends square.

(d) Reinforced Pile Tips - Install pile points, shoes, or other tip reinforcement according to the manufacturer's recommendations and Section 02520.

(e) Driving - During driving, protect the pile head with a fitted metal helmet.

(f) Splices - Where splices are unavoidable, submit for approval their number, location and details.

(1) Welded Splices - Make welded splices using a full penetration butt weld, as shown. Comply with the welding procedures of AWS D1.1.

(2) Mechanical Splices - Mechanical splices may be used if the splice transfers the full pile strength in compression, tension, and bending, according to unstamped working drawings submitted according to 00150.35 and approved by the Engineer.

(g) Welding - Weld pile splices, pile tips, pile anchors, and other welded attachments to steel piles according to AWS D1.1.

(1) Splices - Splice joints for ~~round~~pipe piles shall conform to Joint B-U4a or ~~C-~~B-U4a~~-~~-GF (Single~~-~~-Bevel Groove Weld) in D1.1 Figure 3.4. Weld back-up rings with a full penetration groove weld. Pipe pile splices that include a steel plate for soil plug formation shall conform to Joint TC-U4a or TC-U4a-GF.

Splice joints for H-piles shall conform to Joint B-U3b or B-U3-GF (Double V-Groove Weld) in D1.1 Figure 3.4 for both the web and flange sections. Joint B-U4a or ~~C~~B-U4a-GF may be substituted on the flange weld. Provide access holes at the ends of the web according to D1.1 Section 5.17.

(2) Submittals - Prior to welding, submit the following for approval:

- A Welding Procedure Specification (WPS) for all pile welds, conforming to the limitations of D1.1 Table 4.5. Both ASTM A 36 and ASTM A 252 Grade 1 and 2 may be treated as prequalified base metals under Group 1. ASTM A 252 Grade 3 will not be considered a prequalified base metal unless the steel has a Carbon Equivalent (CE) of 0.30~~%~~ percent or less. Develop a Procedure Qualification Record (PQR) for all welding using Grade 3 steel or present proof that the chemistry of the steel meets the CE requirements.

- Qualification documents for each welder. Use welders qualified according to D1.1 Section 4 for the position, process and pile diameter used on the job.

Do not begin welding without approval.

Following completion of all welding, submit the following:

- An inspection report stating that the welding under the Contract was performed according to D1.1. The report shall include a review of the WPS, a review of welder qualifications and a report on visual inspection of the welds on the job site. The inspection shall be signed by a Certified Welding Inspector (CWI) holding QC1 certification as defined in D1.1 Section 6.
- If the plans or Specifications call for additional inspection other than visual, include reports in the submittal.

(3) Additional Testing - The Engineer may request additional nondestructive testing (NDT), such as radiography or ultrasonic testing of any or all welds. If the additional testing identifies defects warranting rejection, perform repair and additional inspection at no additional cost to the Agency. If the additional NDT does not identify defects warranting rejection, the Agency will pay the cost of the additional testing. Radiographic and ultrasonic defect indications will be evaluated according to the statically loaded criteria of D1.1.

(h) Cutoff Lengths - Cut off the tops of all permanent piles square and smooth at the elevation shown or as directed. All cut-off pile becomes the property of the Contractor. Dispose of according to 00290.20. With approval, undamaged cutoffs may be used as pile extensions or welded together to form full length piles. Steel pile cutoffs welded together, whether pile extensions or full length piles, shall not vary from a straight line more than 1/4 inch in 20 feet measured along any edge of the pile.

All acceptable cutoffs and unused pile lengths remaining at completion of pile driving will be marked for identification by the Engineer as acceptable for use on other or future Agency projects if requested by the Contractor.

(i) Capping - If required by the plans, cap steel piles with a steel plate of the size and shape shown. Connect this cap to the pile according to the details shown.

00520.44 Prestressed Concrete Piles:

(a) General - Furnish full-length prestressed concrete piles according to the Special Provisions and Section 00550.

(b) Lifting, Storing, and Transporting - Lift, store and transport prestressed concrete piles according to 00550.49.

(c) Strength Before Driving - Do not drive precast, prestressed concrete piles until the conditions of 00550.12(~~d~~c) are met, and the Engineer gives consent to proceed.

(d) Extensions or "Build-ups" - If additional driving is required beyond the order length, splice on pile extensions or build-ups as specified and directed. Prestressed concrete pile cutoffs may be used as extensions if additional driving is not required. Do not use pile cutoffs as extensions exceeding 5 feet in length unless approved.

(1) Epoxy-Dowel Method - Make splices of prestressed concrete piles to prestressed concrete piles and poured-in-place extensions or build-ups with the epoxy-dowel method, as shown or approved.

(2) Mechanical Splices - Mechanical splices may be used subject to limitations of 00520.43(f).

(e) Cutoffs - Cut off permanent prestressed concrete piles at the elevations shown or directed. All cut-off lengths become the property of the Contractor. Dispose of according to 00290.20. Take care to prevent spalling of the concrete below the footing or pile cap. Repair damage to the piles at no additional cost to the Agency.

(f) Finishing - Finish all exposed prestressed concrete pile surfaces to 1 foot below ground surface according to 00550.47.

00520.45 Timber Piles:

(a) General - Furnish full length treated timber piles according to the Special Provisions and 02120.20. Cut the heads of piles back square to untreated wood before driving. Provide a length of pile above the elevation of cutoff sufficient to permit the complete removal of all pile damaged by driving. Splicing of timber piles will not be allowed.

(b) Storage and Handling - Store and handle piles to avoid damage. Avoid breaking the surface of treated piles. Do not use cant hooks, dogs or pike poles on portions of the piles remaining in the completed work. Give cuts or breaks in the surface of treated piles three brush coats of pentachlorophenol, hot creosote oil or other preservative from the QPL. Pour pentachlorophenol, hot creosote oil or preservative from the QPL into all bolt holes. If the treatment is damaged so the integrity of the pile is in jeopardy, the pile will be rejected. Furnish a replacement pile at no additional cost to the Agency.

(c) Strapping - Strap timber piles with at least three straps as follows:

- One approximately 18 inches from the butt
- One approximately 24 inches from the butt
- One approximately 12 inches from the tip

Use straps manufactured according to 02120.30. Wrap the strap around the pile once and fasten with a clip so crimped that the joint will have a tensile strength of at least 4,100 pounds. Install the straps after pressure treating the pile.

(d) Reinforced Pile Tips - Provide metal tips and fasten securely to the pile when shown or specified. Carefully shape the pile tip to secure an even, uniform bearing on the pile tip reinforcement.

(e) Cutoffs - Saw timber piling to a plane parallel to the bottom of the structure at the elevation shown or as directed. All cut-off materials become the property of the Contractor. Dispose of according to 00290.20.

(f) Capping - Cover timber pile heads not encased in concrete with alternate layers of hot asphalt and loosely woven fabric, using four applications of asphalt and three layers of fabric. Make the cover at least 6 inches more in dimension than the diameter of the pile head. Neatly fold down over the pile and secure by binding with not less than seven complete turns of commercial corrosion resistant wire (13.5 gauge minimum diameter) held in place by large headed commercial corrosion resistant nails or staples. Hot-dipped galvanized or stainless steel straps and clips conforming to 02120.30 may be used instead of commercial corrosion resistant wire. Neatly trim the edges of the fabric projecting below the binding.

00520.46 Damaged or Defective Piles - In addition to other specified requirements:

- Approval of a pile hammer shall not relieve the Contractor of responsibility for piles damaged from misalignment of the leads, failure of capblock or cushion materials, failure of splices, malfunctioning of the pile hammer or other improper construction methods.
- Piles damaged during installation will be considered unsatisfactory unless the nominal bearing resistance is proved by load tests performed by the Contractor. If such tests indicate inadequate resistance, take corrective measures, such as the use of damaged piles at reduced resistance, installation of additional piles, strengthening of damaged piles, or replacement of damaged piles.
- A concrete pile will be considered defective if a visible crack appears around the entire periphery of the pile, or any other crack or defect is observed which is determined to affect the strength or performance of the pile.
- Do not place footing concrete until all piles within a footing are inspected by the Engineer.

Measurement

00520.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Furnish Pile Driving Equipment ~~for Driving Piles~~ - No measurement of quantities will be made for furnishing equipment for driving piles.

(b) Furnish Piles - The quantities of furnishing steel, prestressed concrete, timber, and test piles will be measured on the length basis, ~~to the nearest foot,~~ as follows:

(1) Steel Piles - Steel piles will be the length of each pile remaining in the completed work, from the pile tip to the cutoff plane.

(2) Prestressed Concrete and Timber Piles - Prestressed concrete and timber piles will be the sum of the lengths of piles of the types and lengths ordered, furnished according to these Specifications, and stockpiled in good condition at the work site.

(3) Test Piles - Test piles, including test piles remaining in the completed work, will be measured according to (b-1) and (b-2) above as applicable.

No allowance will be made for that length of pieces furnished by the Contractor to replace piles previously accepted by the Engineer, but that are subsequently damaged before completion of the Project

(c) Drive Piles - The quantities of driving steel, prestressed concrete, timber, and test piles will be measured on the unit basis. Driving test piles includes test piles remaining in the completed work.

Preboring will be measured on the length basis~~, to the nearest foot~~.

Jetting will be measured on the unit basis, for each pile driven with the aid of jetting.

(d) Load Tests - Load tests ~~to be~~ will be measured on the unit basis, for the number of specified load tests completed and accepted. Load tests made at the option of the Contractor will not be measured.

(e) Reinforced Pile Tips - The quantities of reinforced pile tips will be measured on the unit basis.

(f) Pile Splices - Pile splices will be determined as follows:

(1) Steel Piles - Splices incorporated in the finished structure that were made to increase the length of the pile 5 feet or more for estimated pile lengths of 60 feet or less and 10 feet or more for estimated pile lengths of over 60 feet beyond the estimated pile length will be measured on the unit basis. Only one splice will be measured per pile.

No measurement will be made for splices to steel piles within the estimated lengths listed in 00520.11 of the Special Provisions.

(2) Prestressed Concrete Piles - No measurement of quantities will be made for prestress concrete pile splices shown or specified Additional splices required to complete the work will be ~~done as Extra Work~~paid according to ~~Section 00196~~00195.20.

Payment

00520.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Furnish Pile Driving Equipment	Lump Sum
(b)	Furnish _____ Piles	Foot
(c)	Furnish _____ Test Piles	Foot
(d)	Drive _____ Piles	Each
(e)	Drive Test Piles	Each
(f)	Preboring Piles	Foot
(g)	Jetting Piles	Each
(h)	Pile Load Test (static)	Each
(i)	Pile Load Test (dynamic)	Each
(j)	Reinforced Pile Tips	Each
(k)	_____ Steel Pile Splices	Each

Partial payments for Item (a) will be made as follows:

- When equipment for driving piles is furnished and is satisfactorily driving piles 75%
- When driving piles is complete and equipment has been removed from site.....25%

Item (a) includes:

- furnishing all materials, equipment, and labor necessary for transporting, erecting, maintaining, replacing any ordered equipment, dismantling and removing the entire pile driving equipment
- resubmittal of wave equation analysis data if original data is rejected
- replacing previously approved hammers if hammer operates improperly
- all considerations when selecting the pile hammer size

The cost of all materials and labor, including the manipulation of the pile driving equipment in connection with driving piles will be included in the unit price each for driven piles. Furnishing equipment for driving sheet piling is not included in this work.

In items (b),(c), (d) and (k) the type and size of pile will be inserted in the blank.

Item (d) includes cutting off piles, treating and capping pile heads, attaching anchor brackets, lugs or other attachments, and finishing concrete piles.

Items (d) and (e) include all expenses involved in driving piles which have not attained the required bearing resistance and are required to stand for a "set period".

Item (j) includes attaching the tips to the piles.

Item (k) includes steel pile splices required to increase pile length beyond the estimated length listed in 00520.11 of the Special Provisions. No payment will be made for splices to steel piles that are within the estimated lengths listed in 00520.11 of the Special Provisions.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- work needed to drive piles to minimum tip elevation as shown or specified.
- No separate or additional payment will be made for welding inspection performed according to 00520.43(g-2).)
- No separate or additional payment will be made for preboring and jetting of piles if not included in the Contract Schedule of Items but requested by the Contractor.

Preboring and jetting, if not included in the Contract Schedule of Items, larger hammers, and construction of concrete pile extensions, build-ups, and splices ordered by the Engineer, as a result of differing site conditions (see 00140.40) will be made on an Extra Work basis according to Section 00196 00195.30.

Section 00530 - Steel Reinforcement for Concrete

Description

00530.00 Scope - This work consists of furnishing and placing steel reinforcement of the grade, type and size shown or specified.

Materials

00530.10 ~~General~~Materials - Furnish materials meeting the following requirements:

Deformed Bar Reinforcement.....02510.10
Epoxy Coated Reinforcement 02510.11
Headed Bar Reinforcement.....02510.25
Galvanized Coating.....02510.30
Mechanical Splices.....02510.20
Welded Wire Fabric.....02510.40
Wire Reinforcement.....02510.60

00530.11 Order Lists and Bending Diagrams - Before ordering material, submit all order lists according to 00150.37 and unstamped bending diagrams according to 00150.35 for approval. Do not order material until such lists and bending diagrams have been approved. The review of order lists and bending diagrams by the Engineer will in no way relieve the Contractor of responsibility for the correctness of such lists and diagrams. Revise lists and diagrams as required to make them comply with the design drawings at no additional cost to the Agency.

Order lists and bending diagrams for reinforcement affected by stressing system in prestressing beams or post-tensioning systems such as anchorage design and duct placement will not be reviewed before the stressing system is reviewed.

00530.12 Fabrication - Cold bend reinforcement bars to the shapes shown. Make bends, tag, mark and ship reinforcement bars according to the current edition of the CRSI "Manual of Standard Practice".

00530.13 Miscellaneous Metal - Minor metal parts such as drains, bolts, concrete anchors, spacer blocks, expansion and bearing devices, access hole covers and frames, anchor bolts, inserts and similar miscellaneous metal, unless otherwise provided, will be classified as reinforcement.

Pipe attached to or used in conjunction with bridge deck drains or catch basins will be classified as reinforcement.

00530.14 Concrete Inserts - Furnish hot-dip galvanized expanded coil concrete inserts with closed-back ferrule threaded to receive UNC threaded bolts or rods of the size shown. Provide concrete inserts with the following minimum lengths and capacities:

Bolt or Rod Diameter (Inches)	Minimum insert Length (Inches)	Minimum Safe Working Load in Shear or Tension (Pounds)
3/4	4 1/2	4,000
1	5 1/2	6,000
1 1/4	7 1/2	10,000
1 1/2	9 1/2	16,000

Labor

00530.30 Mechanical Splice Installers - Provide qualified mechanical splice installers to construct mechanical splices. To qualify an installer, provide the Engineer with three completed mechanical splice samples of each type and size to be installed on the Project for each mechanical splice installer, at no additional cost to the Agency. Prepare the splice samples as follows:

- Make splice samples in the presence of the Engineer using the same materials, equipment, and procedures that will be used on the Project.
- Construct each splice sample according to the manufacturer's recommendations.
- Construct each splice sample with two equal lengths of straight reinforcing bar so the total length of the assembled splice sample is at least ~~48~~96 inches.
- Mark each splice sample with the heat treatment lot number.

Provide splice samples that meet the requirements of 02510.20. Do not begin mechanical splice installation until the Engineer confirms, in writing, the qualification of each mechanical splice installer. The Engineer may suspend mechanical splice installation if the Contractor substitutes unapproved personnel during construction.

00530.35 Headed Bar Reinforcement Installers - Provide qualified headed bar reinforcement installers to construct headed bar reinforcement. To qualify an installer, provide the Engineer with three complete headed bar reinforcement samples of each type and size to be installed on the Project for each installer, at no additional cost to the Agency. Prepare the headed bar reinforcement samples as follows:

- Make samples in the presence of the Engineer using the same materials, equipment, and procedures that will be used on the Project.
- Construct each sample according to the manufacturer's recommendations.
- Construct each sample so the total length of the assembly is at least 48 inches.
- Mark each sample with the heat treatment lot number.

Provide headed bar reinforcement samples that meet the requirements of 02510.25. Do not begin headed bar reinforcement installation until the Engineer confirms, in writing, the qualification of each headed bar reinforcement installer. The Engineer may suspend headed bar reinforcement installation if the Contractor substitutes unapproved personnel during construction.

Construction

00530.40 Protection of Material - Store reinforcement above the surface of the ground on dunnage. Protect reinforcement from damage at all times. Ensure reinforcement is free of dirt, detrimental rust or scale, paint, oil and other foreign substances when placed in the work.

In addition to the requirements above, store epoxy coated bars with supports close enough to prevent sagging in the bundles. Provide protective padding when bundles are stacked or when supported on metal. Store bars as close as practical to where they will be placed in the structure. Cover bars with an opaque material during storage to protect them from exposure to sunlight and saline mist. Move bars to or from storage according to 02510.11(c) to minimize damage to the coating. Do not allow the total exposure time from bar delivery to concrete placement, while in storage or in place, to exceed ~~two~~ 2 months.

00530.41 Placing and Fastening - Place all reinforcement within the tolerances recommended in the CRSI "Manual of Standard Practice" unless otherwise specified. Hold reinforcement firmly during the placing and setting of concrete.

(a) Fabric - If fabric reinforcement is shipped in rolls, straighten it into flat sheets before placing.

(b) Ties and Supports - Keep reinforcement properly positioned during placement of concrete according to the following:

- ~~Tie bars in~~In top mats of footings and deck slabs, tie bars at all intersections~~. Where~~ except where bar spacing is less than 6 inches, tie bars at alternate intersections.
- Tie all other bars at all intersections except where bar spacing is less than 1 foot in each direction~~; in that case,~~ tie bars at alternate intersections.
- Use precast concrete bar supports with approved shape and dimensions, and equal or greater compressive strength as the concrete to be placed.
- When precast concrete ~~blocks~~bar supports are used, provide ~~blocks that have cast-in wire ties.~~Wired Blocks. Provide tie wires meeting the requirements of 02510.60. Combination Blocks may be used in horizontal applications.
- Where at least one of the bars to be tied or supported is epoxy coated, provide tie wires that are either plastic or epoxy coated.
- For bridge decks, support the bottom mat with precast concrete Wired Blocks or Combination Blocks. The wire ties need not be coated. Plastic bar supports are not allowed.
- For bridge decks, support the top mat of reinforcing steel from the bottom mat with reinforcing bar supports according to Chapter 3 of the CRSI "Manual of Standard Practice" (SBU, BBU or CHCU) at 24 inch maximum centers. Plastic bar supports are not allowed.
- ~~Where at least one of the bars to be tied or supported~~When stainless steel rebar is specified, use stainless steel wire bar supports conforming to the requirements of ASTM A 493, Type 430, stainless steel rebar Standees, or Class 1A epoxy coated~~, provide tie wires that are either~~ wire bar supports.
- Use plastic ~~coated~~tipped feet or ~~epoxy coated. Where~~ Class 2, Type A stainless steel tips if the feet of the support will be on an exposed surface.
- Turn up the legs of steel wire bar supports a minimum of 1/8 inch.
- Separate layers of bars with precast concrete bar supports or by other approved bar support devices.
- Do not use pebbles, broken stone or brick, metal pipe or wooden blocks ~~with cast-in wire ties are used to support bridge deck reinforcement, the wire ties need not be coated~~as bar supports.

(c) Clearances:

- Provide the same surface clearance for ties and splices that is shown or specified for the reinforcement.
- Maintain clearance distance from the forms with stays, precast concrete blocks, ties, hangers, or other approved supports.
- ~~Separate layers of bars with precast concrete blocks or by other suitable devices.~~
- ~~Use precast concrete blocks with approved shape and dimensions and with the same or greater compressive strength as the concrete to be placed.~~

- ~~Do not use pebbles, pieces of broken stone or brick, metal pipe or wooden blocks as bar supports or to separate layers of bars.~~
- ~~Use stainless steel metal chairs conforming to the requirements of ASTM A 493, Type 430 or plastic chairs from the QPL when the legs of the chair will be on an exposed surface.~~
- ~~Turn up the legs of metal chairs a minimum of 1/8 inch.~~
- Remove all precast member lifting devices prior to placing concrete deck reinforcement.
- Ensure bridge deck clearances meet the requirements of 00540.48(g).

(d) Approval - After placing reinforcement in any member have it inspected and approved before placing concrete. Concrete placed in violation of this provision may be rejected and removal required.

00530.42 Splicing:

(a) General - Furnish full length reinforcing bars the specific length shown or the calculated length for those designated "full length".

If specific locations are designated for splices, make splices only at those locations, or use full-length bars.

In the absence of other directions, including bars designated "continuous," furnish reinforcing bars to provide the minimum practical number of bars.

Where splicing is allowed, unless shown otherwise:

- Splice No. 11 bars and smaller by lapping, or with an approved mechanical splice.
- Splice No. 14 bars and larger with an approved mechanical butt splice.

(b) Lapped Splices - In lapped splices, place the bars in contact and fasten together according to 00530.41 with at least three ties per splice.

Where coated reinforcement is spliced to uncoated reinforcement, provide the required splice lap for the coated reinforcement unless shown otherwise.

(c) Mechanical Splices:

(1) General - Construct mechanical splices according to 02510.20 and the manufacturer's recommended procedures. Use devices that join bars end-to-end if a butt splice is specified; otherwise bars may be lapped or joined end-to-end. All requirements for mechanical splices apply to mechanical butt splices.

Ensure mechanical butt-spliced reinforcing bars do not deviate from the layout line by more than 1/4 inch over a 3 foot length of bar.

When approved, dowels may be replaced by reinforcing bars with threaded sleeve mechanical splice couplers embedded in the portion of concrete placed first and threaded reinforcing bars inserted in the couplers after forms are removed. Construct assemblies that develop 135~~%~~ percent of the specified minimum yield strength of the dowels shown or specified. Construct reinforcing bars that have effective splice or development lengths equal to the replaced dowels.

When grout sleeve mechanical splices are allowed, submit a written installation plan at least 14 calendar days before splice installation. Include splice installation details including grouting operations, equipment, material, and testing requirements. Submit an installation plan that conforms to the Manufacturer's testing and installation recommendations.

Provide written documentation, signed by the qualified mechanical splice installer verifying the splices were tested and installed according to manufacturer's recommendations and these specifications. Also, submit copies of all test results.

Construct the three qualifying splice samples in the same orientation as the production splices.

(2) Sampling and Testing:

a. General - Furnish labor, material and equipment for fabricating sample mechanical splices at no additional cost to the Agency. All sample splices will be tested by the Agency at no cost to the Contractor.

b. Samples - Provide all samples meeting the requirements of 02510.20 and this subsection.

c. Testing - Construct test splices in the presence of the Engineer. Construct test splices with two equal lengths of straight reinforcing bar so that the total length of the assembled sample is not less than ~~148~~96 inches. Mark each splice sleeve with the heat treatment lot number.

d. Jobsite Quality Control - During the installation of mechanical splices:

- Submit one quality control sample for each 100 splices performed up to 500 splices~~.~~ and then submit one sample for each 500 splices. Successful installer qualification according to 00530.30 satisfies quality control for the first 100 splices being installed. This sequence of testing will be required for each heat treatment lot used.
- Make non-threaded mechanical splice quality control samples at the jobsite in a manner similar to that used for the production splices.
- Fabricate threaded sleeve mechanical splice quality control samples on a random basis during the cutting of threads on the reinforcing bars and deliver to the Engineer at the jobsite with the material they represent.
- Complete the splice according to the manufacturer's recommendations.
- Quality control samples will be tested according to this Section. If any sample fails to meet the test criteria, the lot which it represents will be rejected until the cause of failure has been determined. Materials from a rejected lot may be accepted if they are shown to be free of the condition which caused the failure.

(3) Installation - Install splices in the presence of the Engineer. Splices made without the Engineer present will be rejected.

Do not place stirrups and other reinforcing bars between a mechanical splice sleeve and the surface of the concrete where it would impair the specified clearance. Instead, place additional reinforcement as necessary at no additional cost to the Agency.

Coat mechanical splices of epoxy coated reinforcing bars after installation, according to AASHTO M 284 for patching damaged epoxy coatings.

Where pre-coating is required, pre-coat splices with an approved coating.

Following installation on projects within 25 aerial miles of the Pacific Ocean, coat exposed areas of bare steel with heat shrink tubing from section 2510.11 of the QPL. On all other projects, coat exposed areas of bare steel with heat shrink tubing or epoxy patching material from section 2510.11 of the QPL. Apply coating according to AASHTO M 284.

(d) Welded Splices - Perform welded splices of steel reinforcing according to AWS D1.4. Submit welder certification, Welding Procedure Specifications and Procedure Qualification Records to the Engineer for approval.

Provide a Certified Welding Inspector according to AWS D1.4 that:

- Performs visual inspection of work performed by the certified welder.
- Prepares, signs, and submits a signed report confirming the work was preformed according to AWS D1.4.

00530.43 Splicing Welded Wire Fabric - Overlap sheets of welded wire fabric as shown or provide edge and end laps not less than one mesh in width. Securely fasten sheets at the ends and edges according to 00530.41.

00530.44 Substitutions - Substitute different size bars only if approved.

00530.45 Inspection and Repair of Epoxy Coated Rebar - Inspect coated bars before placement for damage to coating. Patch all visual defects in the coating with a prequalified patching material according to AASHTO M 284 before installation. Clean areas to be patched to remove all surface contaminants and damaged coating. Promptly treat cleaned areas according to the resin manufacturer's recommendations and before detrimental oxidation occurs. Where rust is present, remove it by blast cleaning or power tool cleaning methods immediately before applying the patching material. Clean and roughen the metal before applying patching material. Feather the patching material 2 inches to 3 inches, or as recommended by the manufacturer, into undamaged coated areas. Apply patching material to a thickness greater than 8 mils.

Clean visual damage found after placement as specified above. Coating damage exceeding 2 percent of the surface area in any lineal foot section of a bar may be cause for rejection of that bar.

00530.46 Marine Environment - On projects within 3 aerial miles of the Pacific Ocean, clean bars with a high pressure washer (1,500 pounds per square inch minimum pressure, with a fan pattern, 4.5 gallons per minute capacity) just prior to placing concrete.

00530.47 Headed Bar Reinforcement:

(a) General - Construct headed bar reinforcement according to 02510.25 and the manufacturer's recommended procedures.

(b) Sampling and Testing:

(1) General - Furnish labor, material and equipment for fabricating sample headed bar reinforcement at no additional cost to the Agency. All sample headed bar reinforcement will be tested by the Agency at the Agency's expense.

(2) Samples - Provide all samples meeting the requirements of 02510.25 and this subsection.

(3) Testing - Construct test headed bar reinforcement in the presence of the Engineer. Construct test headed bar reinforcement with straight reinforcing bar not less than 48 inches in length. Mark each headed bar with the heat treatment lot number.

(4) Jobsite Quality Control - During the installation of headed bar reinforcement:

- Submit one quality control sample for each 100 headed bars installed up to 500 headed bars, and then submit one sample for each 500 headed bars. Successful installer qualification according to 00530.35 satisfies quality control for the first 100 headed bars being installed. This sequence of testing will be required for each heat treatment lot used.
- Complete the headed bar reinforcement according to the manufacturer's recommendations.
- Quality control samples will be tested according to this Section. If any sample fails to meet the test criteria, the lot which it represents will be rejected until the cause of failure has been determined.

(c) Installation - Install headed bar reinforcement in the presence of the Engineer. Headed bar reinforcement installed without the Engineer present will be rejected.

When using epoxy coated reinforcing bars, pre-coat heads with an approved coating. After the heads have been attached to the rebar, coat exposed areas of bare steel and seal the rebar to head interface with epoxy patching material from 02510.11 of the QPL. Apply coating according to AASHTO M 284.

Measurement

00530.80 Measurement - The quantities of reinforcement will be measured by one of the following methods:

(a) Lump Sum - Under this method, no measurement will be made. Estimated quantities of reinforcement will be listed in the Special Provisions. The weight of reinforcement in prestressed beams, slabs, piles and other items where the reinforcement is included in those items will not be included in the listed estimated quantities.

(b) Weight - Under this method, reinforcement will be measured on the weight basis, of reinforcement incorporated into the concrete based on the total computed weight for the sizes and lengths of bars as shown or authorized.

The following assumed densities will be used as a basis for computing the theoretical weight of miscellaneous metal:

Steel	-	490 pounds/cubic foot
Copper	-	555 pounds/cubic foot
Cast Iron	-	450 pounds/cubic foot

The weight of mesh will be computed from the theoretical weight of plain wire. If the weight per square foot is shown, that weight will be used.

For the purpose of computing weight of reinforcement, weights published in the CRSI "Manual of Standard Practice" will be used.

The weight of reinforcement in prestressed beams, slabs, piles and other items where the reinforcement is included in those items will not be included in the listed quantities.

If bars are substituted at the Contractor's request, and as a result, more steel is used than specified, only the amount specified will be included in the pay quantities. When laps are made

for splices for the convenience of the Contractor, the extra reinforcement will not be included in the pay quantities.

Payment

00530.90 Payment - The accepted quantities of reinforcement will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Reinforcement	Lump Sum or Pound
(b) Coated Reinforcement	Lump Sum or Pound

Item (a) includes fabricating and placing uncoated reinforcement as specified.

Item (b) includes placing epoxy coated reinforcement as specified.

Payment for reinforcement will be made when the reinforcement is incorporated into the concrete.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified,

No separate or additional payment will be made for clips, wire, separators, wire chairs, and other material used in fastening the reinforcement in place.

Section 00535 - Resin Bonded Anchor Systems

Description

00535.00 Scope - This work consists of drilling and preparing holes in hardened concrete and providing and installing anchor bolts and/or reinforcement using a resin bonded anchor system as shown.

Materials

00535.10 Materials - Furnish anchor bolts meeting the requirements of 02560.30 and reinforcing steel meeting the requirements of Section 02510 as shown. High-strength anchor bolts meeting the requirements of ASTM A 193, Grade B7 may be substituted in place of these specified in 02560.30(b).

Furnish a polyester, vinyl ester, or epoxy resin bonding system from the QPL that will sustain not less than the pullout forces shown. See Table 00535-1 when pullout forces are not shown. Provide the resin in proper proportions to be mixed easily.

TABLE 00535-1

Minimum Pullout Force					
	Anchor Bolts			Rebar	
	Grade 36	Grade 55	Grade 105	Grade 60	
Dia. (inch)	Force (Pounds)			Size	Force (Pounds)
1/2	7,400	9,700	15,300	3	7,900
5/8	11,700	16,900	24,300	4	14,400
3/4	17,300	22,500	36,000	5	22,300
7/8	24,000	31,200	49,900	6	31,700
1	31,700	40,900	65,400	7	43,800
				8	56,700

Unless shown otherwise, do not install anchors larger than 1 inch in diameter using a resin-bonded anchor system.

Unless shown otherwise, select a resin from the QPL as follows:

- For Grade 36 and Grade 55 anchors, use either low strength or high strength resin.
- For Grade 105 anchors and Grade 60 rebar, use high strength resin only.

Provide the Engineer with:

- Certification, according to 00165.35, that the anchor system meets all requirements for the Project.
- Mill test certificates verifying the strengths of material used in the manufacture of the anchors.
- Proposed embedment depths for approval, if not shown.

Unless shown otherwise, galvanize all anchors which have any portion of the anchor exposed. Galvanize according to AASHTO M 232 (ASTM A 153) or AASHTO M 298 (ASTM B 695), Class 50. When within 25 aerial miles of the Pacific Ocean, galvanize according to AASHTO M 232

(ASTM A 153) only. Unless otherwise shown, anchors that become completely encased in concrete will not require galvanizing.

Provide thread lengths as shown. If thread lengths are not shown and the anchor is not rebar, provide threads on the resin-bonded end of the anchor for at least 80~~%~~ percent of the embedment depth shown.

Construction

00535.40 Construction - Install the anchor system according to the manufacturer's recommendations and to the embedment depths shown. Use epoxy resins only when the ambient air temperature is within the temperature range recommended by the manufacturer. Unless stated otherwise in the manufacturer's instructions, use a drill bit diameter 1/8 inch larger than the nominal anchor diameter for AASHTO M 314 anchors and 5/64 inch larger than the out-to-out diameter for rebar. Unless shown otherwise, drill holes for anchor bolts as follows:

- When the center of the hole is more than 6 inches from a concrete edge, use either a 9 pound air hammer weight, or a carbide bit rotary hammer with two cutting edges on the diameter.
- When the center of the hole is 6 inches or less from a concrete edge, use either a diamond bit core drill or a carbide bit rotary hammer with four cutting edges on the diameter.

Clean holes with a non-metallic brush, compressed air, and water. Remove excess water from the hole. The cleaned hole may be damp, but be free of concrete dust, foreign matter, and standing water.

When nuts are applied to anchor bolts, tighten to one quarter turn past snug-tight unless shown otherwise.

Measurement

00535.80 Measurement - No measurement of quantities will be made for resin bonded anchor systems.

Payment

00535.90 Payment - No separate or additional payment will be made for resin bonded anchor systems. This work is included in payment made for the applicable items in which the anchor system fastens.

Section 00536 - Internal Shear Anchors

Description

00536.00 Scope - This work consists of constructing internal shear anchors in existing concrete beams that includes drilling and preparing holes, inserting epoxy resin, inserting steel rods, and repairing, patching, and finishing the concrete surface.

00536.02 Plans - Plans of the existing structure are available for viewing at the office of the Project Manager. Prints of these plans are available upon request.

00536.03 Submittals - Submit the following for approval at least 12 calendar days before beginning internal shear anchor work:

- The manufacturer's recommended materials.
- Describe the materials to be used including the properties of each material and the specifications to which the materials comply. Published manufacturer data is acceptable.
- Proposed changes to the required installation procedure.

Materials

00536.10 Epoxy Resin - Furnish crack injection epoxy products from the QPL.

00536.11 Threaded Shear Anchors - Furnish fully threaded shear anchor rods meeting the requirements of ASTM A 449 or ASTM A 193 (Grade B7). Furnish one extra anchor rod from each separate lot for check testing.

00536.12 Concrete Repair - Furnish PCC repair material meeting the requirements of Section 02015 that is compatible with the epoxy resin.

00536.13 Epoxy Resin Manufacturer's Recommendations - Submit the following manufacturer's recommendations to the Engineer before beginning installation:

- Confirmation that the proposed products are suitable for the internal shear anchor application.
- Confirmation that the proposed products can be installed according to 00536.41 and 00536.42 or, if not, the manufacturer's recommended changes to the installation procedures.
- The estimated time it will take the epoxy resin to reach a minimum compressive strength of 3,000 psi at the anticipated installation temperatures.

Construction

00536.40 General - Mark anchor locations on the bridge member for each entire span before drilling anchor holes for that span. Obtain the Engineer's approval of each span, before drilling the holes.

Install the epoxy resin according to the manufacturer's recommendations and the following:

- Install epoxy resin and anchors when the ambient air temperature is above 50 ºF.
- Complete installation of the internal shear anchors within 12 calendar days of drilling the holes.

00536.41 Internal Shear Anchors - Bottom:

(a) Demonstration - Demonstrate the installation of the internal shear anchors that will be installed from the bottom in the presence of the Engineer using the same materials, equipment, and installation methods that will be used for the final installation. Perform the demonstration according to the following:

- Construct a frame that can support and orient a PVC pipe at the angles and the lengths of the finished installed anchors.

  For variable angles and non-variable lengths perform the demonstration using the closest to vertical angle.

  For variable angles and variable lengths, perform either two demonstrations or one demonstration as follows:

  - For two demonstrations, perform the first demonstration using the longest anchor length at that anchor's corresponding angle. Perform the second demonstration using the closest to vertical angle at that anchor's corresponding length.
  - For one demonstration, perform the demonstration using the longest anchor length at the closest to vertical angle.
- Use clear Schedule 40 PVC pipe that has an internal diameter that matches the internal diameter of the specified anchor hole within a tolerance of ± 1/4 inch. Cap the top of the PVC pipe.
- Insert the anchor rod into the PVC pipe then inject the epoxy resin. Simulate the anchor rod placement conditions including temperature, humidity, geometry, injection pressure, and the method that will be used to prevent the epoxy resin from escaping. Measure the quantity of resin injected.
- After curing, cut the demonstration specimen into three separate sections, as directed.
- If required, perform additional demonstrations until the Engineer is satisfied that the epoxy resin has been fully distributed throughout the PVC pipe.

Do not begin drilling holes in the bridge until the Engineer has provided written approval of the demonstration.

(b) Construction - Unless otherwise approved, use the following procedure to install internal shear anchors from below:

- Lay out and mark proposed anchor locations.
- Locate existing reinforcement by using an electronic rebar mapping device or by removing a 6 inch maximum diameter plug of concrete, as required, to expose the existing bottom layer of longitudinal reinforcement at the locations shown. If locations are not shown, perform concrete removal at enough locations to determine the location of the existing bottom longitudinal reinforcement.
- After locating the reinforcement, drill an 8 inch deep hole using a carbide bit rotary hammer. If existing reinforcement is encountered, stop drilling and adjust the hole location. Unless shown or approved, adjust the hole location up to 3 inches in any direction. If existing reinforcement is not encountered, drill the hole to the required depth using a diamond bit core drill.
- Clean and scarify the hole with a high-pressure water system that has a rotating tipped wand and can deliver water at a water pressure of approximately 17,000 psi.
- Brush the hole with a non-metallic brush.
- Flush the hole with water and compressed air.

- Tie a sponge or rag to a section of scrap rebar. Test the drilled hole for concrete dust and debris by touching the tip and sides of the hole with the sponge or rag. Repeat water flush and compressed air procedure until no evidence of concrete dust and debris is observed on the sponge or rag.
- Measure and record the length and diameter of the drilled hole.
- Let all water drip from the hole before proceeding.
- Insert the anchor rod into the hole and inject the epoxy resin. Measure and record the volume of epoxy resin used.
- Patch the beam bottom surface using a PCC repair material.
- Submit the measured depth, diameter, and volume of epoxy resin of each hole and the total recorded volume of epoxy after installation is complete.

00536.42 Internal Shear Anchors - Top - Unless otherwise approved, use the following procedure to install internal shear anchors from above:

- Lay out and mark proposed anchor locations.
- Locate existing reinforcement by using an electronic rebar mapping device or drill an 8 inch deep hole using a carbide bit rotary hammer. If existing reinforcement is encountered, stop drilling and adjust the hole location. Unless shown of approved, adjust the hole location up to 3 inches in any direction. If existing reinforcement is not encountered, drill hole to the required depth using a diamond bit core drill.
- Clean and scarify the hole with a high-pressure water system that has a rotating tipped wand and can deliver water at a water pressure of approximately 17,000 psi.
- Vacuum the hole with a minimum 30 hp vacuum. Attach a PVC pipe or other type of extension to the end of the vacuum hose to reach the bottom of the hole.
- Tie a sponge or rag to a section of scrap rebar. Test the drilled hole for standing water and debris by touch the bottom of hole with the sponge or rag. Repeat vacuuming until no evidence of water or debris is observed on the sponge or rag.
- Plug the hole until epoxy resin is installed.
- Before installing the anchor rod and epoxy resin, remove the plug and perform testing and cleaning described above.
- Inject the epoxy resin into the hole to cover the top of the anchor rod.
- Insert the anchor rod and twist it at least 360 degrees during the insertion process.
- Remove excess liquid epoxy resin from the top of the hole.
- Repair the deck with a PCC repair material. Remove all loose material according to the manufacturer's recommendations for patch preparation. Provide a patched surface finish that matches the appearance of adjacent deck sections.
- Cure the epoxy resin to the manufacturer's recommended time to reach 3,000 psi compressive strength and cure the PCC repair material as recommended by the manufacturer before opening the section to traffic.

Measurement

00536.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Lump Sum Basis - No measurement of quantities will be made for lump sum items.

(b) Unit Basis - Measurement will be by actual count.

Payment

00536.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Internal Shear Anchors, Top	Each
(b) Internal Shear Anchors, Bottom	Each
(c) Anchor Demonstration	Lump Sum

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for anchor rods used for check testing, for adjusting and redrilling holes, and for repairing, patching, and surface finish work.

Section 00538 - Crack Injecting Existing Bridges

00538.00 Scope - This work consists of cleaning, sealing, and injecting cracks that are 1/64 inch and greater in width in existing concrete bridge members as shown.

00538.01 Submittals - Submit the following for approval at least 6 calendar days before beginning work:

- Personnel qualifications.
- The manufacturer's recommended materials.
- Describe the materials to be used including the properties of each material and the specifications to which the materials comply. Published manufacturer data is acceptable.
- An injection procedure for performing the work.

Materials

00538.10 Epoxy Resin - Furnish crack injection epoxy from the QPL.

00538.11 Surface Seal - Furnish epoxy paste surface seal that is compatible with the epoxy resin.

00538.12 Portland Cement Concrete Patching Material - Furnish PCC patching material meeting the requirements of Section 02015.

00538.13 Epoxy Resin Manufacturer's Recommendations - Submit the following manufacturer's recommendations to the Engineer before beginning work:

- The range of crack width over which the product is effective.
- The horizontal, vertical, and overhead orientation of cracked surfaces that the epoxy resin can be used.
- The cleaning requirements for epoxy resin.
- The estimated time it will take for the epoxy resin to reach a minimum compressive strength of 1,500 psi at the anticipated installation temperatures.

Labor

00538.30 Personnel Qualifications - Provide personnel skilled in the application of epoxy crack injection. Experience shall be relevant to anticipated conditions, materials, and construction techniques for epoxy crack injection. The on-site epoxy crack injection supervisor shall have successfully completed at least three projects within the past 5 years.

Submit personnel experience documentation and, for the on-site supervisor a brief description of each of the three projects the on-site supervisor supervised. For each project, include the project name, location, year of construction, owner's contact name, and current phone number.

The Engineer will respond within 7 calendar days after receipt of the submittal. If, after checking references, the Engineer determines that the proposed personnel are not qualified, they will not be allowed to work on the Project. Do not begin crack injection work until the Engineer has approved, in writing, the proposed personnel.

The Engineer may suspend the epoxy crack injection work if the Contractor substitutes unapproved personnel during construction. Submit requests to substitute the on-site supervisor or other personnel. The Engineer will respond to the substitute request 7 calendar days after receiving each request. Additional costs resulting from the suspension of work due to the changing of personnel is

the Contractor's responsibility, and no adjustment in contract time resulting from the suspension of work will be made.

Construction

00538.40 General - Remove dirt, dust, grease, oil, efflorescence, and other foreign material from surfaces adjacent to the cracks to be injected. Clean the crack with compressed air. Test the compressed air for oil and water according to ASTM D 4285. Perform other cleaning requirements that are recommended by the epoxy resin manufacturer.

Provide entry ports along the crack at intervals of not more than the thickness of the concrete at that location. Apply epoxy paste surface seal along the entire exposed face of the crack between entry ports. Allow the epoxy paste surface seal to cure before beginning epoxy crack injection work.

Perform crack injection work when the ambient girder temperature is above 40 °F or the manufacturer's recommended temperature, whichever is higher.

Begin injection work at the lowest entry port. Continue injection work until the crack is filled and epoxy resin appears at the next entry port. If port to port travel of epoxy resin is not apparent, stop work and notify the Engineer. Do not restart work until allowed by the Engineer.

After the injected epoxy resin has cured, remove the epoxy paste surface seal and all epoxy resin runs and spills by grinding or by abrasive blasting.

00538.42 Acceptance - Crack injection work will be accepted visually by determining that the epoxy resin has set and cured and that all cracks are sealed. If visual inspection reveals suspected failures, the Engineer will require cores samples. When required, provide 2 inch minimum diameter by 6 inch minimum depth core samples. The Engineer will determine the number of core samples and the locations to take the core samples. Take core samples at least 24 hours after the crack injection work. When the crack injection work is performed on only one side of the girder, take the core sample from the opposite side of the girder. When obtaining core samples do not cut or damage existing steel reinforcement. Fill core holes with a PCC repair material.

If core samples show fully hardened epoxy resin and at least 90 percent of the crack is filled, the crack injection work for that crack will be accepted. If core samples show inadequately hardened or inadequately filled cracks, stop all crack injection work. Submit a revised crack injection procedure to the Engineer. Do not resume crack injection work until the revised crack injection procedure has been approved by the Engineer.

After approval of the revised crack injection procedure, re-inject all failed cracks to fill at least 75 percent of the crack volume.

Temporary

00538.50 Traffic Control - In addition to the requirements of Section 00225, provide traffic control beginning with the application of epoxy paste surface seal and continue for 6 hours after completion of the crack injection work or until the injected epoxy resin has reached a compressive strength of at least 1,500 psi whichever is less.

Unless otherwise shown, stage traffic so that the edge of the nearest travel lane is no closer than the center of the adjacent girder.

Measurement

00538.80 Measurement - The quantities of epoxy injected cracks will be measured on the length basis. The length will be determined by measuring the straight line distance between the beginning point and ending point of each filled crack.

Payment

00538.90 Payment - The accepted quantities of epoxy injected cracks will be paid for at the Contract unit price, per foot, for the item "Inject and Seal Cracks".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for providing core samples, patching core holes, and re-injecting cracks.

Section 00540 - Structural Concrete

Description

00540.00 Scope - This work consists of furnishing, placing, and finishing portland cement concrete, throughout this Specification referred to as structural concrete or concrete, for bridges and other structures according to these Specifications and in close conformity to the lines, grades and dimensions shown or established.

00540.01 Abbreviations and Definitions:

ASTV - Actual Strength Test Value - See 02001.02 for definition.

Falsework - Structural system to support the vertical and horizontal loads from forms, reinforcing steel, plastic concrete, structural steel, loads from placement operations and other related loads.

Forms - Structural system to contain the horizontal pressures exerted by plastic concrete.

HPC - High Performance Concrete - See 02001.02 for definition.

Post-Tensioned - Tensioning of prestressing steel after concrete has reached specified strength.

Surrounding Temperature - The air temperature measured in the shade. When placement and curing of concrete is enclosed, it is the lowest temperature within the enclosure.

Tolerance:

- The permitted variation from a given dimension or quantity, or
- The range of variation permitted in maintaining a specified dimension, or
- A permitted variation from location or alignment.

00540.02 Deck Pre-Placement Conferences:

(a) Supervisory Personnel - Hold a pre-placement conference with all supervisory personnel who are to be involved in the concrete work at a mutually agreed time approximately ~~three~~ 3 weeks in advance of placing concrete for bridge decks. Ensure the Engineer, concrete supplier, and any other subcontractor is represented. Present and discuss all phases of the concrete deck placement work.

(b) Placement Crew - Hold a second pre-placement conference with the Engineer and the entire concrete placement crew at the job site ~~one-half~~ 1/2 hour before the first placement begins to discuss placement duties and procedures.

Materials

00540.10 ~~General~~Materials - Furnish materials meeting the following requirements:

Concrete.....02001
Concrete and Crack Sealers 02060
Concrete Coating .....02210~~.30~~
Curing Materials 02050
Epoxy and Non-Epoxy Bonding Agents 02070

Epoxy and Non-Epoxy Grouts.....02080
Epoxy Cement.....02060
Portland Cement Concrete Repair Material.....02015
Poured Joint Fillers.....02440.30
Preformed Expansion Joint Filler 02440.10

Furnish a concrete surface retarder from the QPL.

00540.11 Classes of Concrete - Furnish concrete meeting the requirements of Section 02001 and the requirements of Table 02001-1 for the classes of concrete to be used in various structures and concrete paving mixtures. The plans or Special Provisions will show the class of concrete required for the component parts of the structure. Use the specified class of concrete, or a higher class. Where the class is not specified, use Class 3300.

00540.14 Concrete Mix Tolerances and Limits - Furnish a workable concrete mixture, uniform in composition and consistency and meeting the properties and limits requirements of 02001.20.

00540.15 Form Materials - Furnish wood, ~~plywood~~minimum nominal 5/8 inch thick APA exterior grade plywood, minimum nominal 5/8 inch thick APA plyform, metal, or other suitable form material. For round concrete columns, provide either metal or other approved form material that produces a smooth and true surface free from fins, joints and other irregularities. ~~Where plywood is used, provide a minimum nominal thickness of 5/8 inch~~Use APA plyform for all decks and slabs.

00540.16 Quality Control - Provide quality control according to Section 00165 and the following:

- Sample and test according to the MFTP.
- For all structural concrete, provide personnel according to 00540.30 to sample and test the mix for temperature, air content, slump, water-cementitious ratio, density and yield, from the first load of each placement, whenever there is a visible change in the slump of the concrete, and when a set of cylinders is obtained.
- If the results of any test are outside of the specification limits, stop placement of the load. Correct the load or, if the load cannot be corrected, do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct subsequent loads if any of the tests are still outside the specification limits. Return to the specified test frequency when the test results from two consecutive loads are shown to meet the specification limits.

00540.17 Acceptance of Concrete - Acceptance of concrete will be according to Section 00165 and the following:

(a) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified, according to Section 00165. ~~Blend aggregates only as allowed in 02001.20.~~

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level indicated in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165-2 for a 1.00 PF.

(b) Plastic Concrete - Acceptance of plastic concrete will be based on tests performed by the Contractor's QCT, according to the tolerances and limits of 02001.20.

(c) Hardened Concrete - Cast and cure test specimens according to AASHTO T 23 in 6 inch x 12 inch or ~~14~~4 inch x 8 inch, single-use plastic molds and test at 28 days according to AASHTO T 22.

(1) General - For all classes of concrete, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test cylinders at an Agency certified laboratory.

(2) Actual Strength Test Value ~~(28-Day)~~ - The ASTV at 28 days is the average compressive strength of the three cylinders tested. If the compressive strength of a single test specimen varies by more than 10~~%~~ percent from the average of the other two specimens, that compressive strength value will be discarded. The average compressive strength test of the two remaining specimens will be the ASTV.

(3) Acceptance - Hardened concrete with an ASTV meeting or exceeding the specified design strength, f'c will be accepted for strength. If the ASTV is less than f'c but at least 85~~%~~ percent of f'c, the Engineer may review the results to determine if the concrete represented by the cylinders is suitable for the intended purpose. Remove concrete that has an ASTV less than 85~~%~~ percent of f'c unless otherwise authorized, in writing, by the Engineer. If the concrete is removed, the cost of removal, replacement and all related work is the Contractor's responsibility. If the Engineer determines that the concrete is suitable for the intended purpose, the concrete may be allowed to remain in place, subject to a price adjustment according to 00150.25.

If an ASTV falls below f'c, the Contractor may submit a written plan ~~within three days of the test for review by the Engineer. Provide a plan~~ outlining a proposed alternate method of evaluating compressive strength. Submit the plan for review by the Engineer within 3 days of the test. Provide evidence that a reasonable f'cr (over~~-~~design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. ~~If the~~The Engineer ~~determines that~~may allow an alternate method of acceptance if the compressive strength test results are determined to be suspect from definable external factors~~, the Engineer may allow an alternate method of acceptance~~.

Equipment

00540.22 Concrete Conveying Equipment - Use clean, non-aluminum conveying equipment capable of supplying concrete to the point of placement without segregation.

(a) Concrete Pumping Equipment - Provide a discharge line for the pump made of steel or rubber pipe and having the following minimum size:

Nominal Maximum Size of Concrete Aggregate	Minimum Pipe Size, Inside Diameter
1 inch	4 inches
1 1/2 inches	5 inches

(b) Chutes - Use steel or steel-lined chutes. Where steep slopes are required, equip the chutes with baffles or provide short lengths that reverse the direction of movement.

(c) Pipes or Trunks - Other than tremie seal pipe, provide rubber or steel pipes, and plastic trunks.

(d) Tremie Seal Pipe - Provide a tremie seal pipe that:

- Is rigid pipe with minimum diameter of 10 inches and sufficient length to reach from the bottom of the excavation to above the waterline, with an attached receptacle or hopper for receiving concrete.
- If jointed, is the flange-and-gasket type and waterproof.
- Has means to close the discharge end.
- Is supported to permit free movement of the discharge end throughout the seal.
- Is equipped with a device to permit rapid lowering when necessary to retard or stop the flow of concrete.

00540.23 Vibrators - Provide vibrators that:

- Are an internal type unless other methods are approved by the Engineer.
- Are capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.
- Are in working condition to meet manufacturer's rating.
- Are fitted with a manufactured rubber ~~head~~sleeve to ~~minimize~~prevent damage to epoxy coated reinforcement.

00540.24 Deck Finishing Machine - Provide a deck finishing machine that is:

- Capable of finishing the entire roadway surface or the specified stage construction width.
- Self-propelled with positive control in both forward and reverse directions.
- Capable of raising rolls or screed to clear the screeded surface with positive control to the specified grade.
- Equipped with augers.
- Equipped with rollers or vibrating screeds.

(a) Deck Finishing Machine Support System - Furnish calculations and detailed drawings of the proposed deck finishing machine support system according to 00540.41.

(b) Other Deck Finishing Equipment - In narrow bridge widenings where a deck finishing machine is not practical, a mechanical vibrating screed may be used.

00540.25 Straightedge - Furnish a 12 foot metal straightedge for checking bridge deck roadway and sidewalk surface tolerances.

00540.26 Concrete Saws - Provide power-driven concrete saws for sawing joints and as required for surface texture.

00540.28 Power Washers - Provide power washers that produce a minimum 2,500 psi pressure at the nozzle, with a fan pattern, and a minimum 4.5 gallons per minute capacity. For bridge decks, provide at least one power washer for each side of the deck section to be placed. When using power washers to produce a fog spray for curing, match the flow rates and pressures of the power washers with the fogging nozzles to produce an average droplet size of 3 mils, according to the nozzle manufacturer's recommendation.

00540.29 Work Bridges - Provide at least two transverse work bridges when placing concrete on a bridge deck. Use the transverse work bridges to facilitate placement of the cure.

Labor

00540.30 Quality Control Personnel - In addition to the certified technicians required in 02001.50 provide and designate an individual to be present at the placement site at all times during concrete placements for projects with more than 100 cubic yards of structural concrete and for all high performance concrete, and who is authorized and responsible for acceptance and rejection of materials.

Construction

00540.40 Tolerances - The following tolerances apply to cast-in-place structures:

(a) Foundation Footings:

(1) Lateral Alignment:

- Actual (as cast) location of the center of gravity: 0.02 times width of footing in the direction of misplacement, but not more than 2 inches
- Supporting masonry: 1/2 inch

(2) Level or Vertical Alignment:

- Top of footing supporting masonry: 1/2 inch
- Top of other footings: minus 2 inches to plus 1/2 inch

(3) Cross-Sectional Dimensions:

a. Horizontal dimension of formed members: minus 1/2 inch to plus 2 inches

b. Horizontal dimension of unformed members cast against soil:

- Less than and equal to 2 feet: minus 1/2 inch to plus 3 inches
- Over 2 foot and less than and equal to 6 feet: minus 1 1/2 inch to plus 6 inches
- Over 6 feet: minus 1/2 inch to plus 12 inches

c. Vertical dimension (thickness): 0 to plus 6 inches

(4) Relative Alignment - Footing side and top surfaces may slope with respect to the specified plane at a rate not to exceed 1 inch in 10 feet.

(b) All Other Structural Members:

(1) Vertical Alignment:

- Exposed surfaces: ± 3/4 inch
- Concealed surfaces: ± 1 1/2 inches
- Construction joints: 0 to minus 3 inches

(2) Lateral Alignment - Centerline alignment: 1 inch

(3) Level Alignment:

a. Profile grade: ± 1 inch

b. Top of other concrete surfaces and horizontal grooves:

- Exposed: ± 3/4 inch
- Concealed: ± 1 1/2 inches

c. On ramps, sidewalks and intersections, in any direction, the gap below a 12 foot unleveled straightedge resting on high spots shall not exceed 1/4 inch.

d. On bridge decks, in any direction the gap below a 12 foot unleveled straightedge does not vary from the testing edge by more than 1/8 inch.

(4) Cross-Sectional Dimensions:

- Bridge slabs and decks vertical dimension (thickness): minus 1/8 inch to plus 1/4 inch
- Members such as columns, beams, piers, walls and others (slab thickness only): minus 1/4 inch to plus 1/2 inch
- Openings through members: 1/2 inch

(5) Relative Alignment:

a. Location of openings through members: 1/2 inch

b. Formed surfaces may slope with respect to the specified plane at a rate not to exceed the following amounts in 10 feet:

- Watertight joints: 1/8 inch
- Other exposed surfaces: 1/2 inch
- Concealed surfaces: 1 inch

c. Unformed exposed surfaces, other than pavements and sidewalks, may slope with respect to the specified plane at a rate not to exceed the following amounts:

- In 10 feet: 1/4 inch
- In 20 feet: 3/8 inch

00540.41 Design of Falsework for Vertical Pressures:

(a) Submittal of Working Drawings and Calculations - Submit stamped falsework plans and design calculations according to 00150.35, except as modified below.

Ensure the falsework designer prepares a Falsework Design Summary and completes a Falsework Design Checklist to accompany the plans and calculations. Include in the summary a list of each falsework member with its:

- Assumed dead and live loads
- Allowable and design stresses
- Allowable and calculated deflections

- Design references and derivations for design formulas
- Documentation for computer generated calculations

The Falsework Design Checklist is included in the Special Provisions.

Submit five sets (nine sets if railroad approval is required) of the plans and three copies (five copies if railroad approval is required) of the calculations, summary, and checklist.

Design falsework according to the current edition of "AASHTO Guide Design Specifications for Bridge Temporary Works" except where in conflict with these Specifications.

(b) General Design Loads - Design and construct falsework to support the total applied loads and provide enough redundancy in the design to prevent a failure of the entire system.

Ensure design loads used are the maximum loadings. Ensure deflections used on manufactured devices and assemblies do not exceed the manufacturer's recommendations. Furnish catalog data that lists the manufacturer's recommendations.

(c) Falsework Foundation:

(1) On Soils - Consider anticipated construction and soil conditions in determining the soil's support capacity, including draining water away from the supports. For falsework supported on soils, show the following in the calculations:

- Assumptions and methods used to determine the soil's capacity to support the footing loads.
- Anticipated falsework footing settlement based on the allowable soil bearing values.

(2) On Piles - For falsework supported on piles, show on the working drawings the pile type, size and spacing. Accompany these drawings with calculations which show the assumptions and methods used to design the piles and the bearing values to which the piles need to be driven to support the calculated loads.

(d) Requirements at Highway and Railroad Traffic Openings - For falsework adjacent to or spanning a highway or railroad traffic opening, do the following:

- Design the posts using a minimum elastic section modulus, about each axis, of:
  - 12.2 cubic inches for structural steel
  - 244 cubic inches for timber
- Increase the vertical post load 150~~%.~~ percent. If the load on the falsework will be increased by load transfer due to prestressing, increase the vertical post load by the additional load due to prestressing or by 150~~%,~~ percent, whichever is greater.
- Provide mechanical connections for posts to supporting footing with capacity to resist a minimum lateral force of 2,000 pounds applied in any direction at the base of the post.
- Provide mechanical connections between top of posts and the cap or stringer capable of resisting a lateral force of 1,000 pounds from any direction.
- Tie down all beams or stringers spanning traffic so that each will resist a 500 pound force from any direction.
- Use 5/8 inch diameter or larger bolts at connections for timber bracing.
- Show temporary erection/removal bracing on the falsework plans.

(e) Additional Requirements at Railroad Traffic Openings - For falsework bents within 20 feet of the track centerline:

- Design bracing so that the bent will resist the required horizontal load or 500 pounds, whichever is greater.
- Provide solid sheathing of 5/8 inch thick plywood between 3 feet and 16 feet above the top of the rail, properly blocked at the edges.
- On falsework plans, show:
  - Collision posts if they are required
  - Soffit and deck overhang forming details

00540.42 Falsework Construction - Construct falsework according to the current edition of "AASHTO Construction Handbook for Bridge Temporary Works", except where in conflict with these Specifications. Assure that falsework is constructed according to the falsework design and on soils equal to or exceeding design assumptions. Within ~~two~~2 days of notice of the falsework design engineer's pending inspection, the Engineer will provide a list of construction concerns. Do not place concrete until the falsework design engineer of record, accompanied by the Engineer, field inspects that portion of the falsework proposed for use. Do not place concrete until all construction concerns have been addressed, the falsework design engineer furnishes the Engineer a written statement that the falsework conforms to the design and will serve the intended use, and the Engineer agrees in writing that the falsework will serve the intended use.

Set falsework to give the finished structure the camber shown or specified.

Install telltales on falsework at locations as directed and use jacks, hardwood wedges or other methods approved, to take up settlement in the formwork.

When used, provide sand jacks consisting of a metal piston and metal frame filled with compacted, clean, dry sand. Ensure the annular space between the top bearing plate or piston and the frame does not exceed 1/4 inch.

Use temporary concrete barriers according to 00225.12(c) to protect falsework from damage from adjacent traffic. Make provisions to prevent damage by debris in streams.

Upon completion of the structure, remove all falsework to at least 24 inches below ground line or streambed.

Limit the height of timber blocking and wedging to 24 inches, or to less than ~~one and one-half~~ 1 1/2 times the least horizontal dimension of the blocking or wedges, whichever is smaller. Limit post, shim pack and wedging assemblies supporting beams to six faying (interface or contact) surfaces. Ensure adjacent beam support assemblies do not have a difference of more than two faying surfaces. Ensure timber blocks loaded perpendicular to the grain are free of splits.

For post-tensioned structures, do not remove falsework until post-tensioning is complete.

00540.43 Joints - Construct joints in concrete bridges according to details shown or directed.

(a) Construction Joints - Make construction joints between concrete placements only where shown or specified unless otherwise approved.

Do not form construction joints in concrete exposed to salt water between levels of extreme low and high water. Where concrete may be exposed to the action of alkaline water or soil, place concrete continuous until completion of the section, or until the concrete is at least 18 inches above the ground or high water level.

Unless otherwise shown, provide construction joints with a roughened surface. Do not smooth or trowel aggregate into the cement paste. Provide a minimum deviation from a plane surface or 1/4 inch and a maximum deviation from a plane surface equal to the maximum size of aggregate in the specified class of concrete.

~~Within 24 hours after placing~~ Apply a concrete~~,~~ surface retarder according to the manufacturer's recommendations. Remove surface mortar within the time period recommended by the manufacturer and clean the joint surface and reinforcing steel by removing loosened particles of aggregate, damaged concrete, unconsolidated concrete and surface laitance with a high pressure washer conforming to 00540.28 to the extent that clean aggregate (free of ~~cement film)~~surface mortar) is exposed on 50~~%~~ percent of the surface~~ is exposed~~. Clean the joint surface again immediately prior to the concrete placement to remove any subsequent deposits of dirt, debris or other foreign materials. Saturate the joint surface with potable water immediately before resuming concrete placement. Remove standing water in depressions or hollows of the joint surface.

Saw cut the top 1 inch of the deck joints with a straight vertical cut before subsequent concrete placement and before saturating the surface with water. Where joints are straight and without spalls, the Engineer may waive this saw cut requirement.

Hand rub or brush fresh concrete paste onto the existing surface of vertical deck joints down to the top mat of reinforcing steel at the beginning of subsequent concrete placement.

Stay in place joint forms are not allowed in bridge deck construction joints.

(b) Open Joints - Locate open joints as shown. Construct the form so the form support system may be released as soon as the concrete takes its initial set. Do not chip or break the corners of the concrete when removing forms. Do not extend reinforcing bars across an open joint unless shown.

(c) Joints with Fillers - Construct joints with preformed expansion joint fillers or poured fillers as shown and according to the manufacturer's recommendations for the filler used. Provide a 3/4 inch chamfer on each edge of the joint unless otherwise noted.

(d) Bridge Deck Expansion Joints - Construct expansion joints for bridge decks as shown and according to Section 00585.

00540.44 Foundations - Place concrete foundations for structures on suitable soil or rock bearing surfaces, concrete seals or piles as shown. Excavate and backfill according to Section 00510.

00540.45 Construction of Forms - Construct forms that:

- Are mortar-tight and sufficiently rigid to conform to and maintain the specified dimensions and tolerances.
- Provide a 3/4 inch chamfer on all exposed concrete edges unless otherwise noted.
- Provide a smooth concrete surface unless otherwise specified.
- Are constructed so portions may be removed without disturbing forms that are to remain.
- Are treated with a release agent that is not detrimental to the concrete.

- Are cleaned of dirt, sawdust, excess water and other foreign material before placing concrete in the forms.

- Are saturated with water immediately before placing concrete and kept damp during placement.
- Are retightened before depositing new concrete on or against concrete which has hardened.

On structures 25 aerial miles from the Pacific Ocean, construct metal ties or anchorages within the forms so they can be removed to a depth of 2 inches from accessible surfaces. On all other structures, construct metal ties or anchorages within the forms so they can be removed to a depth of at least 1 inch from accessible surfaces.

Install embedded conduit 2 inches clear of the nearest face of concrete.

Secure in place expanded polystyrene forms and spacers between adjacent concrete placements to prevent floating or displacement during concrete placement. Carefully cut joints in expanded polystyrene and fill with a suitable filler or mastic to prevent intrusion of concrete mortar. After the concrete has hardened, completely remove expanded polystyrene unless otherwise stated.

Permanent stay-in-place bridge deck forms are not allowed unless shown otherwise.

(a) Footings - When footings are not founded in firm rock, concrete may be placed without forms if the excavation does not exceed the tolerances of 00540.40(a-3-b).

Do not form portions of footings founded in firm rock. Place concrete against undisturbed rock, filling the overbreak to the top of rock or top of footing.

(b) Accessible Box Girder Cells - Falsework and deck forms for accessible box girder cells may be supported by girder stems or bottom slab provided the bottom slab is fully supported and designed to take additional loading from deck forms and falsework, deck concrete, and concrete placement forces.

(c) Inaccessible Box Girder Cells - Falsework and deck forms for inaccessible box girder cells may be left in place provided:

- Falsework and deck forms left in place are not supported off the bottom slab. Falsework and deck forms supported by girder stems are allowed.
- 1/2 inch preformed expansion joint filler are placed between the end of deck forms and transverse beams and at 25 foot spacing in the deck forms.
- Box girder cells are cleared of materials and forms except as necessary to support the deck slab before the deck forming is complete.

(d) Form Maintenance - Set forms and maintain them true to designated line and grade until the concrete hardens. When forms appear to be unsatisfactory, either before or during the placing of concrete, the Engineer may order the work stopped until the defects have been corrected. Leave forms in place for periods specified in 00540.52.

00540.47 Delivering Concrete - Schedule delivery of concrete to ensure continuous delivery during placement. For all placements except seal and deck placements, ensure the interval between the end of one load and the start of the next load does not exceed 20 minutes. See 00540.48 for seal and deck placements.

If the requirements of the previous paragraph are not met, the Engineer will determine whether the concrete has taken its initial set and may order a bulkhead installed or removal of concrete in the affected placement.

00540.48 Handling and Placing Concrete:

(a) General - Do not place concrete under water or in flowing water unless specifically authorized. Place concrete:

- In the sequence shown or as approved.
- In its final position in the forms within ~~one-and-one-half~~1 1/2 hours after the addition of the cement to the aggregate. A retarder may be used or required. Use a retarder from the QPL and furnish at no additional cost to the Agency.
- As close as possible to its final position and consolidated to:
  - Avoid segregation of the materials and displacement of the reinforcement
  - Produce a dense, homogeneous concrete, free of voids and rock pockets
- Through pumps, chutes or trunks conforming to 00540.22, when placement requires dropping concrete more than 5 feet. Place the bottom of pump hose, chutes, pipes or trunks as close to final placement position as practical.
- In layers not more than 18 inches thick, except for seal concrete placement, and unless shown otherwise. Place and consolidate each layer before the preceding layer has taken initial set to avoid surfaces of separation between the layers.

Do not place concrete prior to complete approval of:

- The excavation and the bearing material in a foundation
- Installed piling
- The falsework and forms
- Placed reinforcing steel

After initial set of the concrete, do not disturb the forms or place loads on the ends of reinforcing bars projecting from the concrete placement until allowed by 00540.52.

(b) Pumping Concrete - Pump concrete with pumping equipment conforming to 00540.22. Pump a cement-water slurry through the lines before starting the mix through the pump. Operate the pump in a manner that produces a continuous stream of concrete without air pockets or segregation. When a placement nears completion, if concrete remaining in the pipeline is to be used, remove it in a manner that will not cause contamination of the concrete already in place.

There will be no extra payment for additional cement or additives required to ensure a mix is pumpable.

(c) Vibrating Concrete - Except for seal concrete, thoroughly consolidate fresh concrete according to the following:

- Vibrate concrete internally using mechanical vibrating equipment.
- Provide an extra vibrator for emergency use.
- Re-vibration of concrete may be required as directed.

Apply vibration at the point of freshly deposited concrete. Apply vertically at points uniformly spaced not farther apart than 1 1/2 the radius over which the vibration is visibly effective. Penetrate into previously placed plastic layers.

Do not use vibrators to make concrete flow or to move concrete from one point to another in the forms. Do not apply directly on or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration.

Supplement vibration by spading as necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners or other locations impossible to reach with vibrators.

Continue vibration until the concrete is thoroughly consolidated. Discontinue vibration if segregation occurs or localized areas of grout form.

(d) Concrete Exposed to Salt Water, Alkaline Water, or Soil - For concrete exposed to salt water, see 00540.43(a) for location of construction joints, and 00540.53 for surface finish requirements.

Do not allow alkaline water or soil to contact the concrete during placement or for a period of at least 72 hours after placement. See 00540.43(a) for location of construction joints.

(e) Seal Concrete - Deposit seal concrete in still water near its final position, by means of a tremie seal pipe meeting the requirements of 00540.22(d) or a concrete pump with a rigidly held discharge line to prevent unwanted vertical movement. Place seal concrete continuously from start to finish, at a rate of at least 50 cubic yards per hour, keeping the surface of the concrete nearly horizontal at all times. Place each increase in height before the preceding concrete has taken its initial set.

Do not use vibrators.

At the start of the work and on any withdrawal of the pipe, close the discharge end to prevent water entering the pipe. During the progress of the work, keep the pipe full of concrete to the bottom of the hopper. When concrete is dumped into the hopper, start the flow of concrete by slightly raising the discharge end, always keeping it in the deposited concrete. Control the elevation of water inside the cofferdam to prevent any flow through the seal.

Dewatering may proceed when the concrete seal has achieved a compressive strength of 2,200 psi. Remove high spots, laitance and other unsatisfactory material from the exposed surface.

(f) Walls, Abutments, Bents, Piers, Columns, Beams, Girders, and Slabs - Place concrete following the sequences shown and the delay period specified in 00540.52.

Delay placement for the superstructure until the column forms have been stripped sufficiently to determine the character of the column concrete. Ensure superstructure loads are not carried by the bents or piers until the concrete has been in place and has attained the strength specified in 00540.52.

Stop placement for the bottom slab of box girder structures at the bottom of beam stems or bottom of stem fillets. Before placing concrete in the stems, wait for a period not less than that specified in 00540.52.

Stop placement for T-beams and box girder stems at the bottom of the deck fillet. Before placing deck concrete, wait for a period not less than that specified in 00540.52.

(g) Bridge Decks - Use deck finishing machines conforming to 00540.24 and set to run parallel to the skew of the bent lines. Place screed rails outside the finishing area. Extend screed rails beyond both ends of the scheduled placement length for a distance that allows the finishing machine to reach all of the concrete.

For bridges with continuous spans, ensure reinforcing steel is in place and tied in any adjacent span in the continuous bridge segment before placing concrete.

Before placing concrete, operate the finishing machine the length of the proposed placement, and check the deck thickness and clearance from the screed to the reinforcing steel in the presence of the Engineer, by an approved method. The permissible variation from the clearance indicated will be plus or minus 1/4 inch. Make necessary corrections before beginning the placement.

Furnish transverse work bridges according to 00540.29. Extend the screed rails beyond the start end to allow placement of all transverse work bridges on the screed rails before placement of concrete begins.

Do not place bridge deck concrete until the Engineer is satisfied that the Contractor:

- Meets the requirements of 00540.41, 00540.45 through 00540.49, and 00540.52.
- Has the finishing machine and transverse work bridges placed and ready on the screed rails.
- Is able to deliver concrete for decks so deck placement progresses at a rate of not less than 20 feet per hour.
- Proceeds up grade from the lowest deck elevation, unless otherwise shown.
- Is able to produce and place concrete at a rate sufficient to complete proposed placement and finishing operations within the specified time.
- Illuminates the work area during hours of darkness.
- Has experienced concrete finishers and necessary finishing tools and equipment at the work site.
- Provides wind breaks, fog spray, or other approved methods when the concrete surface is exposed to conditions which may cause premature drying during placement operations.
- Has saturated the tops of precast prestressed concrete members and formwork by applying continuous water for a minimum of 2 hours immediately prior to beginning deck placement.

If delays occur lasting longer than 30 minutes, the Engineer may order construction of a bulkhead. If a bulkhead is constructed, do not begin further placement in that span or the adjacent falsework span, if any, for at least 24 hours. Construct bulkheads only where shown or when directed by the Engineer.

00540.49 Weather Conditions for Concreting:

(a) All Concrete Placement:

(1) Hot Weather - Maintain the concrete temperature during hot weather as specified. When concrete temperatures approach 80 °F, take appropriate action to lower concrete temperature.

Do not place concrete on or in forms if surface temperature of forms or reinforcing steel is 90 °F or above.

(2) Cold Weather:

a. General - Do not place concrete if the air temperature is, or is forecast to be, below 40 °F the day of placement or is forecast to be below 40 °F on any of the next ~~seven~~7 calendar days (14 calendar days for decks) after placement, unless a ~~specified enclosure and heat are used or insulated forms are~~Cold Weather Plan has been approved ~~and used~~by the Engineer.

To place concrete when the temperature is below 40 °F, submit a Cold Weather Plan that identifies the methods that will be used to prevent the concrete temperature from falling below 50 °F. Methods include heated enclosures and insulated forms. Also include in the plan measures that will be taken if the concrete temperature falls below 50 °F. Provide a 24 hour continuous recording thermometer to verify the concrete temperature.

Keep the foundation, form surfaces and reinforcing steel free of frost and ice.

Ensure the temperature of the concrete is not less than 60 °F when placed in the forms. If air temperature is below 40 °F, heat mixing water to a temperature of at least 70 °F, but not more than 150 °F, or heat the aggregates with either steam or dry heat. Ensure the temperature of concrete produced with heated aggregate, heated water, or both does not exceed 80 °F before placing.

b. Enclosures - If enclosures are used, do the following:

- Furnish and use, within the enclosure, a 24-hour ~~high-low or~~ continuous temperature ~~recording thermometer~~/humidity recorder to record the air temperature ~~within the enclosure~~and relative humidity every hour during the cure period.
- Supply ~~heat~~ and maintain curing moisture~~.~~
- ~~Maintain the air temperature~~ and heat in the enclosure for 7 calendar days (14 calendar days for bridge decks) after placing concrete as follows:
  - Relative humidity of at least 40 percent.
  - Air temperature between 60 °F and 80 °F ~~for a period of seven days after placing concrete~~.

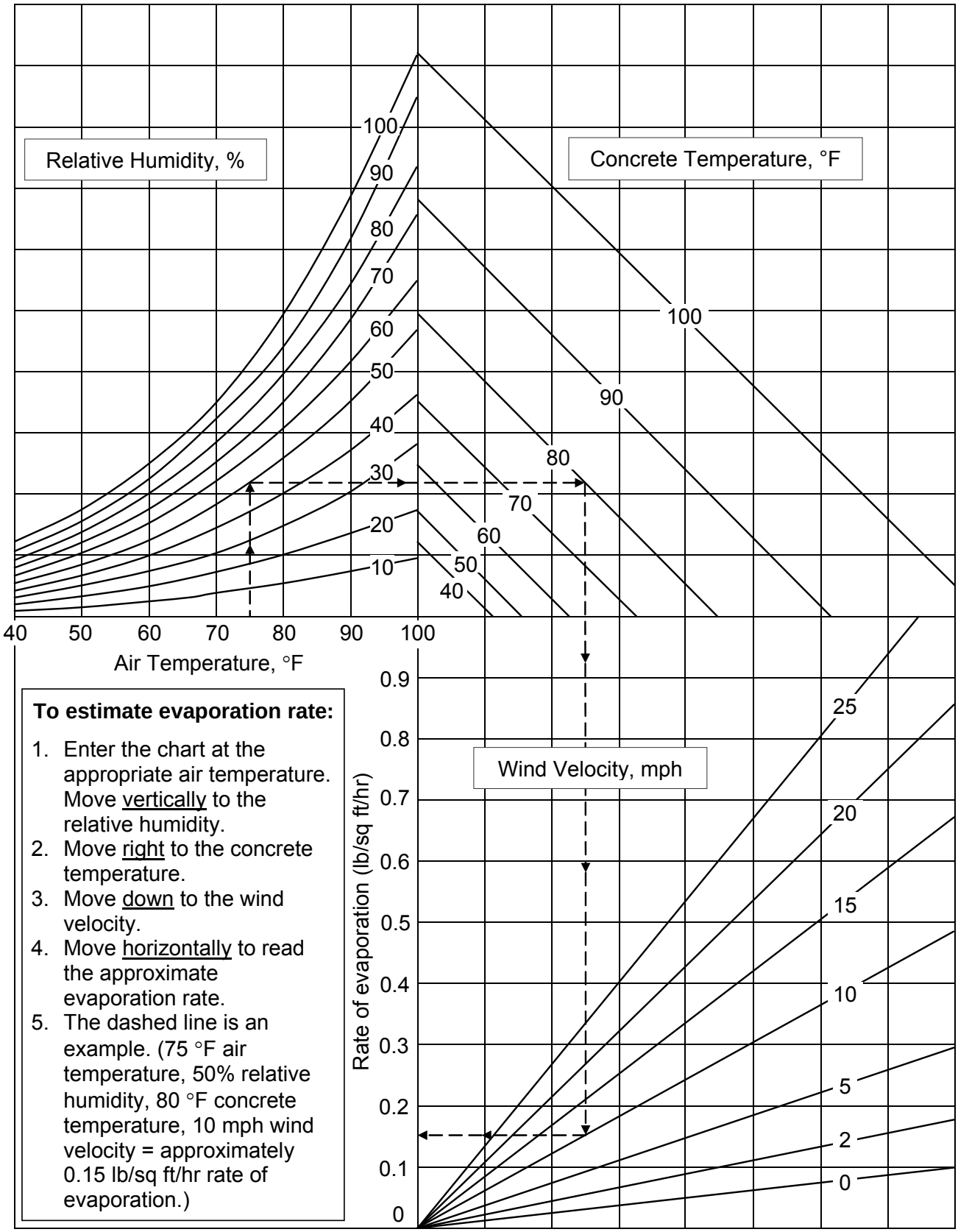
c. Insulated Forms - When approved by the Engineer, insulated forms, capable of maintaining the surface of the concrete at not less than 50 °F for a period of ~~seven days,~~7 calendar days (14 calendar days for bridge decks), may be used instead of enclosures and heating. If forms are insulated, protect exposed horizontal surfaces with a similar layer of insulating material securely fastened in place. If the insulated forms do not maintain the proper temperature at the concrete surface, use auxiliary protection, and provide additional heat and thermometer, as described in (b) above.

(b) Bridge Deck Placement - Place concrete for bridge decks:

- Only if precipitation is not forecast between 2 hours before and 2 hours after the scheduled placement duration. An acceptable forecast will have less than 30 percent chance of precipitation for the entire placement window. Provide, from an agreed upon weather forecast service, a forecast to the Engineer 1 hour before placement.

- Only if not raining and the combination of air temperature, relative humidity, concrete temperature and wind velocity produces an evaporation rate of less than 0.10 pounds per square foot of surface area per hour, according to Figure 00540-1, or
- Within an enclosure, according to 00540.49(a-2-b).

FIGURE 00540-1 SURFACE EVAPORATION FROM CONCRETE [1]



To estimate evaporation rate:

1. Enter the chart at the appropriate air temperature. Move vertically to the relative humidity.
2. Move right to the concrete temperature.
3. Move down to the wind velocity.
4. Move horizontally to read the approximate evaporation rate.
5. The dashed line is an example. (75 °F air temperature, 50% relative humidity, 80 °F concrete temperature, 10 mph wind velocity = approximately 0.15 lb/sq ft/hr rate of evaporation.)

[1] Based on ACI 305 R, "Hot Weathering Concreting"

00540.50 Bridge Deck Roadway and Sidewalk Finish:

(a) General - After the bridge deck roadway and sidewalk concrete is placed and consolidated, strike it off to lines, grades and cross sections shown.

(b) Deck Roadway Finish - After the deck roadway concrete has been screeded with a finishing machine conforming to 00540.24, float, if necessary, to produce a uniform surface, according to 00540.55. If the work does not conform to the prescribed limits, stop the operation until revised methods, changes in equipment, or correction of procedures are approved for trial. Also stop the revised operation if it does not produce a specified surface.

(c) Deck Roadway Texturing - After correcting any non-specification surface tolerance according to 00540.55, texture the deck roadway surface with a saw that cuts grooves into the bridge deck as follows:

- Cut grooves 1/8 inch wide and 1/8 inch to 3/16 inches deep.
- ~~Unequally space~~Space grooves randomly from 3/4 inch to 1 1/2 inches apart with a minimum of 12 grooves for every foot of deck surface. Measure groove spacing parallel to the roadway centerline.
- Orient the grooves perpendicular to the roadway centerline and full width of the roadway except leave smooth strips 16 inches wide along each curb face. Do not overlap grooves.
- Do not groove within 6 inches of joint blockouts and bridge ends. For skewed bridges, additional ungrooved portions at joint blockouts and bridge ends are allowed to accommodate the width of the gang saw.
- Continuously remove saw slurry and laitance from the sawing operation while cutting grooves.
- Cut grooves after the bridge deck has been checked for non-specification surface tolerances as required by 00540.55 and after the water cure is complete.
- Cut grooves no sooner than 14 days after the deck is cast. Cut grooves before opening the roadway to traffic. For structures constructed in stages, the roadway may be opened to traffic before cutting grooves provided the time period from opening to actual construction of grooves is between June 1 and October 1.

(d) Deck Sidewalk Finish - After the deck sidewalk surface has been struck off with a strike board, float it with a wooden or cork float. Use an edging tool on edges and at expansion joints. Remove edging tool marks prior to final finishing. Apply a light broom texture to the surface.

00540.51 Curing Concrete:

(a) General Requirements - Cure cast-in-place concrete with water. Begin curing as soon after placement as possible without damaging the freshly placed concrete. Continue curing for ~~seven~~ 7 calendar days (14 calendar days for bridge decks) after placement.

Keep surfaces not covered by waterproof forms damp by applying water with a fog nozzle until the surface has set sufficiently to allow sprinkling with water or covering with wet burlap or an approved wet or dry material.

Do not interrupt curing for more than ~~one~~1 hour during the curing period.

~~If temperature falls below 35 °F during the seven-day cure period, the Engineer may require enclosures or insulated forms according to 00540.49(a-2).~~

(b) Curing Concrete Bridge Decks - In addition to requirements of 00540.49, cure cast-in-place concrete bridge deck surfaces by doing the following:

- Provide wind breaks or other approved methods when exposed to conditions which may cause premature drying during placement operations. Premature drying is defined as an evaporation rate equal to or greater than 0.~~20~~10 pounds per square foot per hour, as determined from Figure 00540-1, or as the loss of surface sheen when the evaporation rate at the surface exceeds the bleed rate.
- Provide high pressure washers, according to 00540.28, fitted with fog nozzles during all deck placements to prevent and control premature drying. Apply fog spray upwind of the concrete placement during finishing. The purpose of fogging is to maintain a layer of high humidity above the concrete surface in order to minimize water loss in the mix after placement and before application of cure. Do not allow larger water droplets that drip from nozzles to fall onto the freshly finished plastic concrete.
- Cover the concrete with a single layer of clean initial covering immediately after finishing. Apply initial covering no later than 20 minutes after final pass of the finishing machine and no greater than 20 feet from the back of the finishing machine. Provide an initial covering with a minimum length sufficient to cover the bridge deck from side to side of the concrete placement. Use one of the following:
  - Saturated wet burlap having a minimum dry weight of 10 ounces per yard for material 40 inches wide. Presoak the burlap by immersing it completely in water for 72 hours prior to the deck placement and presoak new burlap with a wetting agent. Overlap the edges at least 6 inches.
  - Non-woven, needle punched polypropylene fabric curing blanket from the QPL. Thoroughly wet fabric within 15 minutes of fabric placement. Overlap the edges at least 12 inches.
- Provide soaker hoses for additional soaking of the initial covering. Place over the full width of the concrete placement, at a maximum of 10 foot intervals. Do not allow initial wetting of burlap or fabric to dry before soaker hoses are in place and operational. Operate soaker hoses continuously to keep the initial covering saturated.
- Place a layer of 4 mil polyethylene film over the initial covering and soaker hoses. Provide clear or white polyethylene film if the air temperature is forecasted to be above 65 °F within 24 hours of the concrete placement, and black at other times, as determined by the Engineer. Overlap the edges of polyethylene film by 12 inches. Keep the film in place by taping and weighting the edges where they overlap or are vulnerable to movement by wind. Once a particular type of film has been placed, do not change it during the curing period.
- Maintain a continuous water cure of the concrete surface for 14 days.

(c) Additional Cure Time - If, during the cure time, the surrounding temperature falls below 45 °F, extend the cure for the number of hours the temperature is below 45 °F.

00540.52 Removal of Forms and Falsework, and Subsequent Loading - Do not remove forms and falsework or place subsequent loads without approval.

In determining when to remove forms and falsework, and when to place subsequent loads, the Engineer will consider the Contractor's proposed schedule, the location and character of the structure, the weather, and other conditions influencing the setting of the concrete. If appropriate, these operations will be controlled by compressive strength tests of cylinders cast by the Contractor and witnessed by the Engineer. Test the cylinders at a recognized testing laboratory at no additional cost to the Agency. ~~Cure~~Cast and cure cylinders ~~under conditions~~according to AASHTO T 23 (field cured) which ~~are~~is equivalent to the most unfavorable field conditions for the portions of the concrete which the cylinders represent.

Forms and falsework may be removed and subsequent loads may be placed when both conditions of Table 00540-1 are met.

Table 00540-1

Part 1:

Form and Falsework Removal for:	**Percent of Specified Strength**	**Counting Days [1]**
Side form for footings, walls, abutments, caps, traffic and pedestrian barriers, and any other side forms not supporting the concrete weight	–	1
Columns	–	3
Cantilevered bridge deck sidewalks	–	7
Bridge decks supported on steel beams or precast, prestressed concrete members; top slabs of concrete box culverts	80	7
Crossbeams, caps, box girders, T-beam girders, and flat slab superstructures [2]	80	7
Arches [2]	80	7

Part 2:

Subsequent Loading [3] of:	**Percent of Specified Strength**	**Counting Days [1]**
Footings for signal, luminaire and sign supports	100	7
Footings [4]	–	3
Walls, wall-type abutments, columns, vertical girder stems, and box culvert stems over 4 feet in height [4]	–	3
Bottom slabs of box girders	66	5
Members and falsework designed integrally to carry the additional loads	100	7
Pile caps, bents, and other members designed as moment-carrying members	100	7
All other members	100	7

[1] From the time of the last placement in the forms or falsework supports and excluding days when the surrounding temperature is below 40 °F for a total of ~~four~~4 hours or more.

[2] Where continuous spans are involved, the time for all spans will be determined by the last concrete placed affecting any span.

[3] Except loads from forms and reinforcing steel of further concrete placements.

[4] Mass type or other type members where subsequent loading will not induce flexural bending and flexural stresses.

Early removal of forms does not eliminate the curing requirement of 00540.51.

Remove forms and falsework:

- With methods not likely to deface, damage, or cause overstressing of the concrete.
- In a manner that permits the concrete to uniformly and gradually take the stresses due to its own weight.
- From the interior of structural steel box girders.
- From accessible concrete box girder cells before any loading, post-tensioning or removal of the supporting falsework.
- From all decks after subsequent loading is authorized, except those necessary to support the deck slab in inaccessible cells.

Dispose of forms and falsework according to 00290.20(c).

00540.53 Surface Finish Other Than Bridge Decks - Provide concrete surfaces with a general surface finish unless otherwise shown or specified. See 00540.50 for bridge deck and sidewalk surface finishing. Leave concrete surfaces unfinished as they come from the forms when exposed to salt water between the levels of extreme low and high water, except for needed repairs.

If a Class 1 or Class 2 surface finish is required, it will not include the interior sides of girders and the underside of decks between girders. Finish Class 1 and Class 2 surfaces to a point 1 foot below finished ground line.

(a) General Surface Finish - Give all concrete surfaces a general surface finish prior to the higher class finish specified for a particular item of work. A general surface finish consists of the following:

(1) On All Surfaces:

- Remove form bolts and metal to a depth of 1 inch, 2 inches on structures within 25 aerial miles of the Pacific Ocean.
- Remove rock pockets and unsound concrete.
- Fill holes and depressions at least 1/~~2~~4 inch in depth or diameter with an approved ~~patching~~PCC repair material.

(2) On All Exposed Surfaces:

- Correct bulges, fins, depressions, stains, discolorations and other imperfections.
- Slope formed surfaces with respect to the specified plane at a rate not to exceed the following amounts in 10 feet, if required:
  - Watertight joints: 1/8 inch
  - Other exposed surfaces: 1 1/2 inch
  - Concealed surfaces: 1 inch

- Slope unformed, exposed surfaces, other than pavements and sidewalks, with respect to the specified plane at a rate not to exceed the following, if required:
  - In 10 feet: 1/4 inch
  - In 20 feet: 3/8 inch

The Engineer will determine the extent of the required repairs.

(b) Class 1 Surface Finish (Ground and Coated) - After completion of the general surface finish, grind the surface with a power grinder or an equivalent method to remove laitance and surface film. Apply coating according to (d) below.

(c) Class 2 Surface Finish (Ground, Floated and Coated or Uncoated) - After completion of the general surface finish, grind the surface with a power grinder or an equivalent method to remove laitance and surface film. Float the surface with a rubber or sponge float, using a paste of fine mortar sand, cement, water, and bonding agent to fill air holes or voids and to bring the surface to a uniform texture. Keep the retextured surface damp a minimum of 12 hours or until the paste has set, whichever is longer. If dusting occurs after the retextured surface sets and is rubbed, refinish the surface.

After the paste has set for a minimum of 24 hours, apply coating according to (d) below.

(d) Concrete Coating - Apply either a concrete paint or a concrete stain or sealer as shown or specified. Where a Class 1 or Class 2 surface finish is shown, apply a concrete paint unless specified or shown otherwise.

(1) Concrete Paint - Thoroughly saturate the surface with water and coat it, while damp, with a coating material conforming to 02210.30~~(c).~~. Apply a minimum of two coats of coating material. Apply coating according to the manufacturer's instructions. The second coat may be applied any time after the previous coat, when touched lightly, does not adhere to the finger. Additional coats may be required to provide uniformity in coverage and color. Mortar sand may be added to the coating material to help achieve a uniform surface.

(2) Penetrating Concrete Stain or Sealer - Select a penetrating concrete stain or sealer from the QPL. Apply stain or sealer to a dry concrete surface and according to the manufacturer's instructions. Ensure the concrete has cured sufficiently. Apply a minimum of two coats of stain or sealer. Additional coats may be required to provide uniformity in coverage and color.

00540.54 Crack Inspection and Deck Sealing - ~~Immediately after~~Before allowing public traffic across the ~~cure period~~bridge, the Engineer will inspect the deck ~~surface~~and end panels for cracks.

After correcting non-specification surface tolerance according to 00540.55 and after texturing the deck surface according to 00540.50(c), seal all visible cracks ~~with a methacrylate sealer~~as follows:

- In areas where cracks are 10 feet or ~~epoxy sealer as directed by the Engineer.~~ more apart, seal each crack separately.
- In areas where the cracks are numerous~~,~~ or are less than 10 feet apart, seal the entire area ~~may be flooded with a methacrylate or an epoxy sealer. Cover the sealer with a dry, washed sand, prior to the sealer setting. Use only QPL listed methacrylate or epoxy products approved for deck sealing applications~~where the cracks occur.

Seal with a low modulus concrete and crack sealer.

Perform ~~deck~~crack sealing work at no additional cost to the Agency. Complete all ~~deck~~crack sealing work before opening to traffic~~, unless otherwise directed by the Engineer.~~. If the bridge is opened to

traffic at the Contractor's request ~~prior to completion of deck~~before completing crack sealing, ~~perform~~ all additional traffic control to complete ~~deck~~crack sealing will be at no additional cost to the Agency.

00540.55 Final Acceptance of Bridge Deck Surface - Ensure the finished bridge deck roadway surface meets the tolerance specified in 00540.40(b-3-d) at every point. Furnish a 12 foot straightedge and use it under the Engineer's direction.

Correct non-specification surface tolerances by complete removal and replacement or with a diamond grinder. If the surface is ground, take care not to unnecessarily sacrifice concrete cover over the reinforcing bars. Restore transverse texture to specification tolerance. Perform correction work, including required traffic control, at no additional cost to the Agency.

Measurement

00540.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Concrete - Concrete will be measured by one of the following methods:

(1) Lump Sum - Under this method, no measurement will be made. Estimated quantities of concrete will be listed in the Special Provisions.

Concrete quantities listed for cast-in-place deck is based on the nominal deck thickness shown.

Concrete quantities for prestressed, precast members, piling, bridge rail, slope paving, tremie seals and other similar items will not be included in the listed quantities.

(2) Volume - Under this method, concrete will be measured on the volume basis within the neat lines of the structure as shown.

No deductions will be made for the volume of pile heads, metal reinforcement, scoring, chamfer strips or structural steel embedded in the concrete.

(b) Saw Cut Texturing - The quantities of surface texturing will be measured on the area basis~~. The area~~ and will be ~~determined by surface measurement of~~ the ~~width~~area of each bridge deck or end panel ~~from curb face to curb face minus~~ shown less 16 inches ~~on each side, and the full length of the bridge deck or end panel. The area~~along each curb. Field measurement of surface texturing will not be ~~calculated to the nearest square yard, for each bridge~~made.

Payment

00540.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Foundation Concrete, Class _____	Lump Sum or Cubic Yard
(b)	Deck Concrete, Class _____	Lump Sum or Cubic Yard
(c)	General Structural Concrete, Class _____	Lump Sum or Cubic Yard
(d)	Saw Cut Texturing	Square Yard

In items (a), (b), and (c), the class of concrete will be inserted in the blank.

Item (a) includes footings, pile caps, and all other elements so designated.

Item (b) includes bridge decks and all other elements so designated.

Item (c) includes columns, crossbeams, diaphragms, wingwalls, backwalls, abutments, and all elements that are not designated as either (a) or (b) above.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Reinforcing steel, metal expansion joints, or other metal incorporated in the work will be paid for according to the appropriate Section in which the work is performed.

No separate or additional payment will be made for:

- surface finish, fogging, curing, joint filler, admixtures and other similar items, and for all other items required to complete the concrete work
- portland cement and fly ash used in excess of the minimum specified
- extra concrete required to fill footings cast directly against rock or soil or where forms are omitted
- additional concrete placed in deck buildups on top of beams to achieve the desired deck elevations

Section 00545 - Reinforced Concrete Bridge End Panels

Description

00545.00 Scope - This work consists of constructing reinforced portland cement concrete bridge end panels at the locations shown or as directed, and in close conformity to the lines, grades and dimensions shown or established.

Materials

00545.10 Materials - Furnish materials meeting the requirements of Section 00530 and Section 02001, modified as follows:

- Furnish Class HPC4000 concrete for end panels, unless shown otherwise.
- When pipe under end panels are shown, provide one of following types:
  - Class V reinforced concrete pipe meeting the requirements of 02410.20
  - Schedule 80 polyvinyl chloride (PVC) pipe meeting the requirements of ASTM D 1785
  - Type PSM polyvinyl chloride (PVC) sewer pipe meeting the requirements of ASTM D 3034 SDR 26
  - Grade A or B galvanized steel pipe, STD weight class minimum, meeting the requirements of ASTM A 53, hot-dip galvanized according to AASHTO M 111 (ASTM A 123)
- For pipe under end panels, provide pipe bedding, pipe zone material, and backfill meeting the requirements of 00405.12, 00405.13, and 00405.14.
- Provide granular structure backfill meeting the requirements of 00510.13.

00545.15 Quality Control - Provide quality control according to Section 00165.

Labor

00545.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT, CDT, and CSTT technical certifications.

~~• CEBT~~
~~• CDT~~
~~• CSTT~~

Construction

00545.40 General - Perform work according to Section 00530 and Section 00540 except as modified by this Section.

00545.41 Earthwork - Remove pavement and subgrade according to Section 00310 and Section 00330.

00545.42 Surface Finish - For end panels with an asphalt concrete wearing surface, a finishing machine and roadway texturing are not required. For end panels without an asphalt concrete wearing surface, texture the end panel roadway surface by saw cutting according to 00540.50(c). Perform saw cutting on end panels no sooner than 14 days after the end panels are cast.

00545.43 Curing - Cure concrete according to 00540.51(a).

00545.44 Expansion Joints - Construct expansion joints as shown, according to Section 00585, and as follows:

- Install armored corners for strip seal joints in preformed blockouts a minimum of 14 days after the bridge deck and end panels are cast. Set the joint opening as shown. Support the armored corners securely in position before placing concrete in the joint blockout.
- Place compression joint seals or poured sealant joint seals a minimum of 14 days after the bridge deck and end panels are cast.
- Place asphaltic plug joints a minimum of 14 days after the end panels are cast and after final paving is complete.

Saw cut the AC wearing course at the roadway end of end panels when detailed on the plans, as soon as practical but within 48 hours after paving. Use a saw cut width of 5/8 inch, plus or minus 1/8 inch, and 1/4 inch less than the thickness of the wearing course, to a maximum depth of 1 1/2 inch.

Flush the saw cut thoroughly with a high-pressure water stream immediately after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a traffic loop sealant from the QPL.

00545.45 Pipes under End Panels - Install pipes under end panels for future utilities as shown and according to Section 00445.

00545.46 AC Paving - Compact AC abutting end panels according to 00744.45(b) and 00745.~~62(b).~~48(b), as applicable.

00545.47 Bridge Rails - Construct bridge rails on end panels as shown and according to Section 00587.

Measurement

00545.80 Measurement - The quantities of reinforced concrete bridge end panels will be measured on the area basis. The area will be determined by surface measurement of the width and length of each separately constructed end panel. ~~The area will be calculated to the nearest square yard, for each bridge.~~

Surface texturing by saw cutting will be measured according to 00540.80.

Expansion joints at panel ends will be measured according to 00585.80.

Bridge rails on end panels will be measured according to 00587.80.

Payment

00545.90 Payment - The accepted quantities of reinforced concrete bridge end panels will be paid for at the Contract unit price, per square yard, for the item "Reinforced Concrete Bridge End Panels".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals to complete the work as specified.

Surface texturing by saw cutting will be paid for according to 00540.90.

Expansion joints at panel ends will be paid for according to 00585.90

Bridge rails on end panels will be paid for according to 00587.90.

No separate or additional payment will be made for:

- saw cutting and filling the joint in the wearing surface at the roadway end
- furnishing and placing pipe under the end panels for future utilities
- extra thickness of panels as shown at the panel ends
- required stage construction, including splices

Section 00550 - Precast Prestressed Concrete Members

Description

00550.00 Scope - This work consists of the manufacture, storage, transportation and installation of precast prestressed concrete girders, box girders, slabs or other concrete members. Precast prestressed concrete members in this Specification will be referred to as members.

00550.02 Design - Essential elements of design and section dimensions for members are as shown. Submit unstamped working drawings, stressing calculations, and detensioning sequence for all members for approval according to 00150.35.

00550.03 Alternate Designs - Agency design specifications will be furnished by the Agency upon request. The Contractor may propose another type of prestressing system or different member dimensions provided the following requirements are met:

- Before manufacturing the members, submit stamped design calculations, working drawings, and specifications for all modified members according to 00150.35.
- With the calculations, show that the member meets all applicable service and strength limit states used for the Agency design.
- Do not increase member dimensions by more than 1 inch, except that bulb width and overall depth may be increased up to 2 inches from the dimensions shown. Where overall depth is increased, verify that the required minimum vertical roadway clearance has been maintained.
- Do not incorporate alternate materials or members into the work until the proposal has been accepted by the Engineer.
- Make any structural changes required to accommodate an approved alternate prestressing system or section at no additional cost to the Agency.

00550.04 Member Tolerances:

(a) General - Fabricate members to the dimensional tolerances in the PCI "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products" and as specified below. Acceptance or rejection of members outside these tolerances will depend on how the structure's strength, rideability and appearance are affected.

(b) Twist - Provide members with a relative twist of member bearing surfaces between member ends of less than or equal to 1/16 inch per foot of bearing width measured at right angles to the centerline of the member.

00550.05 Fabricator Certification and Qualification - Certification under the PCI Plant Certification Program is required for all plants producing precast prestressed concrete bridge members. Certification in Bridge Group B3 or Bridge Group B4 is mandatory for the fabrication of prestressed straight strand bridge members. Certification in Bridge Group B4 is mandatory for the fabrication of prestressed draped strand bridge members.

Materials

00550.11 Materials - Furnish materials meeting the following requirements:

Backer Rod 02440.14
Concrete Coating .....02210~~.30~~
Concrete.....02001

Deformed Bar Reinforcement.....02510.10
Epoxy and Non-Epoxy Grouts.....02080
Epoxy Coating.....02510.11
Keyway Grout.....02080.30
Portland Cement Concrete Repair Material.....02015
Poured Joint Filler.....02440.30
Prestressing Reinforcement.....02515
Tie Rods.....02560.30

00550.12 Acceptance of Concrete - Acceptance of concrete will be according to Section 00165 and the following:

(a) Aggregate - Acceptance of aggregate will be based on the Contractor's quality control testing, if verified, according to Section 00165.

(b) Plastic Concrete - Acceptance of plastic concrete will be based on tests performed by the QCT, according to Section 02001.

(c) Hardened Concrete:

(1) General - Acceptance of hardened concrete will be based on analysis of compressive strength test results of cylinders cast and cured by the Contractor and tested according to AASHTO T 22 by a CSTT at an ODOT certified laboratory and verified according to Section 00165.

(2) Sampling and Testing - Obtain a sample from a delivery vehicle, selected at random, during placement in each bed. Test the sample for temperature, slump, density and air content and cast at least three cylinders for testing at 28 days. Cure the cylinders in a manner similar to the members they represent. Alternately, the cylinders may be cured in a curing chamber correlated in temperature with the concrete in the beds. Leave the cylinders in the bed with the member or in the curing chamber until the member is stripped. After the member is stripped, place the acceptance cylinders in storage in a moist condition according to AASHTO T 23.

(3) Acceptance - Concrete members with an ASTV meeting or exceeding the specified design strength, f'_c, will be acceptable for strength. If the compressive strength of a single test specimen varies by more than 10~~%~~ percent from the average of the other specimens, that compressive strength value will be discarded. The average compressive strength test of the remaining specimens will be the ASTV.

If the ASTV is less than f'_c but at least 85~~%~~ percent of $f'c$, the Engineer may review the results to determine if the member is suitable for the intended purpose. If suitable, the concrete represented by an ASTV less than f'_c may be accepted subject to a price adjustment according to 00150.25.

Concrete that has an ASTV less than 85~~%~~ percent of f'_c will not be accepted. All costs of removal, replacement, and all related work is the Contractor's responsibility.

Equipment

00550.20 Prestressing Equipment - Provide hydraulic jacks equipped with calibrated pressure gauges. Calibrate the jack and gauge combination and furnish a graph or table showing the calibration to the Engineer.

If other types of jacks are used, furnish calibrated proving rings or other devices that accurately indicate the jacking forces.

Recalibrate the jack and gauge combination annually or at any time the results are in question.

00550.25 Vibrators - Provide either internal or external vibrators in working condition meeting the manufacturer's rating.

When epoxy coated reinforcement is used, use internal vibrators fitted with a manufactured rubber head to minimize damage to the epoxy coating.

Construction

00550.40 Forming - Provide forms that are mortar-tight and sufficiently rigid to conform to the specified dimensions without appreciable distortion, warping or opening of joints.

Before placing concrete in the forms, remove all dirt, sawdust, excess water and other foreign material.

Tighten forms before depositing new concrete on or against hardened concrete.

00550.41 Placing Reinforcement - Place reinforcement according to the plans, Section 00530, and these Specifications.

00550.42 Pretensioning:

- Do not proceed with stressing prior to receiving the Engineer's approval of stressing calculations submitted according to 00550.02.
- Provide a person, skilled in the use of the system of prestressing to be used, to supervise the work and assist the Engineer.
- Hold the prestressing strands accurately in position and stress by jacks meeting the requirements of 00550.20.
- Determine the force induced in the strands by measurement of elongation and, independently, by direct measurement of force using a pressure gauge dynamometer and load cell. If the difference in force determination for the two methods exceeds 5~~%,~~ percent, determine the cause and correct it.
- Measure strand elongation on the first and last strands stressed, and on at least 10~~%~~ percent of the other strands in the bed.
- Record the jacking forces and the elongations produced.
- In single straight strand tensioning, and in a completely open bed with no headers or other possible sources of friction, loads indicated by the gauging system may be used.

00550.43 Placing Concrete:

(a) General - Place concrete so that the finished members are uniform and monolithic, free from cold joints.

Do not deposit concrete in the forms until the Engineer has inspected and approved the placement of reinforcement, conduit, anchorages and prestressing steel.

In preparation for placing concrete, prepare forms according to 00550.40. Remove struts, stays and braces serving temporarily to hold the forms in correct shape and alignment before the placing of concrete when the concrete placing has reached an elevation rendering them

unnecessary. Remove these temporary members entirely from the forms and do not bury them in the concrete.

Place concrete close to its final position, without segregation of materials or displacement of the reinforcement.

(b) Consolidation - Consolidate concrete, during and immediately after placing, by mechanical vibration as follows:

- Operate vibrators at frequencies that produce consolidated placements.
- Do not use vibration for shifting concrete to the extent of causing segregation.
- Vibrate at points uniformly spaced and not further than twice the radius over which vibration is visibly effective.
- Continue vibration until the concrete is thoroughly consolidated, but not until segregation occurs or localized areas of grout form.

00550.44 Hot or Cold Weather - Produce and place concrete within the temperature range specified in 02001.20(d). When the air temperature is, or is expected to be, below 40 °F or above 100 °F, observe the following precautions:

- Do not place concrete on forms, reinforcing steel or appurtenances when the temperature of these facilities is below 40 °F. Provide heat to maintain their temperature at 40 °F minimum.
- Do not place concrete when the form temperature is 100 °F or more.

00550.45 Curing - Cure members with low-pressure steam or radiant heat inside a suitable enclosure to contain the steam or heat, and minimize moisture and heat loss.

(a) Curing Temperature - Measure cure temperature by one of the two following methods:

(1) Measuring Enclosure Temperature:

- Equip the enclosure with 24-hour recording thermometers at each end of each casting bed. Record the temperature for each thermometer on a single chart for each 24-hour period.
- Do not allow the curing temperature within the enclosure to exceed 160 °F. During the initial application of live steam or radiant heat, do not allow the temperature within the enclosure to increase at a rate exceeding 40 °F per hour.

(2) Measuring Concrete Temperature:

- Embed a thermocouple 6 inches to 8 inches from the top or bottom of the member on its centerline and near its midpoint.
- Record the concrete temperature with a calibrated recorder that provides a continuous record of time and temperature throughout the curing cycle.
- Do not allow the concrete temperature to exceed 190 °F. During the initial application of steam or radiant heat, do not allow the concrete temperature to increase at a rate exceeding 80 °F per hour.

(b) Curing with Low-Pressure Steam:

- Make the initial application of steam after initial set of concrete as determined by AASHTO T 197 (ASTM C 403).

- Provide a steam supply line to the enclosure equipped with a motor-operated modulating steam control valve operated by a temperature-sensing element located in the enclosure.
- Provide steam at 100~~%~~ percent relative humidity.
- Do not apply steam directly on the concrete, form surfaces or test cylinders.
- Distribute the steam within the enclosure through suitable ports located on each side of the units within the enclosure at not more than 30 foot centers to keep the units being cured completely and uniformly surrounded with steam.

(c) Curing with Radiant Heat - Radiant heat may be applied to beds by means of pipes circulating steam, hot oil or hot water, by electric blankets or heating elements adjacent to forms, or by circulating warm air under and around forms. Do not allow pipes, blankets or heating elements to be in contact with concrete, form surfaces, or test cylinders.

00550.46 Release of Prestress - Transfer bond stress to the concrete, or release end anchors, only when the concrete has attained the minimum compressive strength shown or specified for such transfer of load. Cut or release the elements according to the sequence shown on the reviewed working drawings so lateral eccentricity of prestress will be a minimum.

Determine the compressive strength of the concrete to establish time for detensioning by testing standard cylinders cast and cured identically with the member. Cast and test cylinders used to determine release time according to AASHTO T 22 and AASHTO T 23.

00550.47 Surface Finish - Apply the specified finish to each surface as shown or specified.

Where no finish is shown or specified, provide a Class 1 surface finish to all exposed concrete surfaces, except on the tops of members, unless shown otherwise. For concrete surfaces that are not exposed, provide a general surface finish except on the tops of members. For surfaces receiving a Class 1 surface finish (ground and coated), finish the surfaces when the member is in its final position and finish to a point 1 foot below the finished ground line.

Provide a roadway finish on the tops of members~~.~~ that do not have an asphalt concrete wearing surface. Provide a light broom finish on the tops of members that have an asphalt concrete wearing surface. After the concrete has been struck to grade and cross section, float it to produce a uniform surface. After the concrete has hardened sufficiently, texture it with a 1/8 inch wide steel-tined tool that will mark the finished concrete to a depth of 1/8 inch to 3/16 inch. Space the markings 3/4 inch on centers. Do not overlap the texturing. Produce the texture transverse to the roadway centerline and full member width.

(a) General Surface Finish - Apply a general surface finish as a final finish or preparatory to a higher class finish.

Remove strands in members, except members with ends to be embedded in concrete, to a depth of 1 inch from the face of the concrete and point up the resulting holes flush with the end of the member with an epoxy grout from the QPL.

Remove all metal form bolts, snap ties and any other metal to a depth of 1 inch below the finished concrete surface. Repair air pockets over 1/2 inch in depth, all form tie removals, rock pockets and unsound concrete, and fill resulting holes or depressions with concrete or ~~a patching~~PCC repair material ~~from the QPL~~. On exposed surfaces, correct all bulges, fins, depressions, repairs, stains or discolorations to produce a smooth surface with uniform texture, lines, and appearance.

The Engineer will determine the extent of required repairs.

(b) Class 1 Surface Finish (Ground and Coated) - After completion of the general surface finish:

- Grind the surface with a power grinder or other equal method to remove all laitance and surface film.
- Thoroughly saturate the surface with water and coat while damp with a coating material conforming to 02210.30~~(c).~~.
- Apply a minimum of two coats of coating material. The second coat may be applied at any time after the previous coat does not adhere to the finger. Apply additional coats as required to provide uniformity in coverage and color.
- Mortar sand may be added to the coating material to achieve a uniform surface.

00550.48 Exposed Reinforcement - After a member is removed from the casting bed, clean any projecting reinforcement of dirt, oil, grease, rust and corrosives and protect it from damage until concrete is cast around it.

00550.49 Lifting, Storing, Transporting, Erecting, and Bracing - Be responsible for the safety of precast members during all stages of construction. Include lifting and storage details on the working drawings for all precast members. Lifting, storage, transporting, erecting, and bracing details will not be reviewed by the Engineer. Lifting, storage, transporting, erecting and bracing of members is the sole responsibility of the Contractor subject to the following requirements:

(a) Lifting:

- Lift members so as to prevent damage.
- Lift members at the support points specified by the manufacturer.
- Lift members in a manner that does not cause damaging bending or torsional forces.
- Members will be rejected if not handled correctly as specified.

(b) Storing - Store members with support points that are level transversely.

(c) Transporting - Transport members from the casting yard not less than ~~seven~~7 calendar days after casting, not less than ~~seven~~7 days after all concrete patching and repairing is complete and after 28-day compressive strengths have been achieved.

- Temporary prestress strands may be added to precast concrete members for the purpose of controlling concrete stresses during transportation. Detension these strands after the members are set in the field and prior to establishing grades for the bottom of deck forms.
- Temporary strands may be either post-tensioned or pretensioned in the fabrication yard. Debond post-tensioned strands completely from end to end. Debond pretensioned strands completely from end to end except for a length at the end of the beam equal to the development length of the strand, but not more than 10 feet. Pretensioned strands may be used for simple span girders only.
- The stress from temporary strands may be transferred to the concrete member only after the stress from the permanent strands has been transferred to the concrete member. This requirement may be waived for pretensioned strands if calculations are submitted, and approved by the Engineer, that show acceptable stress levels in the member.
- For pretensioned temporary strands, form a hole in the girder at mid span or at each end of the debonded length, so the strand can be cut for detensioning. Ensure these holes are free draining and patched after detensioning. The detensioned strands may be left in place.

- Post-tensioned temporary strands may be placed in a conduit or debonded full length with direct contact sheathing. In either case, patch the holes formed by the conduit or sheathing to a depth of 1 1/2 inch, after the removal of the conduit or sheathing to this same depth. The detensioned strands may be left in place.
- Submit stamped calculations that predict the effect of temporary strands on initial and long term girder camber according to 00150.35.

Damaged members will be rejected. Replace damaged members, or if allowed by the Engineer, repair damaged members to the Engineer's satisfaction at no additional cost to the Agency.

(d) Erecting and Bracing - After a member has been erected and until it is secured to the structure, provide temporary bracing as necessary to resist wind or other loads. Provide the Engineer with an erection plan and bracing details at least 2 days prior to erecting girders. Bracing details are not necessary for side-by-side slab and box beam construction.

00550.50 Tie Rods - Furnish tie rods according to the Plans and Section 02560. Install as follows:

- Clean and lubricate tie rods and nuts before installation.
- Lubricate galvanized tie rods and nuts with a lubricant from the QPL containing dye that visibly contrasts with the color of galvanizing or coating.
- Install compressible washer type direct tension indicators under the ~~non-~~turned nuts and tighten the nuts ~~at the other end of the tie rods~~ as recommended by the manufacturer until the gaps in the indicators are nil or as shown. A nil gap is defined as a gap when the number of spaces between the protrusions of a direct tension indicator in which the 0.005 inch feeler gauge is refused at each tie rod equals or exceeds 2, 3, 3, 4, or 4, when the number of spaces between protrusions in the direct tension indicator are 4, 5, 6, 7, or 8, respectively, and a visible gap exists in at least one space.

00550.51 Keyway Grouting for Slabs, Box Beams, and Integral Deck Members - After forms have been removed from slabs, box beams and integral deck bulb tees, sandblast all keyways to remove residual form oil and any other foreign material. After the members are in place and the tie rods are tensioned (for slabs and box beams) or welded connections are made (integral deck bulb tee girders), clean the keyways of all foreign material and keep moist for 24 hours before grouting. For slabs and box beams, after the tie rods are tensioned, seal the space remaining at the bottom of the keyways with a backer rod as shown before grouting.

Do not pour keyway grout unless the air temperature is above 45 °F and at or below the maximum air temperature recommended by the manufacturer. Water cure grout for the period of time indicated by the manufacturer.

00550.52 Poured Joint Filler for Integral Deck Members with AC Wearing Surface - After grout is poured to the level of the keyway shown for slabs and box beams, remove loose grout, and other foreign material from exposed keyway walls. After keyway grout is fully cured, dry surfaces to be sealed immediately before installing poured joint filler.

Install poured joint filler according to the manufacturer's directions. Cure the filler sufficiently to resist the pressures and temperatures of the paving operation before the wearing surface is placed.

00550.53 Differential Camber Correction for Integral Deck Members with No ~~AC~~Asphalt Concrete Wearing Surface - Correct differential camber between adjacent slabs, box beams or integral deck bulb tees in a span (measured in place at the site) if the variance between adjacent members or stages is 1/2 inch or more at any place along the top edge corners.

Equalize the camber differences by either patching with an epoxy or nonepoxy grout ~~deck patching material from the QPL,~~ or other approved method, at no additional cost to the Agency. Before patching, clean the area by sandblasting. Water cure the patch for the period of time indicated by the manufacturer. If patching is used, slope it away from the joint on a 1V:6H slope or flatter.

Measurement

00550.80 Measurement - The quantities of work performed under this Section will be measured on the length basis, and will be the sum of the horizontal lengths shown for each type and size of member. Field measurement of each member length will not be made. The quantities will be determined by calculating the theoretical horizontal length shown, added together for a total for each type and size~~, then rounded to the nearest foot~~.

Payment

00550.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	_____ Precast Prestressed Girders	Foot
(b)	_____ Precast Prestressed Slabs	Foot
(c)	_____ Precast Prestressed Box Beams	Foot

In item (a), the girder type and depth will be inserted in the blank.

In item (b), the slab depth will be inserted in the blank.

In item (c), the box beam depth will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- reinforcement, prestressing steel, enclosures for post-tensioning steel, anchorages, plates, nuts, and all other material contained within the member
- furnishing, transporting, and placing members
- furnishing and tensioning rods and pretensioning strands
- grouting keyways and installing poured joint filler
- furnishing and installing metal diaphragms for integral deck bulb tees
- furnishing and placing anchor bolts, dowels and diaphragm threaded rods where applicable
- furnishing and installing elastomeric bearing pads

00550.91 Fabrication Inspection Expense - If fabrication of members outside of the State of Oregon creates additional shop and plant inspection expenses for the Agency, the Contractor's payment for members will be reduced according to 00165.91.

Section 00555 - Post-Tensioning

Description

00555.00 Scope - This work consists of post-tensioning cast-in-place and precast concrete by furnishing, placing and tensioning stressing steel according to details shown and specified. This work also includes furnishing and installing any items necessary for the stressing system used including, but not limited to, anchorage assemblies, ducts and grout for pressure grouting. Concrete that is to be stressed by the post-tensioning method will be referred to as a member.

00555.03 Anchorage Devices - Secure all post-tensioned stressing steel at the ends by means of approved permanent type anchorage devices. Design anchorage devices according to the current AASHTO LRFD Bridge Design Specifications. Identify post-tensioning anchorage systems as either "Normal Anchorage Devices" or "Special Anchorage Devices" as defined in the AASHTO LRFD Bridge Design Specifications. Provide anchorage devices that meet all testing and construction requirements of the AASHTO LRFD Bridge Design Specifications and the AASHTO LRFD Bridge Construction Specifications. Equip all anchorages with a permanent fiber reinforced plastic grout cap that encloses the whole wedge plate. Provide a grout cap that is vented, bolted to the anchorage and rated for a minimum pressure of 145 psi. Seal the group cap to the anchor plate using either a neoprene gasket or epoxy bonding agent.

For bearing plates, provide 7 inch minimum edge distance from the top of deck and 2 inch minimum edge distance from expansion joint blockouts and any other concrete edge.

Install 3 piece anchor wedges in all permanent post-tensioning applications.

Materials

00555.10 ~~General~~Materials - Furnish materials meeting the following requirements:

Anchorage Devices	02530 and 02540
Couplings	02515.60
Tendon Duct	02515.50

00555.11 Stressing Steel - Furnish stressing steel according to one of the following as the Contractor may elect, unless otherwise shown or specified:

Seven-Wire Strand	02515.10
High Strength Steel Bars	02515.30
Seven-wire strand epoxy coated reinforcement	02515.40

00555.12 Tendon Grout - For grouting post-tensioning ducts, furnish a commercial, pre-packaged, thixotropic tendon grout meeting the requirements of 02080.50. Label each grout bag with application, mixing and pumping instructions, lot number, date of manufacture and shelf life. A grout expiration date may be used in lieu of the date of manufacture and shelf life. Tendon grout will be rejected if the shelf life or expiration date has been exceeded.

Use water meeting the requirements of Section 02020.

At least 48 hours prior to the trial batch, submit a detailed written mix design showing the exact brand and batch quantities of pre-packaged grout and water including dosages proposed.

00555.13 Tendon Grout Trial Batch - Mix a trial batch of grout using the equipment, materials, ~~and~~ proportions, and grouting crew proposed for use on the ~~project at least 48 hours before~~Project. Mix a trial batch of grout for each separate tendon grout lot number. If the ~~scheduled~~

~~grouting.~~duration between grouting stages is greater than 14 calendar days, a new trial batch is required. Grouting may proceed ~~anytime~~any time after approval of the ~~grout~~ trial batch.

Perform the following tests:

(a) Flow Cone - Determine the efflux time at 0 quiescent time according to ASTM C 939 modified as follows:

- Fill the flow cone to the top of the cone.
- When thoroughly mixed, the efflux time of grout will be the time to fill a ~~one quart~~1 Liter container that is placed directly under the flow cone. Ensure the efflux time of the grout immediately after mixing is between 5 and 30 seconds.
- Let the grout stand for 30 minutes without agitation then retest as follows:
  - Remix for 30 seconds.
  - Ensure the efflux time of the grout immediately after remixing is ~~30~~within 10 seconds ~~or less~~of the originally established flow.

(b) Bleeding - Determine ~~wick-induced bleeding~~bleed resistance according to ASTM C~~-940 as modified by~~ 1741 and the PTI "~~Guide~~ Specification for Grouting of Post-Tensioned Structures~~"~~ ~~except limit the~~ M55.1" using 100 psi Gelman pressure. The maximum allowable bleed ~~to~~is 0~~.0% at three hours~~ percent.

(c) Mud Balance - Determine a wet density value for mud balance comparative testing during grouting operations according to API RP 13B-1 (American Petroleum Institute).

(d) Compressive Strength - Determine compressive strengths according to ASTM C 109. ~~Provide~~Sample 2 sets of 3 cubes~~,~~ at least once for ~~informational purposes only,~~each trial batch. Provide the test results to the Engineer for 7 and 28 ~~-~~day testing.

If the proposed grout mix design does not produce acceptable trial batch results, revise the mix design and perform another trial batch. Results from previous projects will not be considered acceptable documentation. ~~Seven and 28-day test results will be used for documentation purposes only.~~

Equipment

00555.20 Certified Calibrated Jacking Equipment - Equip each jack used to stress tendons with either:

- A pressure gauge with an accurate reading dial at least 6 inches in diameter and of such capacity that the final pressure reading is in the upper half of its range. Calibrate each jack and its gauge as a unit with the cylinder extension in the approximate position that it will be at final jacking force, and provide a ~~certified~~ calibration chart certified by an independent testing agency; or
- A certified, calibrated load cell with an indicator by which the stressing force in the tendon may be determined, and with a range such that the lower 10~~%~~ percent of the manufacturer's rated capacity will not be used in determining the jacking stress.

Adjustment or repair of jacks, gauges, or load cell after certification will be cause for rejection.

The ~~certified~~ calibration charts for the hydraulic jacks, pressure gauges or load cells used for tensioning stressing steel may be checked before and during tensioning operations by Agency

personnel with Agency-furnished load cells. Perform certified calibration of stressing system not more than 180 days before use.

00555.21 Grouting Equipment - Provide grouting equipment with:

- Separate motors or engines for the grout mixer and the grout pump, and a system for controlling each independent of the other.
- A high speed, high shear, colloidal mechanical grout mixer that will produce uniform and thoroughly mixed tendon grout.
- Equipment which will accurately measure solids and liquids to be batched.
- An easily accessible filter screen before the grout pump with clear openings of 1/8 inch maximum size.
- A grout pump capable of producing a minimum pressure of 75 psi, with a pressure gauge reading from 0 to 300 psi, and with a relief valve that will limit grouting pressures to less than 200 psi.
- Watertight grout hoses, valves and pipe fittings.

Provide standby water flushing equipment which:

- Is in addition to and separate from the grouting equipment
- Has a different power source than the grouting equipment
- Is capable of developing a pumping pressure of 250 psi and has sufficient capacity to flush out any partially grouted ducts or vents if necessary

Labor

00555.30 Personnel - Provide the following:

- **Post-Tensioning Supervisor** - A person, skilled in the use of the system of stressing to be used, to supervise the work.

- **Grouting Technician** - An American Segmental Bridge Institute (ASBI) certified grouting technician or PTI Level 2 Bonded PT Field Specialist to supervise, inspect, and document the entire grouting operation.

Construction

00555.40 Required Submittals:

(a) Test Report - Submit a certified test report to the Engineer for review and acceptance for each size and type of anchorage device showing that the device meets the requirements of the AASHTO LRFD Bridge Design Specifications and the AASHTO LRFD Bridge Construction Specifications. With the certification, include a statement that the design, materials and manufacture of the anchorage devices have not changed since testing. Ensure the concrete strength, edge clearance dimensions and amount of reinforcing for the test block is not greater than that proposed for the Project.

(b) Working Drawings and Calculations - Submit stamped working drawings and calculations for post-tensioning systems to the Engineer for review according to 00150.35.

(c) Review of Methods - Submit for review complete details of the materials, equipment, method and sequence proposed for the stressing operations, including but not limited to:

- Additions or rearrangement of reinforcing steel or changes in member dimensions from that shown.
- For normal anchorage devices, bearing stress and resistance calculations satisfying Section 5.10.9.7.2 in the LRFD Bridge Design Specifications.
- Complete specifications and details of the ducts, stressing steel including arrangement and alignment, and the anchoring devices.
- Pressure grouting materials and equipment.

Furnish reinforcement working drawings that are compatible with the approved Post-Tensioning System working drawings.

Do not cast any member to be stressed before the working drawings have been reviewed according to 00150.35.

00555.41 Ducts - Provide ducts for post-tensioning tendons according to the following:

(a) General - Make ducts mortar-tight and place them accurately at the locations shown or as directed. Provide positive, metallic, mortar-tight connection joints between sections of rigid duct which do not permit angle changes at the joints. Use waterproof tape at connections.

(b) Vents - Provide vents in all ducts within plus or minus 3 feet of high and low points, and other locations shown. Make vents of 3/4-inch nominal diameter standard PVC, galvanized steel or copper pipe. Make connections to ducts with compatible structural fasteners. Make the vents mortar-tight, tape as necessary, and provide means for injecting grout through the vents and for sealing the vents. Securely fasten ducts and vents in place to prevent movement. After grouting, remove the ends of vents to provide 2 inches of cover to the nearest concrete surface.

(c) Repair - Before placing concrete, repair all holes or openings in the ducts. Holes less than 1/4 inch may be repaired by several wraps of waterproof tape. Repair holes larger than 1/4 inch with a split metal sleeve which overlaps itself by 3 inches, extends at least 3 inches on either side of the hole, is sealed with waterproof tape, and is secured to the duct. Cut out indentations which cannot be repaired and repair as above for holes larger than 1/4 inch.

(d) Maintenance - After installing ducts, keep the ends covered at all times in a manner that prevents entry of moisture or debris. If the surrounding temperature is below 32 °F, keep the ducts free of water to avoid damage due to freezing.

Before placing forms for the decks of box girder cells, demonstrate to the satisfaction of the Engineer that all ducts are unobstructed.

Clean all ducts and remove accumulated water at the time of placing stressing steel.

00555.42 Stressing:

(a) General - Do not make welds, or grounds for welding equipment, on the forms or on the steel in the member after any stressing steel has been installed.

Protect stressing steel against physical damage and rust or other corrosion at all times until grouted. A corrosion inhibitor may be used. Stressing steel that has sustained physical damage, detrimental rust, pitting or other results of corrosion at any time will be rejected. Stressing steel with only light rust is acceptable if rust spots can be removed by rubbing or scraping with the fingernail and only light streaks of rust remain.

Tension stressing steel by means of hydraulic jacks so that the force in the stressing steel is not less than the value shown.

(b) Duct Alignment - Provide a duct alignment according to the approved working drawings to the follow tolerances:

- **Horizontal Alignment** - ± 1/~~2~~4 inch unless shown otherwise
- **Vertical Alignment** - ± 3/8 inch

(c) Timing - Do not stress members until at least 14 days, excluding days when the surrounding temperature is below 40 °F for a total of ~~four~~4 hours or more, after the last concrete has been placed in the member and not until all the concrete has reached the specified compressive strength.

Subject to prior written approval, a portion of the total stressing force may be applied to a member when the concrete compressive strength in the member is less than the value shown. Approval of such partial stressing will in no way relieve the Contractor of full responsibility for successfully constructing the member.

(d) Procedures - Tension stressing steel by jacking at each end of the tendon unless otherwise noted.

(1) Continuous Span Members - Jacking of both ends need not be done simultaneously.

(2) Simple Span Members - When jacking from one end only is allowed, tension half of the stressing steel in each member from one end of the span and the other half from the opposite end, unless otherwise allowed in writing.

(3) Bent Cap Members - Subject to prior written approval, bent cap stressing steel may be tensioned by jacking from one end only.

(e) Measuring Prestressing Force - Conduct tensioning so the tension being applied and the elongation of the stressing steel may be measured at any time. Keep a record of gauge pressures, load cell reading and elongations. Furnish a copy of the record to the Engineer when requested.

Determine prestressing force by both of the following methods:

(1) Measurement of Strand Elongation - Determine required elongation from average load-elongation curves for prestressing strand used.

(2) Observation of Jacking Force - Observe jacking force on a calibrated gauge or load cell or by use of a calibrated dynamometer.

Ascertain the cause of any difference in force determination between (1) and (2) that exceeds 5~~%~~ percent and correct the condition causing the discrepancy.

(f) Post-Stressing Survey - Conduct a visual survey of all surfaces of all stressed concrete elements immediately after tensioning is complete. Search for cracking, distress, or other abnormalities and report findings to the Engineer. Obtain Engineer approval of the post-stressing survey before cutting strand ends.

00555.43 Bonding and Grouting - Bond stressing steel to the concrete by filling the void space between the duct and the tendon with tendon grout consistent with the approved trial batch.

Complete grouting each tendon within 14 calendar days after placing it. If projects are within 25 aerial miles of the Pacific Ocean, complete grouting each tendon within 7 calendar days after placing it. Test grout according to ASTM C 939, as modified in 00555.13(a) at the start of grout production, at least once daily atevery 2 hours after the start of grout production, and as requested by the Engineer, to verify that flow characteristics of the grout remain within the tolerances specified in 00555.13(a). Perform Mud Balance tests for each batch according to 00555.13(c). Compare and document the wet density value with the value obtained during the trial batch. If the values differ by more than 3%, percent, rerun ASTM C 939 as modified in 00555.13(a) for continued compliance.

Perform compressive strength tests according to 00555.13(d) at least once daily and provide the test results to the Engineer for 7 and 28 day testing.

Perform bleed resistance tests at the mixer location according to 00555.13(b) at least once daily.

(a) Pre-Grouting Procedure - Cut stressing steel 1 inch beyond wedges or anchor nuts after stressing operations. Coat stressing strand ends and bearing plates with an epoxy bonding agent from the QPL after post tensioning stressing operations and before post tensioning duct grouting. Do not coat wedges. Prepare post tensioning blockouts according to 00540.43(a) or as approved. Encase each anchorage with concrete after completion of all post tensioning operations.

(b) Grouting Operation - Provide a standby flushing system and demonstrate that it is readily accessible and operable should it become necessary to flush out a partially grouted tendon.

Do not retemper grout. Continuously agitate grout until it is pumped.

(c) Grouting Procedure - Make all ducts clean and free of deleterious materials. Blow out each duct thoroughly with oil-free air immediately before grouting. Ducts may be flushed with water immediately before grouting if approved.

Fit grout injection pipes with positive mechanical shutoff valves. Fit vent and ejection pipes with grout-tight caps, valves or other mechanical closing devices.

Grout from the low end of the structure.

Keep the temperature of the concrete surrounding the duct at 35 °F or higher at the time of grouting and until job-cured grout cubes reach 800 psi compressive strength.

Maintain grout temperatures between 50 °F and 90 °F during mixing and pumping. If necessary, cool the mixing water.

Open all vents when grouting starts. Allow grout to flow from the first vent until residual flushing water or entrapped air is removed, then close the vent. Close remaining vents in sequence in the same manner.

Pump thixotropic grouts with 75 psi pressure or less between outlets. Reduce the pumping pressure to 5 psi while passing intermediate outlets or approaching the end of the tendon. Maintain pressure at 5 psi for 15 seconds after each outlet is reached. Resume 75 psi pressure between intermediate outlets after an outlet is closed off. Allow effluent bleed at tendon end using 5 psi pressure.

Whenever the grout pumping pressure exceeds 100 psi:

- Inject grout at any other vent which has been, or is ready to be, closed as long as a one-way flow of grout is maintained. If this procedure is used, fit the vent used for injection with a mechanical shutoff valve.
- If the one-way flow of grout cannot be maintained, immediately flush the grout out of the duct with water.

Pump grout through the duct and continuously waste it at the outlet vent until:

- No visible slugs of water or air are ejected.
- The afflux time of the grout at the mixer during the grouting process is not more than 5 seconds different from the efflux time at the mixer during the initial measurements of the flow cone test during the trial batch, and is between 5 and 30 seconds.
- The efflux time of the ejected grout is not more than 5 seconds different from the efflux time at the mixer.

Do not over-mix the grout.

Close the outlet vent and maintain the pumping pressure or 60 psi, whichever is greater, for at least 30 seconds; then close the valve at the injection pipe while maintaining this pressure. Do not open valves or vents until the grout sets.

(d) Anchorage Encasement - Following grouting, encase grout caps and fill all grouting and ~~anchorage recesses~~post tensioning blockouts with concrete and finish flush~~ immediately after applying~~. Prepare post tensioning blockouts according to 00540.43(a) or as approved. Apply an epoxy bonding agent from the QPL to exposed bearing plate and wedge plate surfaces prior to placing concrete in the blockouts.

Measurement

00555.80 Measurement - No measurement of quantities will be made for work performed under this Section. Estimated quantities of materials will be listed in the Special Provisions.

Payment

00555.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract lump sum amount for the item "Post-Tensioning".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for anchorage devices, ducts, tendons, prestressing steel, grout, and admixtures, or for preparation and testing of grout.

Section 00556 - Multi-Layer Polymer Concrete Overlay

Description

00556.00 Scope - This work consists of preparing bridge decks and sealing and resurfacing them with a multi-layer polymer concrete overlay (MPCO).

00556.04 Submittals - Submit the following at least 2 weeks before beginning the overlay work:

- A manufacturer's safety data sheet for each MPCO component.
- Manufacture dates and shelf-life expiration dates for each production lot of primer/sealer and polymer components.
- Tabulated data indicating the estimated cure time, in minutes, for the allowable ambient temperature range, in increments of 10 °F.
- A detailed work plan for the MPCO preparation, application, and cleanup. Include estimated dates and timeframes.
- A fourier transform infra-red spectrum analysis of each polymer component.
- Aggregate (except moisture content) and polymer resin test results.

00556.05 Pre-placement Conferences:

(a) Supervisory Personnel - Hold a pre-placement conference with all supervisory personnel, subcontractors, suppliers, MPCO manufacturer and other personnel who will be involved in the overlay work. Meet at a mutually agreed time approximately 2 weeks in advance of the work. Present and discuss all phases of the overlay work.

(b) Placement Crew - Hold a second pre-placement conference with the Engineer and the entire overlay work crew at the job site 1/2 hour before overlay work begins to discuss placement duties and procedures. Do not begin the overlay work until this meeting is held.

Materials

00556.10 Materials:

(a) Multi-Layer Polymer Concrete Overlay - Furnish a MPCO from the QPL.

Sample the furnished aggregate according to AASHTO T 2, and test it by performing sieve analysis according to AASHTO T 27, and additional testing according to the following:

Sieve Size	Percent Passing (by Weight)
4	100
8	30 – 75
16	0 – 5
30	0 – 1

Property	Test Method	Requirements
Aggregate Absorption	AASHTO T 84	1% max.
Abrasion Loss	AASHTO T 327	9.5% max.
Moisture Content *	AASHTO T 255	0.20% max.
Mohs Hardness	–	6.0 min.

* At time of mixing the polymer resin.

Package all aggregate material so that it arrives at the project site clean, dry, and at the specified moisture content.

Sample and test the elongation of the mixed polymer resin according to ASTM D 638.

(b) Portland Cement Concrete Repair Material - Furnish PCC repair material meeting the requirements of Section 02015.

00556.16 Bond Strength - Before opening to traffic, perform two bond tests for each complete placement in the presence of and at locations designated by the Engineer. Cut 3 inch diameter cores and conduct bond tests on the cores.

The bond tests consist of:

- Coring through the MPCO approximately 1 inch into the existing concrete.
- Attaching a device to the top of the core.
- Exerting a tensile load to the core sufficient to cause failure or achieve 300 psi, whichever occurs first.

Perform bond tests when the deck surface temperature is less than 80 °F.

A successful test is the failure of the concrete substrate or bond failure at or above 250 psi.

After coring and testing, restore the area voided by the cores by blowing with compressed air and filling with MPCO material.

Equipment

00556.20 Equipment - Provide equipment to place the MPCO that meets the requirements of the manufacturer. Remove all equipment that leaks oil or other contaminants from the work area until they are repaired. Before placing the MPCO, cover the prepared deck with clear plastic, overlapping it to prevent contaminants from contacting the deck. Do not use equipment until approval is obtained.

00556.21 Surface Preparation Equipment:

(a) Sawing Equipment - Furnish power-driven concrete saws adequate for sawing joints.

(b) Scarifying Equipment - Furnish power-operated micro-milling and shot-blasting scarifying equipment capable of uniformly removing the existing surface to depths required.

(1) Micro-milling - Furnish cold plane or rotomill grinding machines using carbide cutting tools in a rotary drum. Provide equipment with tooth spacing of not more than 1/4 inch, capable of leaving a smooth, uniform pattern of striations. Limit machines to a gross operational weight of no more than 35 tons and a forward speed of 2.5 feet per minute. Operate at a drum speed of at least 120 RPM.

(2) Shot-Blasting - Furnish mono-directional or bi-directional electric-powered shot blast machines with single or multiple blast wheels that cover a width of at least 2.5 feet per pass, and conform to EPA air pollution requirements by containing dust and steel abrasive media. If the equipment is not equipped for simultaneous bi-directional blasting, make separate passes in opposite directions to ensure equal cleaning on all sides of the exposed aggregate.

(c) Power-Driven Hand Tools - Furnish power-driven hand tools for removal of unsound concrete meeting the following requirements:

- **Class 2 Preparation Equipment** - For Class 2 deck preparation, use chipping hammers equal to or less than a nominal 15 pound class.

- **Class 3 Preparation Equipment** - For Class 3 deck preparation, use chipping hammers equal to or less than a nominal 30 pound class.

(d) Hand Tools - Furnish hammers and chisels to remove final particles of unsound concrete or to achieve the required depth.

(e) Air Compressor - Furnish air compressors equipped with functioning oil traps. Ensure air used for blow-down of prepared surfaces is free of oil.

00556.24 Miscellaneous Equipment:

(a) Tools - Furnish squeegees, rollers, and other approved tools to apply the primer/sealer and the polymer resin.

Furnish a power broadcaster to uniformly apply the MPCO aggregate.

Furnish pickup type power brooms capable of removing loose aggregate.

(b) Coring Equipment - Furnish core cutting equipment that can produce a core at least 3 inches in diameter.

(c) Bond Testing Equipment - Furnish bond testing equipment that:

- Is compatible with the core tested.
- Can exert a tensile load to the core sufficient to exceed 300 psi.
- Is equipped with a measuring device capable of reading tensile force exerted within 1 percent accuracy.

Labor

00556.30 Personnel Qualifications - Provide employees meeting the following requirements:

- Workers that are certified, in writing, by the MPCO manufacturer that they are qualified to place the MPCO.
- A MPCO manufacturer technical representative that is experienced in MPCO application and mix designs.

The MPCO manufacturer technical representative duties include:

- Be present at both pre-placement conferences.
- Be at the project site and verify the deck is prepared to the manufacturer's satisfaction.
- Be at the project site during overlay placements and monitor the placement to ensure the manufacturer's recommendations are met.

Construction

00556.40 General - Prepare the entire deck surface, including the deck edge against the curb, to receive the MPCO. Remove all grease, oil, paint, dirt, laitance, rust, and all other contaminants that would affect adhesion of the MPCO.

00556.41 Surface Preparation:

(a) General - Remove surface concrete by approved hand methods that cannot be reached by power-driven equipment.

Remove existing asphalt wearing surfaces according to Section 00503.

Dispose of all materials according to 00290.20.

Perform a delamination deck survey using chain drag or other approved methods to determine limits of Class 2 preparation required.

(b) Bridge Deck Drains - Temporarily block all deck drains and catch basins while preparing the surface and placing MPCO. Do not allow scarifying, chipping, sawing, sandblasting, shot-blasting, sweeping, water blasting, or flushing material to enter them.

(c) Expansion Joints - Before constructing the MPCO, block out expansion joints with rigid polyethylene foam or other approved material, compatible with the primer/sealer and polymer resin.

Remove material that is within 12 inches of all joints with bush-hammers, scabblers or by other means acceptable to the Engineer. Do not damage the joints.

(d) Initial Surface Preparation - Perform surface preparation far enough in advance of resurfacing so that all further deck preparation can be satisfactorily completed. Prepare bridge decks according to the following:

(1) Class 1 Preparation - Before beginning Class 1 preparation, construct a 50 foot long by 5 foot wide test strip in an area approved by the Engineer. Roughen the existing concrete surface to an exposed aggregate surface texture depth profile of at least 1/16 inch, determined according to ASTM E 965 (standard volumetric test). Do not proceed with Class 1 preparation until the Engineer approves the test strip results.

Continue to roughen the existing concrete surface to match the test strip.

Protect visible reinforcing steel and reinforcing steel where the plans show it to be within 1/2 inch of the surface.

(2) Class 2 Preparation - In Class 2 areas, remove concrete with nominal 15 pound powered chipping hammers as follows:

- Remove all unsound concrete from the lower limit of Class 1 preparation down to a maximum depth of half the total thickness of the existing deck.
- Remove a minimum of 3/4 inch of concrete around and below reinforcing steel that is not at least 50 percent embedded in the existing concrete surface.
- Sandblast reinforcing steel coated or pitted with rust to a bright finish.

(3) Class 3 Preparation - When Class 3 preparation is required, it will be designated by the Engineer and performed according to 00140.30.

Perform Class 3 preparation as follows:

- Remove the full thickness of deck remaining below the lower limit of Class 2 preparation, using jackhammers.
- Sandblast reinforcing bars pitted with rust to remove all rust.

When concrete is removed to the limits of Class 2 and Class 3 preparation, repair the deck with a PCC repair material compatible with the MPCO. Cure the PCC repair material according to the manufacturer's recommendations before placing the MPCO. Before beginning production, test the PCC repair material to MPCO bond according to 00556.16.

(e) Final Surface Preparation - Roughen the surface leaving an exposed aggregate surface texture depth profile of at least 1/16 inch, determined according to ASTM E 965 (standard volumetric test). Take at least two tests for each placement or for every 350 square yards of surface area whichever is greater.

(1) Micro-milling - When micro-milling is used, prepare final surfaces by:

- Shot-blasting.
- Sweeping the area magnetically to remove metal residue.
- Cleaning with an air compressor immediately before resurfacing.

(2) Shot blasting - When shot-blasting is used, prepare surfaces by:

- Sweeping the area magnetically to remove shot and metal residue.
- Cleaning with an air compressor immediately before resurfacing.

00556.42 Placing Multi-Layer Polymer Concrete Overlay:

(a) Placement Conditions - Place MPCO on prepared surfaces only when all of the following conditions are met:

- The air temperature and the deck surface temperature are within the manufacturer's recommended range.
- The entire deck surface is dry by visual inspection.
- Moisture is not present on the deck surface by visual inspection and moisture is not visible on a test sheet when tested according to ASTM D 4263.
- During the hours of darkness, work areas are illuminated. Submit an illumination plan for approval at the pre-placement conference.

(b) Thickness - Place MPCO in lifts to achieve a total minimum thickness of 3/8 inch.

(c) Mixing the Polymer Resin - Condition and mix the polymer resin as recommended by the manufacturer. Do not dilute, thin, or add foreign material to either the individual polymer resin components or the mixed polymer resin.

(d) Overlay Application - With the Engineer's approval of the surface preparation, apply the MPCO according to the manufacturer's recommendations.

After each lift, before gelling of the polymer resin occurs, broadcast a layer of aggregate at a rate of 2 pounds of aggregate per square yard or until no wet spots are visible.

Feather the MPCO to the expansion joint edges.

If application of the MPCO surface does not meet the manufacturer's recommendations, stop the operation until revised methods, changes in equipment, or correction of procedures are proposed and approved.

(e) Curing - Cure the MPCO according to the manufacturer's recommendations before subjecting it to loads or traffic.

00556.43 Delamination Survey and Repair - The completed MPCO surface will be inspected by the Engineer for delamination, bond failure, and other damage by use of a chain drag, coring, and other devices. Areas of delamination of less than 1 square foot will not require repair. Core samples that do not achieve bond strength of at least 250 psi will be at no additional cost to the Agency. Core samples with a bond strength of 250 psi or greater will be paid according to 00195.20.

Repair all surface defects by removing the defective material and reapplying the MPCO. Do not damage adjacent materials or steel substrates. Repair to the satisfaction of the Engineer at no additional cost to the Agency.

Make all repairs before opening to traffic or, if the resurfaced area is opened to traffic at the Contractor's request before completing repairs, all additional traffic control to complete the repairs will be at no additional cost to the Agency.

00556.44 Use of New Surface:

(a) Vehicles - Do not allow vehicles or construction equipment on the MPCO surface until curing is complete.

(b) Traffic - Do not open sections to traffic until approved by the Engineer. Before opening to traffic, remove all loose aggregate by power brooming and open all drains.

Measurement

00556.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

- **Class 2 Preparation** - Class 2 preparation will be measured on the area basis.
- **Furnish MPCO Material and Constructing MPCO** - Furnishing and constructing multi-layer polymer concrete overlay will each be measured on the area basis. The area will be determined by measuring the actual surface area of the resurfaced bridge deck.

Payment

00556.90 Payment - The accepted quantities of work performed under this Section will be paid at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Class 2 Preparation	Square Yard
(b) Furnish MPCO Material	Square Yard
(c) Construct MPCO	Square Yard

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for Class 1 preparation work.

Class 3 preparation will be paid for according to 00195.20.

Section 00559 - Silica Fume and Latex Modified Concrete Overlays

Description

00559.00 Scope - This work consists of preparing bridge decks and resurfacing them with silica fume concrete (SFC) or with latex modified concrete (LMC).

00559.04 Preplacement Conferences:

(a) Supervisory Personnel - Hold a pre-placement conference with all supervisory personnel, subcontractors, suppliers, the quality control technician, the concrete control technician, and all other personnel who will be involved in the resurfacing work. Meet at a mutually agreed time approximately 2 weeks in advance of the work. Present and discuss all phases of the resurfacing work.

(b) Placement Crew - Hold a second pre-placement conference with the Engineer and the entire resurfacing work crew and the QCT, at the job site 1/2 hour before resurfacing work begins to discuss placement duties and procedures. Do not begin the resurfacing work until this meeting is held.

Materials

00559.10 Materials:

(a) Concrete - Furnish concrete meeting the requirements of Section 02001 except follow the concrete properties, tolerances, and limits of 00559.14.

Furnish coarse and fine aggregates meeting the requirements of Section 02690 and the following:

- Coarse aggregates that consists of uncrushed, clean gravel having hard, strong, durable particles free from adherent coatings and meeting the following grading requirements:

Sieve Size	Percent Passing (by Weight)
3/4"	100
3/8"	35 - 65
No. 4	0 - 15
No. 200	0 - 1.5

- Fine aggregates with a sand equivalent of not less than 75. For LMC fine aggregate, maintain positive control of the amount of moisture by:
  - Keeping the stockpiled fine aggregate free moisture content variation to a maximum of 1.0 percent but in no case more than 6.0 percent free moisture.
  - Being able to report, at any time, the moisture content within ± 0.5 percent.

(b) Portland Cement Concrete Repair Material - Furnish PCC repair material meeting the requirements of Section 02015.

(c) Concrete and Crack Sealers - Furnish concrete and crack sealers meeting the requirements of Section 02060.

00559.13 Mix Designs - Prepare and submit new or current mix designs according to Section 02001 and the following:

(a) Silica Fume - Provide silica fume as a densified powder.

(b) Chemical Admixtures - Use chemical admixtures from the QPL. Determine the quantity of each admixture to be used by trial batches prior to its use in concrete. Add each chemical admixture to the concrete mix according to the manufacturer's recommendations.

(c) Strength Tests - Conduct strength testing at 7 days.

00559.14 Concrete Properties, Tolerances, and Limits - Provide a workable mixture uniform in composition and consistency having the following properties:

Material or Property	Specification or Test Method	Unit	Property Requirements
Fine aggregate	02690.30	% total aggregate (by Weight)	45 - 55 (SFC) 50 - 60 (LMC)
Dry Silica Fume	02030.20	% total cementitious material	4
Fly Ash	02030.10	% total cementitious material	30
Latex Emulsion Admixture	02030.30	gal./cu. yd.	24.5 (min.)
Water-Cementitious Ratio *	AASHTO T 121	lb. water/lb. cementitious material	0.40 (max.)
Air Content	AASHTO T 152	% plastic mix	6 ± 1 1/2
Concrete Temperature	WAQTC TM 10	° F at time of placement	50 (min.) 80 (max.)
Slump	AASHTO T 119	inch	6 ± 2
Compressive Strength ($f'c$) at 7 calendar days	AASHTO T 22	psi	3,000 (min.)

* Include free moisture in aggregate and for LMC, non-solids in latex

00559.15 Quality Control - Provide quality control according to Section 00165 and the following:

- Sample and test according to the MFTP.
- For all SFC and LMC, provide personnel according to 02001.50 to sample and test the mix for temperature, air content, slump, water-cementitious ratio, density, and yield when:
  - The first load of each placement is made.
  - There is a visible change in the slump of the concrete
  - A set of cylinders is obtained.
- If the results of any test are outside of the specification limits, stop placement of the load. Correct the load or, if the load cannot be corrected, do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct subsequent loads if any of the tests are still outside the specification limits. Return to the specified test frequency when the test results from two consecutive loads are shown to meet the specification limits.

00559.17 Acceptance of Concrete - Acceptance of concrete will be according to Section 00165 and the following:

(a) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified, according to Section 00165.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level shown in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level shown in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level shown in Table 00165-2 for a 1.00 PF.

(b) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits for water/cementitious ratio, slump, air entrainment, and temperature of 00559.14

(c) Hardened Concrete - Acceptance of hardened concrete will be based on one set of three cylinders cast from each 50 cubic yards of concrete placed. Cast a minimum of one set per production shift. Cast and cure the test specimens according to AASHTO T 23 in 4 x 8 inch single-use plastic molds and test at 7 days according to AASHTO T 22.

(1) General - For all SFC and LMC, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test the cylinders at an Agency certified laboratory.

(2) Actual 7 Day Strength Test Value - The Actual 7 Day Strength Test Value (ASTV) is the average compressive strength of the three cylinders tested. If the compressive strength of a single test specimen varies by more than 10 percent from the average of the other two specimens, that compressive strength value will be discarded. The average compressive strength test of the two remaining specimens will be the ASTV.

(3) Acceptance - Hardened concrete with an ASTV meeting or exceeding the specified design strength, $f'c$ will be accepted for strength. If the ASTV is less than $f'c$ but at least 85 percent of $f'c$, the Engineer may review the results to determine if the concrete represented by the cylinders is suitable for the intended purpose. Remove concrete that has an ASTV less than 85 percent of $f'c$ unless otherwise authorized in writing by the Engineer. If the concrete is removed, the cost of removal, replacement and all related work shall be the Contractor's responsibility. If the Engineer determines that the concrete is suitable for the intended purpose, the concrete may be allowed to remain in place, subject to a price adjustment according to 00150.25.

If an ASTV falls below $f'c$, the Contractor may submit a written plan outlining a proposed alternate method of evaluating compressive strength. Submit the plan for review by the Engineer within 3 days of the test. Provide evidence that a reasonable $f'cr$ (over-design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. The Engineer may allow an alternate method of acceptance if the compressive strength test results are determined to be suspect from definable external factors.

(d) Surface Tolerance - The finished surface, when tested with a 12 foot straightedge, shall not vary by more than 1/8 inch. Furnish the straightedge and operate it under the direction of the Engineer.

If the concrete surface does not meet the surface tolerance, stop the operation until revised methods, changes in equipment, or correction of procedures are proposed and approved.

Correct all non-specification surface tolerance after curing and before texturing with a self-propelled diamond grinder. Correct the surface tolerances before opening the roadway to traffic at no additional cost to the Agency.

(e) Bond Strength - Perform two bond tests for each placement in the presence of and at locations designated by the Engineer within 28 calendar days of overlay placement and before opening the roadway to traffic. Cut 3 inch diameter cores and conduct bond tests on the cores.

The bond tests consist of:

- Coring through the overlay and approximately 1 inch into the existing concrete.
- Attaching a device to the top of the core.
- Exerting a tensile load to the core sufficient to cause failure or achieve 300 psi, whichever occurs first.

A successful test is the failure of the concrete substrate or bond failure at or above 175 psi.

After coring and testing, restore the area voided by the cores by blowing with compressed air and filling with an approved PCC repair material.

Equipment

00559.20 Equipment - Remove all equipment that leaks oil or other contaminants from the work area until they are repaired. Before SFC or LMC placement, protect the prepared deck from contaminant spills by covering with clear plastic, overlapped to prevent contaminants from contacting the deck. Do not use equipment until approval is obtained.

00559.21 Surface Preparation Equipment:

(a) Sawing Equipment - Furnish power-driven concrete saws adequate for sawing joints and for surface texturing.

(b) Scarifying Equipment - Furnish power-operated diamond grinding, micro-milling, shot-blasting, or hydroblasting scarifying equipment capable of uniformly removing the existing surface to depths required.

(1) Diamond Grinding - Furnish power-driven self-propelled machines with the cutting head made up of diamond cutting blades.

(2) Micro-milling - Furnish cold plane or rotomill grinding machines using carbide cutting tools in a rotary drum. Provide equipment with tooth spacing of not more than 1/4 inch, capable of leaving a smooth, uniform pattern of striations. Limit machines to a gross operational weight of no more than 35 tons and a forward speed of 2.5 feet per minute. Operate at a drum speed of at least 120 RPM.

(3) Shot-Blasting - Furnish mono-directional or bi-directional electric-powered shot blast machines with single or multiple blast wheels that cover a width of at least 2.5 feet per pass,

and conform to EPA air pollution requirements by containing dust and steel abrasive media. If the equipment is not equipped for simultaneous bi-directional blasting, make separate passes in opposite directions to ensure equal cleaning on all sides of the exposed aggregate.

(4) Hydroblasting - Furnish hydroblasting equipment capable of removing concrete at a rate and volume acceptable to the Engineer without leaving a striated surface. Demonstrate the removal rate and accuracy of the equipment to the Engineer before beginning work.

(c) Power Washers - Furnish power washers according to 00540.28.

(d) Power-Driven Hand Tools - Furnish power-driven hand tools for removal of unsound concrete meeting the following requirements:

- **Class 2 Preparation Equipment** - For Class 2 deck preparation, use chipping hammers equal to or less than a nominal 15 pound class.

- **Class 3 Preparation Equipment** - For Class 3 deck preparation, use chipping hammers equal to or less than a nominal 30 pound class.

(e) Hand Tools - Furnish hammers and chisels to remove final particles of unsound concrete or to achieve the required depth.

(f) Air Compressor - Furnish air compressors equipped with functioning oil traps. Ensure air used for blow-down of prepared surfaces is free of oil.

00559.22 Mobile Mixer for Latex Modified Concrete - Furnish self-contained, mobile, continuous mixing equipment for proportioning, mixing and placing LMC that:

- Is self-propelled and carries sufficient unmixed dry bulk cement, sand, coarse aggregate, latex modifier, and water to produce at least 6 cubic yards of LMC on the site.
- Provides positive measurement of cement being introduced into the mix that has a recording meter visible at all times and is equipped with a ticket print-out that indicates the quantity.
- Provides positive control of the flow of water and latex emulsion into the mixing chamber and indicates water flow by a flow meter that can be readily adjusted to provide for minor variations in aggregate moisture. Ensure flow meters for water and latex emulsion are accurate to within ± 2.0 percent.
- Is calibrated to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis, as required by the finishing operation, and discharges mixed material full-width directly in front of the finishing machine and has sufficient mixing capacity to permit placement without interruption.

Perform calibration including flow meters, in the presence of the Engineer, to proportion the specified mix according to the manufacturer's recommendations before beginning placement work. Perform new calibrations as follows:

- Whenever the source of material changes.
- Following material or equipment failures.
- Whenever the actual yield varies from the calibration yield by more than ± 2.0 percent.
- Before reuse, whenever the mixer leaves the Project for repair or other use.
- When requested by the Engineer.

00559.23 Finishing Equipment - Furnish a concrete finishing machine for all new surfaces that is:

- Self-propelled with positive control in both forward and reverse direction.
- Capable of mechanically raising the screed, pan, and any other parts of the finishing mechanical operation to clear the screeded surface, and capable of automatically returning to the specified grade.
- Equipped with augers, followed by oscillating, vibrating screed, vibrating roller tamper, or a vibrating pan, followed by a finish roller or rollers.
- Capable of transmitting vibration at frequencies between 3,500 and 4,500 impulses per minute.

Provide continuous supporting rails for the finishing machine that are adequately supported and sufficiently rigid so there is no visible deflection under the weight of the fully loaded machine. Provide anchorage for the supporting rails to ensure horizontal and vertical stability.

Set the finishing machine so it is capable of finishing to the edge of previously placed concrete.

Set the screed rails on the completed lane surface when placing concrete in a lane abutting a previously completed lane.

00559.24 Miscellaneous Equipment:

(a) Hand Tools - Furnish hand tools for placing and finishing concrete. Use manual type screeds with approved vibrators attached to consolidate and finish smaller areas where it is impractical to use a finishing machine. Use spud vibrators when depths exceed 2 1/2 inches. Use supplemental vibration along the meet lines where adjacent pours come together at bulkheads, and along curb lines, unless it can be shown that vibration reaches the meet lines.

(b) Straightedge - Furnish a 12 foot metal straightedge.

(c) Recording Thermometer - Furnish a 24-hour recording thermometer accurate to ± 1 °F.

(d) Coring Equipment - Furnish core cutting equipment that can produce a core at least 3 inches in diameter.

(e) Bond Testing Equipment - Furnish bond testing equipment that:

- Is compatible with the core tested.
- Can exert a tensile load to the core sufficient to exceed 300 psi.
- Is equipped with a measuring device capable of reading tensile force exerted within 1 percent accuracy.

(f) Wet-dry Vacuum Equipment - Furnish vacuum equipment that can remove puddled water ahead of the concrete placement.

Labor

00559.30 Quality Control Personnel - Provide certified technicians according to 02001.50.

Construction

00559.41 Surface Preparation:

(a) General - Remove surface concrete by approved hand methods that cannot be reached by power-driven equipment.

Remove existing asphalt wearing surfaces according to Section 00503.

Dispose of all materials according to 00290.20.

Repair all damage to abutting concrete surfaces or other surfaces that are damaged by Contractor's operations at no additional cost to the Agency.

(b) Bridge Deck Drains - Temporarily block all deck drains and catch basins while preparing the surface. Do not allow any scarifying, chipping, sawing, sandblasting, shot-blasting, sweeping, water blasting, or flushing material to enter them.

(c) Expansion Joints - Remove material that is within 12 inches of all joints in a manner acceptable to the Engineer. Do not damage the joints.

(d) Initial Surface Preparation - Perform surface preparation far enough in advance of resurfacing so that all further deck preparation can be satisfactorily completed. Prepare bridge decks according to the following:

(1) Class 1 Preparation - Before beginning Class 1 preparation, construct a 50 foot long by 5 foot wide test strip in an area approved by the Engineer. Roughen the existing concrete surface to an exposed aggregate surface texture depth profile of at least 1/8 inch, determined according to the standard volumetric test (ASTM E 965). Do not proceed with Class 1 preparation until the Engineer approves the test strip results.

Continue to roughen the existing concrete surface to match the test strip.

Protect visible reinforcing steel and reinforcing steel where the plans show it to be within 1/2 inch of the surface.

(2) Class 2 Preparation - In Class 2 areas, remove concrete with nominal 15 pound powered chipping hammers or hydroblasting equipment as follows:

- Remove all unsound concrete from the lower limit of Class 1 preparation down to a maximum depth of half the total thickness of the existing deck.
- Remove a minimum of 3/4 inch of concrete around and below reinforcing steel that is not at least 50 percent embedded in the existing concrete surface.
- Sandblast reinforcing steel coated or pitted with rust to a bright finish.

(3) Class 3 Preparation - When Class 3 preparation is required, it will be designated by the Engineer and performed according to 00140.30.

Perform Class 3 preparation as follows:

- Remove the full thickness of deck remaining below the lower limit of Class 2 preparation, using jackhammers or hydroblasting equipment.
- Sandblast reinforcing bars pitted with rust to remove all rust.

When concrete is removed to the limits of Class 2 and Class 3 preparation, repair the deck with PCC repair material or with Class 4000 - 3/4 PCC meeting the requirements of Section 02001. Place the SFC or LMC after the repair material cures at least 7 calendar days or according to the manufacturer's recommendations. Cure the PCC for at least 7 calendar days or until it achieves 4000 psi whichever occurs first according to 00559.42.

(e) Final Surface Preparation - Roughen the surface leaving an exposed aggregate surface texture depth profile of at least 1/8 inch, determined according to ASTM E 965 (standard volumetric test). Take at least two tests for each placement or for every 350 square yards of surface area whichever is greater.

(1) Diamond Grinding - When diamond grinding is used, prepare final surfaces by:

- Shot-blasting.
- Sweeping the area magnetically to remove metal residue.
- Cleaning with a power washer and saturating the surface with water for a minimum of 8 hours before resurfacing.
- Removing standing water with compressed air or wet-dry vacuum ahead of concrete placement.
- Repeating cleaning and water saturation on areas that are allowed to dry before resurfacing.

(2) Hydroblasting, Chipping, and Jack Hammers - When hydroblasting, chipping, or jack hammering is used, prepare final surfaces by:

- Cleaning with a power washer and saturating the surface with water for a minimum of 8 hours before resurfacing.
- Removing standing water with compressed air or wet-dry vacuum ahead of concrete placement.
- Repeating cleaning and water saturation on areas that are allowed to dry before resurfacing.

(3) Micro-milling - When micro-milling is used, prepare final surfaces by:

- Shot-blasting.
- Sweeping the area magnetically to remove metal residue.
- Cleaning with a power washer and saturating the surface with water for a minimum of 8 hours before placing resurfacing.
- Removing standing water with compressed air or wet-dry vacuum ahead of concrete placement.
- Repeating cleaning and water saturation on areas that are allowed to dry before resurfacing.

(4) Shot blasting - When shot-blasting is used, prepare surfaces by:

- Sweeping the area magnetically to remove shot and metal residue.
- Cleaning with a power washer and saturating the surface with water for a minimum of 8 hours before resurfacing.

- Removing standing water with compressed air or wet-dry vacuum ahead of concrete placement.
- Repeating cleaning and water saturation on areas that are allowed to dry before resurfacing.

00559.42 Placing:

(a) Mixing and Delivering Silica Fume Concrete - Mix SFC in either batch plant mixers or truck mixers as the Contractor elects. Add the silica fume at the time recommended by the CCT.

(1) Batch Plant Mixing - Mix and deliver SFC in batches no larger than 8 cubic yards. Mix according to ASTM C 94 but not less than 120 seconds. Mix at the mixing speed recommended by the mixer manufacturer beginning after all materials, including water, are in the mixer.

(2) Truck Mixing - Mix and deliver SFC to the jobsite in batches no larger than 63 percent of the drum volume. Before leaving the batch plant, mix the batch for not less than 100 revolutions at the rate of rotation recommended by the mixer manufacturer.

(3) Jobsite Adjustments - Air content and slump may be adjusted at the jobsite to meet specification limits with the addition of chemical admixtures according to CCT instructions. After addition of chemical admixtures, mix the load for a minimum of 30 revolutions at mixing speed.

(4) Delivery - Deliver, discharge, and place SFC in final position before the allowable mix temperature is exceeded, within 90 minutes of initial mixing and before the total revolutions of the mixer drum have not exceeded 300 revolutions.

(b) Mixing and Delivering Latex Modified Concrete - Mix and deliver LMC with mobile mixers.

(c) Placement Conditions - Place SFC and LMC on prepared surfaces only when all of the following conditions exist:

- The combination of air temperature, relative humidity, concrete temperature, and wind velocity produces an evaporation rate of less than 0.10 pounds per square foot of surface area per hour according to Figure 00540-1.
- The surface temperature of the prepared deck is 40 °F or greater and less than 80 °F. The surface temperature is rising if it is between 40 °F and 45 °F. In the presence of the Engineer, measure the surface temperature with an infra-red thermometer at a minimum of three locations on the deck.
- The air temperature is at least 40 °F at the start of and during placement of concrete. Do not place concrete if the air temperature is, or is forecast to be, below 40 °F the day of placement or is forecast to be below 40 °F on any of the next 7 calendar days after placement unless a Cold Weather Plan has been approved by the Engineer.
- If precipitation is not forecast between 2 hours before and 2 hours after the scheduled placement duration. An acceptable forecast will have less than 30 percent chance of precipitation for the entire placement window. Provide a forecast to the Engineer 1 hour before placement.
- During the hours of darkness, work areas are illuminated. Submit an illumination plan for approval at the preplacement conference.

To place concrete when the temperature is below 40 °F, submit a Cold Weather Plan that identifies the methods that will be used to prevent the concrete temperature from falling

below 50 °F. Methods include heated enclosures and insulated forms. Also include in the plan measures that will be taken if the concrete temperature falls below 50 °F. Provide a 24 hour continuous recording thermometer to verify the concrete temperature. Do not place concrete until the Cold Weather Plan is approved.

(d) Thickness - Place SFC and LMC a minimum 1 1/4 inch thick or greater as shown.

(e) Construction Limitations - Place SFC and LMC against a firmly fixed bulkhead. Control sagging or running of freshly placed SFC and LMC in areas of steep gradient by one or both of the following methods:

- Modifying direction or method of placement
- Modifying slump

Except when allowed, keep traffic off the lane adjacent to a placement for at least 4 hours after the placement is completed. When allowed, slow traffic by flagging for at least 4 hours after completion of the pour. In both cases, the Engineer may increase the time limits due to weather or traffic conditions.

(f) Placement Procedures - Furnish at least two transverse work bridges, not counting the finishing machine for SFC and LMC.

(1) Preceding Placement - Each day before placing concrete operate the finishing machine, in the presence of the Engineer, over the deck to check that the required thickness of concrete overlay will be achieved. Place concrete working up-grade, unless otherwise approved.

(2) Joints - At transverse and longitudinal joints, saw cut the section previously placed to form a straight, vertical edge before placing any adjacent sections. Saw cutting joints may be omitted if the bulkhead produces a straight, smooth, vertical surface. On both saw cut and formed joints remove all loose material by sand blasting or water blasting the face of the joints.

a. Longitudinal Joint - A longitudinal construction joint will be allowed only at the centerline of the roadway or at lane lines unless otherwise shown or directed.

b. Transverse Joint - When placement operation is delayed by 1/2 hour or more, form a construction joint by removing all material not up to finish grade, in a straight line.

(3) Placing:

a. Silica Fume Concrete - After the deck surface has been cleaned and immediately before resurfacing, scrub a thin coating of SFC mortar onto the prepared deck. Ensure that all parts receive a thorough, even coating and that no excess mortar or aggregate collects in pockets. Scrub mortar at a rate so that it does not become dry before being covered by SFC. If the mortar does dry, stop the overlay and re-clean and re-prepare the affected area of the deck.

b. Latex Modified Concrete - After the deck surface has been cleaned and before resurfacing, scrub a slurry latex, cement, and water onto the prepared deck. Scrub slurry at a rate so that it does not become dry before being covered by LMC. If the slurry does dry, stop the overlay and re-clean and re-prepare the affected area of the deck.

Stop all placement operations if it starts to rain. Protect fresh previously placed concrete from rain. The Engineer may order removal of all concrete damaged by rain.

(4) Roadway Finish - After the deck has been struck off with a finishing machine, mist the surface horizontally with water and float it, if necessary, to produce a smooth, uniform, sealed surface. Do not spray water directly on the freshly placed concrete and do not allow water to puddle or pond. Hand finishing may be required along edges of concrete placement. Use a 12 foot straight edge during placement to verify deck grades and to correct defects in hand finished areas.

(5) Curing - Cure SFC and LMC by doing the following:

- Provide wind breaks or other approved methods when exposed to conditions which may cause premature drying during placement operations. Premature drying is defined as an evaporation rate equal to or greater than 0.10 pounds per square foot per hour, as determined from Figure 00540-1, or as the loss of surface sheen.
- For curing applications that require water, provide potable water according to 02020.10(b).
- Provide power washers fitted with fog nozzles and apply a fog spray upwind of the concrete placement after finishing according to 00540.28. Do not allow larger water droplets that drip from nozzles to fall onto the freshly finished plastic concrete.
- Cover the concrete with a single layer of clean initial covering immediately after finishing. Apply initial covering no later than 20 minutes after final pass of the finishing machine and no greater than 20 feet from the back of the finishing machine. Provide an initial covering with a minimum length sufficient to cover the bridge deck from side to side of the concrete placement. Use one of the following:
  - Saturated wet burlap having a minimum dry weight of 10 ounces per yard for material 40 inches wide. Presoak the burlap by immersing it completely in water for 72 hours prior to the concrete placement and presoak new burlap with a wetting agent. Overlap the edges at least 6 inches.
  - Non-woven, needle punched polypropylene fabric curing blanket from the QPL. Thoroughly wet fabric within 15 minutes of fabric placement. Overlap the edges at least 12 inches.
- Provide soaker hoses for additional soaking of the initial covering. Place over the full width of the concrete placement, at a maximum of 10 foot intervals. Do not allow initial wetting of burlap or fabric to dry before soaker hoses are in place and operational. Operate soaker hoses continuously to keep the initial covering saturated at all times.
- Place a layer of 4 mil polyethylene film over the initial covering and soaker hoses. Provide clear or white polyethylene film if the air temperature is forecasted to be above 65 °F within 24 hours of the concrete placement, and black at other times, as determined by the Engineer. Overlap the edges of polyethylene film by 12 inches. Keep the film in place by taping and weighting the edges where they overlap or are vulnerable to movement by wind. Once a particular type of film has been placed, do not change it during the curing period.

Wet cure SFC surfaces for 7 calendar days.

Wet cure LMC surfaces for 36 hours then air cure LMC a minimum additional 60 hours. Extend the air cure time period by the number of hours that the surface is wet from either rain or other sources but no more than120 hours from time of placement.

If during the curing time, the temperature on the 24-hour recording thermometer falls below 45 °F, extend the cure time by the number of hours the temperature is below 45 °F.

(6) Saw Cut Texturing - Texture the concrete according to 00540.50(c) after wet curing surfaces for 7 calendar days.

00559.43 Delamination and Crack Inspection:

(a) Delamination Inspection and Repair - The surface will be inspected by the Engineer for delamination, bond failure, or other damage by use of a chain drag, coring, or other devices.

Repair all delaminated areas of 1 square foot or greater. Delaminated areas of less than 1 square foot will not require repair. Core samples that do not achieve a bond strength of at least 175 psi will be at no additional cost to the Agency. Core samples with a bond strength of 175 psi or greater will be paid according to 00195.20.

(b) Crack Inspection and Sealing- The surface will be inspected by the Engineer for cracks.

After correcting non-specification surface tolerances and after texturing the deck surface, seal all visible cracks as follows:

- In areas where cracks are 10 feet or more apart, seal each crack separately.
- In areas where the cracks are numerous or are less than 10 feet apart, seal the entire area where the cracks occur.

Seal with a low modulus concrete and crack sealer.

Perform all repair and sealing work at no additional cost to the Agency. Complete all repair and sealing work before opening to traffic. If the bridge is opened to traffic at the Contractor's request before completing repair work, all additional traffic control to complete the repair work will be at no additional cost to the Agency.

00559.44 Use of New Surface:

(a) Vehicles - Do not allow vehicles or construction equipment on the new concrete surface until curing is complete.

(b) Traffic - Do not open sections to traffic until the deck has been tested, repaired if necessary, and accepted.

Measurement

00559.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

- **Class 2 Preparation** - Class 2 preparation will be measured on the area basis.

- **Furnish Silica Fume Concrete** - Furnishing silica fume concrete material will be measured on the volume basis. The quantities will be determined from the delivery vehicle batch tickets and checked using the yield factor according to AASHTO T 121 (ASTM C 138).

  A deduction will be made for material placed and removed beyond saw cuts or formed construction joints.

- **Furnish Latex Modified Concrete** - Furnishing latex modified concrete material will be measured on the volume basis. The quantities will be determined by converting the weight identified on the mixer's automatic metering device to volume using the yield factor according to AASHTO T 121 (ASTM C 138).

A deduction will be made for material placed and removed beyond saw cuts or formed construction joints.

- **Constructing Silica Fume Concrete or Latex Modified Concrete** - Constructing silica fume concrete or latex modified concrete will be measured on the area basis. The area will be determined by measuring the actual surface area of the resurfaced bridge deck.

- **Saw Cut Texturing** - The quantities of surface texturing will be measured on the area basis and will be the area of each bridge deck or end panel shown less 16 inches along each curb. Field measurement of surface texturing will not be made.

Payment

00559.90 Payment - The accepted quantities of work performed under this Section will be paid at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Class 2 Preparation	Square Yard
(b) Furnish Silica Fume Concrete	Cubic Yard
(c) Furnish Latex Modified Concrete	Cubic Yard
(d) Construct SFC Resurfacing	Square Yard
(e) Construct LMC Resurfacing	Square Yard
(f) Saw Cut Texturing	Square Yard

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for Class 1 preparation work.

Class 3 preparation will be paid for according to 00195.20.

Section 00560 - Structural Steel Bridges

Description

00560.00 Scope - This work consists of furnishing, fabricating, and erecting steel structures as shown or specified. It also includes miscellaneous metal work on bridges and structures, such as access hole covers, frames, ladders, hangers, anchor bolts, scuppers, conduits, ducts, bearing devices, and structural steel shapes.

00560.02 Prefabrication Conference - Meet with the Steel Fabricator, the Engineer and the Agency's steel inspector for a conference at a time mutually agreed upon in advance of ordering steel materials for fabrication. At this conference, present and discuss all phases of the steel fabrication schedule and work. A prefabrication conference is not required for miscellaneous metal work, unless required by Special Provision.

00560.03 Working Drawings - Submit ~~stamped copies of detailed~~unstamped working drawings according to 00150.35. Any work done before review of these drawings shall be at the Contractor's risk. When material is ordered in advance, obtain approval before placing the order.

Provide steel identification on the working drawings according to 00560.22(a).

(a) Reviews - The Engineer's review of the working drawings submitted will only cover "strength and detail" requirements. The Engineer assumes no responsibility for errors in dimensions.

(b) Revisions - Submit copies of any revisions to the detailed working drawings for review. Work done before review of these revisions shall be at the Contractor's risk.

Materials

00560.10 Materials - Furnish structural plates, shapes, bars, and miscellaneous metals meeting the requirements of Section 02530 and Section 02560.

Shop Fabrication

00560.20 Notice of Work - Give the Engineer at least 14 calendar days notice of the beginning of work at the mill, when directed, or at the shop, so inspection may be provided. The term "mill" means any rolling mill or foundry where material for the work is to be manufactured. Do not fabricate material, or perform work at the mill or shop, before the Engineer has been notified.

00560.21 Fabrication Inspection Expense - If fabrication of structural steel outside of the State of Oregon creates additional mill, shop, and plant inspection expenses for the Agency, the Contractor's payment for structural steel structures will be reduced according to 00165.91.

00560.22 Test Results Certificate and Steel Identification:

(a) Test Results Certificate and Initial Identification - Furnish test results certificates, showing chemical analysis and physical tests for each heat or plate of steel, for all members according to 00165.35 and Section 02530. Identify each piece of steel to be fabricated.

Identify on working drawings each piece to be made of steel other than AASHTO M 270 (ASTM A 709), Grade 36 steel. Give pieces made of different grades of steel different assembling or erecting marks, even though they are of identical dimensions and detail.

Provide a system of marking individual pieces made of steel, other than AASHTO M 270 (ASTM A 709), Grade 36, and issue cutting instructions to the shop (generally by

cross-referencing the assembly marks on the working drawings with the corresponding item on the mill purchase order) that maintain identity of the heat number.

Material that can be identified by heat number and mill test report may be furnished from stock.

Mark any unmarked excess material placed in stock for later use with the heat number and with its AASHTO M 160 (ASTM A 6) specification identification color code.

(b) Steel Identification during Fabrication - During fabrication, and until member assembly, each piece of steel, other than AASHTO M 270 (ASTM A 709), Grade 36 steel, shall show clearly and legibly its specification identification color code shown in AASHTO M 160 (ASTM A 6).

Individually marked pieces of steel used in furnished size, or reduced from furnished size, may be used only if end or edge trim does not disturb the heat number or color code. Any usable piece may be used without further color coding providing the heat number or color code remains legible.

Mark individual pieces, other than AASHTO M 270 (ASTM A 709), Grade 36, with the AASHTO M 160 (ASTM A 6) specification identification color code before cutting to a smaller size.

Mark individual pieces of steel, other than AASHTO M 270 (ASTM A 709), Grade 36 steel, which are furnished in tagged lifts or bundles with the AASHTO M 160 (ASTM A 6) specification identification color code immediately on being removed from the bundle or lift.

Pieces of steel, other than AASHTO M 270 (ASTM A 709), Grade 36 steel, which before assembling into members, will be subject to fabricating operations such as heating, blast cleaning, galvanizing or other coating that might obliterate paint color code marking, shall be marked for grade by steel die stamping or by a substantial tag firmly attached. Use only rounded characters when primary stress components are identified by steel die stamping. Impressions shall have a maximum allowable depth of 0.010 inch and shall be placed a minimum distance of 2 inches from edges of tension-stressed plate members. Characters shall be 1/4 inch to 3/8 inch high and shall have a minimum face radius of 0.015 inch.

(c) Check Samples - To verify the accuracy of test reports, obtain check samples from material furnished for fabrication. The plates, shapes or bars from which check samples are required will be as designated on the Plans, and shall be ordered from the mill with the extra size required for samples. The Engineer may take additional samples from drop-offs or scrap material as deemed necessary. No more than two samples will be required from any one plate according to AASHTO M 270 (ASTM A 709) Grade 36, 50, HPS 50W and HPS 70 W with QT processing, or from any one shape or bar. Remove material for check samples in the presence of the Engineer. The Engineer will select the locations where samples are to be taken. Check samples may be ordered cut from either end of the designated steel plate, according to AASHTO M 270 (ASTM A 709) Grade 36, 50, HPS 50W and HPS 70 W with QT processing, or shape or bar. To verify accuracy of test reports for HPS 50W and HPS 70W with thermo-mechanical control process, check samples of both ends of each plate is required.

Check samples in plates shall be rectangular, not less than 24 inches long in the required direction, depending on plate width, for the longitudinal axis of tensile specimens, and 5 inches wide. Bend specimens, where required, shall be not less than 24 inches long in the direction of rolling of the plate. Check samples in bars or shapes shall be the full section and at least 24 inches long. In removing the sample, take care not to damage it by overheating. The Agency will be responsible for the necessary machining of check test specimens and their testing. To expedite obtaining test results, the Contractor may, if approved, perform machining and testing of specimens, in the presence of the Engineer.

The normal basis of acceptance of material will be the mill report or other test report, and fabrication need not be held up pending results of check tests. If the check tests indicate material with properties failing to meet the minimum requirements of the material specification, the material may be rejected and the Contractor required to order new material at no additional cost to the Agency.

For purposes of determining compliance with these Specifications, if the results on an original tensile specimen are within 2,000 psi of the required tensile strength, within 1,000 psi of the required yield point, or within 2~~%~~ percent of the required elongation, a retest will be allowed on two random specimens from the heat or lot. If the results from both of these retest specimens meet Specifications, the heat or lot will be accepted. The specimens shall be oriented with the final direction of rolling in the same manner as the original specimen, and may come from any location within the plate. The extra material from plates, shapes or bars that is not used for check testing shall become the property of the Contractor.

(d) Certification of Identification - Upon request, furnish an affidavit certifying that throughout the fabrication operation the identification of steel has been maintained according to this Specification.

00560.23 Shop Inspection and Testing:

(a) Facilities - Furnish facilities for the inspection of material and work in the mill and shop. Allow the Engineer free access to the material and work for inspection.

(b) Testing - Furnish samples for testing as specified according to Section 00165.

(c) Rejections - The Inspector's inspection at the mill or shop of any material, work or finished members will not prevent their subsequent rejection, if later found damaged or defective, nor relieve the Contractor of the responsibility to correct or replace the work at no additional cost to the Agency.

(d) Transport - Ship no member or piece of fabricated steel without the Inspectors' label or marking.

00560.24 Transporting to, Handling and Storage at Shop - In transporting, handling, and storing the steel work at the shop, ~~take care to~~ avoid bending, scraping, or overstressing the pieces. Reject pieces bent or otherwise damaged. In addition:

- Conduct the loading, transporting and unloading of pieces so the metal remains clean.
- Keep materials free from dirt, oil or other contaminants, and protect from corrosion.
- If pieces are shop-painted, handle with slings or other means that will not damage coating system.
- Handle and store girders and beams upright, and shore.
- Support and handle members so camber is maintained.
- Support long members, such as columns and chords, on skids placed near enough together to prevent damage from deflection.
- Store materials on platforms, skids or other supports above ground and high water elevations and slightly pitch all trough sections that might retain water to provide drainage.

00560.25 Plate Work:

(a) Straightening - Straighten bent or distorted plates, angles, and other shapes or built-up members according to paragraph 3.7.3 of AWS D 1.5, and as specified.

(b) Orientation of Plates - Unless otherwise shown, cut and fabricate steel plates for main members, and splice plates for flanges and main tension members, so the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stresses.

(c) Plate Cut Edges:

(1) Edge Planing - Plane, mill, grind or thermal cut to a depth of 1/4 inch all sheared edges of plate more than 5/8 inch in thickness and carrying calculated stress.

(2) Flame Cutting - Flame cut structural steel according to paragraph 3.2.2 of AWS D1.5, and as specified.

(3) Visual Inspection and Repair - Visually inspect and repair plate cut edges according to paragraph 3.2.3 of AWS D1.5, and as specified.

(4) Re-entrant Corners - Fillet re-entrant corners to a radius of at least 3/4 inch before cutting.

(5) Corners and Edges - Round all corners and edges of steel members, or bevel 1/16 inch.

(d) Bent Plates - Unwelded, cold-bent, load-carrying, rolled-steel plates shall be:

- Rounded at the corners of the plate before bending, to a radius of 1/16 inch throughout the portion of the plate at which the bending is to occur.
- Bent at right angles to the direction of rolling, except that cold-bent ribs for orthotropic-deck structures may be bent in the direction of rolling if allowed.
- Bent so no cracking of the plate occurs. Minimum bend radii, measured to the concave face of the metal, are:

	Plate Thickness				
	Up to 1/2"	**Over 1/2" to 1"**	**Over 1" to 1 1/2"**	**Over 1 1/2" to 2 1/2"**	**Over 2 1/2" to 4"**
All grades of structural steel in this Specification	2 t	2.5 t	3 t	3.5 t	4 t

Where t = Plate thickness in inches

Low alloy steel in thicknesses over 1/2 inch may require hot bending for small radii

00560.26 Welding:

(a) Bridge Welding - Welding, welder qualifications, prequalification of weld details, and inspection of welds for bridge structures shall all conform to AWS D1.5.

(b) Non-Bridge Structures - Welding, welder qualifications, prequalification of weld details and inspection of welds for non-bridge structures shall all conform to AWS D1.1. Non-bridge

structures include bridge railing posts, railing splices, deck expansion joints, earthquake restraints and similar structures. Submit all welding procedure specifications to the Engineer for approval.

Test earthquake restraint welds radiographically or ultrasonically. Testing will be witnessed by the Engineer. Additional inspection for earthquake restraint welds shall include:

- Ultrasonic inspection of 100~~%~~ percent of the complete penetration welds using a straight beam transducer. A weld will be acceptable if it has no indications of cracks and no indications of lack of fusion between adjacent layers of weld metal and between weld metal and base metal.
- Magnetic particle inspection of 10~~%~~ percent of the fillet welds.

00560.27 Bolt Holes:

(a) Punched Holes - Use a die with a diameter not exceeding the diameter of the punch by more than 1/16 inch. Ream any holes that are required to be enlarged to admit the bolts. Make clean cut holes without torn or ragged edges. Poor matching of holes will be cause for rejection.

(b) Drilled or Reamed Holes - Assemble and securely hold connecting parts requiring drilled or reamed holes. Match-mark connecting parts before disassembling.

Where practical, direct reamers by mechanical means.

Perform drilling and reaming with twist drills. Make drilled or reamed holes cylindrical, perpendicular to the member, and complying with the size requirements of these Specifications. Remove burrs on the outside surfaces. If required, take apart assembled parts for removal of burrs caused by drilling.

Poor matching of holes will be cause for rejection.

(c) Accuracy of Punched and Drilled Holes - Locate all holes punched full size, subpunched, or subdrilled so accurately that after assembling (before any reaming is done) a cylindrical pin 1/8 inch smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the member, without drifting, in at least 75~~%~~ percent of the connecting holes in the same plane. Non-conforming pieces will be rejected. If any hole will not pass a pin 3/16 inch smaller than the nominal size of the hole, the non-conforming pieces will be rejected.

(d) Accuracy of Drilled and Reamed Holes - When holes are drilled or reamed, 85~~%~~ percent of the holes in any connecting group shall, after drilling or reaming, show no offset greater than 1/32 inch between adjacent thicknesses of metal.

Provide steel templates with hardened steel bushings in holes and accurately dimensioned from centerlines of the connections inscribed on the template. Use the centerlines in accurately locating the template from the milled or scribed ends of the members. When steel templates 1 inch or greater in thickness are used six or fewer times in drilling members, hardened steel bushings are not required.

(e) Fitting for Bolting - Clean surfaces of metal in contact before assembling. Assemble, well pin, and firmly draw together the parts of a member before drilling, reaming, or bolting is commenced. Take apart assembled pieces, if necessary, for the removal of burrs and shavings produced by the operation. Construct the member free from twists, bends, and other deformation.

Perform drift pinning during assembling only to bring the parts into position and not sufficient to enlarge the holes or distort the metal.

(f) Holes for High-Strength Bolts and Unfinished Bolts - Punch or drill all holes for high-strength bolts and unfinished bolts. When there are not more than five thicknesses of material in a member, and the material is not thicker than 3/4 inch for structural steel or 5/8 inch for high-strength steel, the metal may be punched 1/16 inch larger than the nominal diameter of the bolts unless subpunching and reaming are required by these specifications.

When there are more than five material thicknesses in a member, or when any material is thicker than 3/4 inch for structural steel or 5/8 inch for high-strength steel, either sub drill holes or drill full size.

When required by 00560.27(g), subpunch or sub drill all holes 3/16 inch smaller and, after assembling, ream 1/16 inch larger or drill full size to 1/16 inch larger than the nominal diameter of the bolts. Sub drill if thickness limitation governs.

Holes not more than 1/32 inch larger than the nominal diameter resulting from a drill or reamer of the nominal diameter are considered acceptable. The slightly conical hole from punching operations is considered acceptable.

(g) Holes for Ribbed Bolts, Turned Bolts, and Others - Make holes with a driving fit as specified for ribbed bolts, turned bolts, or other approved bearing-type bolts by one of these methods:

- Subpunch or sub drill 3/16 inch smaller than the nominal diameter of the bolt and ream, while assembled,
- Drill to a steel template, or
- Drill from the solid after assembling.

(h) Holes for Field Connections:

(1) Subpunching and Reaming Field Connections - Unless otherwise specified, subpunch (or sub drill if subdrilling is required according to 00560.27(f) or 00560.27(g)) and subsequently ream holes in all field connections and field splices of main members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, and rigid frames while assembled on a steel template, as required by 00560.43. Holes for field splices of rolled beam stringers continuous over floor beams or crossframes may be drilled full size unassembled to a steel template.

Subpunch and ream all holes for floor beam and stringer field end connections to a steel template or ream while assembled. Drill or ream full size field connection holes through a steel template after the template has been carefully located as to position and angle and firmly bolted in place. Make templates used for reaming matching members, or the opposite faces of a single member, exact duplicates. Locate templates used for connections on like parts or members so accurately that the parts or members are duplicates and require no match-marking.

For any field connection, instead of subpunching and reaming or subdrilling and reaming, the Contractor may drill holes full size with all thicknesses of material assembled in proper position.

Use templates as described above, or do not interchange splice plates.

(2) Numerically Controlled Punched or Drilled Field Connections - Alternately, for any connection or splice designated in 00560.27(f), instead of subpunching and reaming field connections according to 00560.27(h), the Contractor may punch or drill bolt holes full-size in unassembled pieces and connections, including templates, for use with matching subsized and reamed holes by means of suitable numerically controlled punching or drilling equipment subject to this Section. Punch or drill full-size holes according to 00560.27(c).

Submit for review a detailed outline of the procedures proposed for accomplishing the work from initial punching or drilling through check assembly, if required. Include the specific members of the structure that may be numerically controlled punched or drilled, the sizes of the holes, the location of common index and other reference points, composition of check assemblies, and all other pertinent information. Do not begin until written approval is received.

Punch or drill holes by numerically controlled equipment to appropriate size through individual pieces, or drill through any combination of pieces held tightly together. Use each splice plate only once as a template and do not interchange after assembly drilling is complete.

If numerically controlled punching or drilling equipment is used, the Engineer may require the Contractor, by means of check assemblies, to demonstrate that this punching or drilling procedure consistently produces holes and connections conforming to 00560.27(g) and 00560.43.

00560.28 Carbon Steel Bolt Connections - Unless otherwise shown or specified, make connections with unfinished carbon steel bolts nuts and washers conforming to Section 02560. Use holes conforming to 00560.27.

(a) Turned Bolts - Provide and install turned bolts as follows:

- The body surface shall have a surface roughness of 125 microinches, or less, according to ANSI B46.1.
- The unthreaded body shall equal total thickness of connected parts.
- The outer thread diameter shall equal the nominal diameter of the bolt specified.
- Heads and nuts shall be hexagonal with standard dimensions for bolts of the nominal size specified or the next larger nominal size.
- Install bolts in carefully reamed holes with a tight driving fit.

(b) Ribbed Bolts - Provide and install ribbed bolts as follows:

- The body shall have an approved form with continuous longitudinal ribs.
- The diameter of the body, measured on a circle through the points of the ribs, shall be 5/64 inch greater than the nominal bolt diameter specified.
- Round heads shall conform to ~~ANSI~~ ASME B 18.5~~.2.1M~~ unless otherwise specified.
- Ribbed bolts shall make a driving fit with the holes.
- The hardness of the ribs shall be such that the ribs do not permit the bolts to turn in the holes during tightening.
- If for any reason the bolt twists before drawing tight, ream the hole and use an oversized bolt as a replacement.
- Nuts shall be hexagonal, with standard dimensions for bolts of nominal size specified or the next larger nominal size.

(c) Washers - Use hardened washers of suitable thickness under the turning element (nut or bolthead) in tightening.

Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

(d) Nuts - Use single self-locking nuts or double nuts unless otherwise shown or specified. The finished side shall be against the washer or plate.

00560.29 High-Strength Bolt Connections:

(a) General - When shown or specified, assemble structural joint connections with high-strength bolts conforming to AASHTO M 164 (ASTM A 325) or equivalent fastener using bolts, nuts, and washers conforming to Section 02560 and in holes conforming to 00560.27.

Fit-up bolted connections as follows:

- Provide all steel material within the grip of high-strength bolts (no compressible material such as gaskets or insulation).
- Remove burrs that would prevent solid seating, so that parts fit solidly together after bolts are tightened.
- ~~So that parts fit solidly together after bolts are tightened.~~
- Make slope of surfaces in contact with the bolt head or nut less than 1:20 with respect to a plane normal to the bolt axis.
- Install all bolts, unless otherwise shown, to expose the heads on the exterior surface of the structure.

~~(b~~(b) Washer Requirements:

- Where the outer surface of the bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis, use a hardened, beveled washer to compensate for the lack of parallelism.
- Where AASHTO M 164 (ASTM A 325) bolts of any diameter are to be installed in standard, oversize, or short slotted hole in an outer ply, provide a hardened washer under the element of the fastener (nut or bolt head) turned in tightening.
- Where AASHTO M 164 (ASTM A 325) bolts of any diameter are to be installed in a long slotted hole in an outer ply, use plate washers or continuous bars of at least 5/16 inch thickness with standard holes. Provide washers or bars with sufficient size to completely cover the slot after installation. Make the plate washer from structural grade steel. In addition to a plate washer, provide a hardened washer under element of the fastener (nut or bolt head) turned in tightening.
- Oversize and slotted holes are defined by the Manual of Steel Construction Load and Resistance Factor Design (AISC).

(c) Surface Conditions - Make all joint surfaces including surfaces adjacent to the bolt head and nut free of scale, oil, grease, dirt, foreign material, and unless otherwise shown or specified, free of paint, lacquer, rust inhibitor, galvanizing or other coating.

(1) Coated Members - Prepare and coat steel-to-steel contact surfaces within slip-critical bolted joints for coated steel according to Section 00594. Prior to assembly, prepare the contact surfaces with approved methods not harmful to the primer.

Coat fasteners visible to the public, as determined by the Engineer, according to Section 00594 (except the primer coat) after installation. ~~All~~Mechanically galvanize all direct tension indicators ~~shall be mechanically galvanized~~ according to 02560.40(b).

a. Non-Coastal Projects - On projects more than 25 aerial miles, of the Pacific Ocean, ~~all~~use high-strength fasteners ~~shall be~~ either black or galvanized as the Contractor elects. ~~The~~Use fasteners ~~shall~~that meet the following requirements:

1. Black Fasteners - Clean black fasteners, including hardened washers, and the surrounding areas stained by the black fasteners, after installation, using an approved method. Coat according to Section 00594.

2. Galvanized Fasteners - Clean and prepare fasteners as approved, in areas visible to the public, as determined by the Engineer, and coat according to Section 00594 after installation.

b. Coastal Projects - On projects within 25 aerial miles of the Pacific Ocean, ~~all~~use high-strength fasteners, including hardened flat washers, ~~shall be~~ galvanized according to 02560.40 prior to installation. In areas visible to the public, as determined by the Engineer, clean and prepare fasteners as approved, and coat according to Section 00594.

(2) Non-Coated Weathering Steel Members - Blast clean steel-to-steel contact surfaces within slip-critical bolted joints for non-coated weathering steel according to SSPC-SP 10 "Near-White Blast Cleaning". ~~The~~Make the appearance of the blast-cleaned surface ~~shall~~to closely approximate Pictorial Standard Sa 2-1/2 of SSPC-Vis 1.

~~All~~Use only fasteners ~~shall be~~that are black. Do not use direct tension indicators for non-coated weathering steel connections.

(3) Galvanized Members - After galvanizing, roughen surfaces of galvanized slip critical connections by means of hand wire brushing. Power wire brushing is not allowed.

(~~c)~~ d) Verification Testing, Installation, and ~~Tightening:~~

~~**(1) General** - Fasteners shall be assigned~~**Inspection** - Assign lot numbers (including rotational capacity lot numbers) ~~prior to~~to all fasteners before shipping~~, and~~ them. Assemble all components ~~shall be assembled when installed.~~ during installation of the fasteners.

Protect fasteners from dirt and moisture at the Project Site. Take from protected storage only as many fasteners as anticipated to be installed and tightened during a work shift. Return fasteners not used to protected storage at the end of the shift. ~~Do not remove lubricant present in as-delivered condition. Clean and lubricate fasteners, if necessary, and retest before installation. Use lubricant according to 02560.70. Do not relubricate tension control fasteners designed to automatically provide the tension without consulting with the manufacturer.~~

Do not remove lubricant present in as-delivered condition. If necessary, clean and lubricate fasteners and retest before installation. Use lubricant according to 02560.70. Do not re-lubricate Tension Control fasteners.

Install the bolt, nut, and washer or DTI assembly so that at least three and not more than five threads are located between the bearing face of the nut and the bolt head.

Tighten all connections progressing systematically from the most rigid part of the connection to the free edges.

The Engineer will do the following:

- Before installing fasteners:
  - Check markings, surface conditions, and bolt, nut, washer and DTIs if used storage conditions, and faying surfaces of joints for compliance with 00560.29(c).
  - Observe calibration and testing procedures.

- During fastener installation, monitor to:
  - Confirm that the installation procedure is followed and that, when fastener assemblies are supplied, the tensions specified in Table 00560-1 are achieved.
  - Assure that the installation method demonstrated in the Verification Testing procedure develops the specified tension.

Provide a tension measuring device at the Project Site ~~if high-strength bolts are being installed and tightened. The device shall have~~that has the capacity for the bolt being installed. Confirm the accuracy of the tension-measuring device through calibration by an approved testing agency at the start of work and at least annually. ~~Use the tension-measuring device to calibrate wrenches if applicable, to assist the bolting crew in understanding and proper use of the method to be used, and to confirm the ability of the complete fastener assembly to be used in the work, including lubrication, if required, to satisfy the requirements of Table 00560-1.~~Use the tension-measuring device to:

- Calibrate wrenches.
- Assist the bolting crew in understanding and proper use of the method to be used.
- Confirm the ability of the complete fastener assembly to be used in the work, including lubrication satisfies the tension requirements of Table 00560-1.

Install and tighten all fasteners ~~with washers of specified size and quality, located as described below, in properly~~in aligned holes~~, and tighten according to 00560.29(c-3) unless otherwise specified. Tighten~~ to at least the tension specified in Table 00560~~-1 when all the fasteners are tight~~-1. Tightening may be done by turning the bolt while the nut is prevented from rotating when it is impractical to turn the nut~~. Impact~~, if approved. When impact wrenches~~, if~~ are used, ~~shall be of adequate~~provide them with enough capacity and ~~sufficiently~~ supplied ~~with~~ air to tighten each bolt in 10 seconds or less.

Non-galvanized fasteners may be reused~~,~~ once if approved~~, but not more than once~~. Retightening previously tightened fasteners loosened by the tightening of adjacent fasteners will not be considered a reuse. Do not reuse galvanized fasteners.

Use bolt, nut, and washer combinations from the same rotational-capacity lot.

Verify correct lengths of all AASHTO M 164 (ASTM A 325) bolts. In the tightened connection, do not allow the unthreaded portion of the bolt ~~shall not~~to jam against the internal threads of the nut. ~~The bolt shall have full nut engagement with a positive stick-through. The space between the nut and the bolt head (the grip) shall include a threaded length of bolt at least three threads in length.~~

In these Specifications, "snug-tight" is defined as having all plies of the connection in firm contact. ~~Snugging shall progress systematically from the most rigid part of the connection to the free edges. The snugging sequence shall be repeated until the full connection is in a snug condition.~~

~~TABLE~~ Table 00560-1

Required Fastener Tension in Bolts

Nominal Bolt Size (inch)	Minimum Tension (kips)
1/2	12
5/8	19
3/4	28
7/8	39
1	51
1 1/8	56
1 1/4	71
1 3/8	85
1 1/2	103

(~~2) Washer Requirements~~:

- ~~Where the outer surface of the bolted parts has a slope greater than~~ **1**~~:20 with respect to a plane normal to the bolt axis, use a hardened, beveled washer to compensate for the lack of parallelism.~~
- ~~Use a hardened washer under the element of the fastener (nut or bolt head) turned in tightening.~~
- ~~Where AASHTO M 164 (ASTM A 325) bolts of any diameter are to be installed in an oversize or short slotted hole in an outer ply, use a hardened washer conforming to ASTM F 436.~~
- ~~Where AASHTO M 164 (ASTM A 325) bolts of any diameter are to be installed in a long slotted hole in an outer ply, use plate washers or continuous bars of at least 5/16 inch thickness with standard holes. These washers or bars shall have sufficient size to completely cover the slot after installation. Make the plate washer from structural grade steel.~~
- ~~Oversize and slotted holes shall be as defined by Manual of Steel Construction Load and Resistance Factor Design (AISC).~~

~~(3~~) Direct Tension ~~Indicators (DTI's):~~

~~**a. General** - When~~**Indicator Tightening** - Test, install, and inspect direct tension indicators ~~(DTI's) are used to indicate bolt tension, they shall be subjected to verification testing as described below and installed according to~~ (DTIs) at the ~~method specified below. Unless otherwise directed, the DTI's shall be installed~~Project Site. Install DTIs under the head of the bolt ~~and~~with the nut turned to tension the bolt. ~~See 00560.29(c-2) for~~Orient DTI protrusions against the bolt head or a hardened washer~~ requirements~~. Follow the manufacturer's recommendations for ~~the proper~~correct orientation of the DTI and additional washers, if any, required for the correct use of the DTI. ~~The~~ Do not allow the surface contacting the protrusions of a ~~direct tension indicator shall not~~ DTI to turn during the tightening operation. ~~All direct tension indicators shall be~~Provide new ~~and~~, unused ~~and shall be mechanically~~DTIs galvanized according to 02560.40(b). Where tapered holes ~~are found~~ in washers ~~that~~ are in contact with the protrusions of DTI washers, place the face with the smallest hole ~~shall be placed~~ against the DTI.

~~b~~a. Testing:

1. Rotational Capacity Testing - Perform Rotational Capacity Tests according to 02560.60.

2. Verification Testing - Perform verification tests in a calibrated bolt tension-measuring device. Use a special flat insert in place of the normal bolt head holding insert. ThreeConduct three verification tests are required for each combination of fastener assembly, rotational-capacity lot, DTI lot, and DTI position relative to the turned element (bolt head or nut) to be used on).

Use a special flat insert in place of the Projectnormal bolt head holding insert. Do not allow the restrained element to rotate. Install the fastener assembly in the tension-measuring device with the DTI located in the same position as in the work. The element not turned (bolt or nut) shall be restrained from rotation. The purpose of verification testing is to ensure that the fastener will be at or above the desired installation tension when the requisite number of spaces between the protrusions have a gap of 0.005 inches or less, and that the bolt will not have excessive plastic deformation at the minimum gap allowed on the Project.

Conduct verification testsVerification Tests in two stages. The bolt, nut, and DTI assembly shall be installed in such a manner that at least three, and preferably not more than five, threads are located between the bearing face of the nut and the bolt head. Tension the bolt first

First, tension the bolt to the load equal to that listed in Table 00560-2 under Verification Tension for the grade and diameter of bolt. If an impact wrench is used, tighten the tension developednut using the impact wrench shall beto no more than two-thirds the required tension. Subsequently, use a manual wrench to attain the required tension.

Record the number of refusals of a 0.005 inch tapered feeler gauge in the spaces between the protrusions. The number of refusals for galvanized DTI's

For uncoated DTIs under the stationary or turned element, or for coated DTIs used under the stationary element shall, do not exceed the number of refusals listed under Maximum Verification refusals in Table 00560-2 for the grade and diameter of bolt used. The maximum number of verification refusals for galvanized DTI's when used-2.

For coated DTIs under thea turned element shall be no more than, do not exceed the number of spaces on the DTI less one. The galvanized

Reject the DTI lot will be rejected if the gauge is refused in all spacesnumber of refusals are not met.

AfterNext, after the number of refusals is recorded at the verification Verification Tension load, further tension the bolt until the 0.005 inch feeler gauge is refused at all spaces and a visible gap exists in at least one space. Record the load at this condition and remove the bolt from the tension-measuring device. TheRun the nut shall be able to be run down by hand for the complete thread length of the bolt, excluding the thread runout. If the nut cannot be run down for this thread length, reject the DTI lot shall be rejected unless the load recorded is less than 95 percent of the average load measured in the rotational capacity test for the fastener lot.

If the bolt is too short to be tested in the calibration device, verify the DTI lot on a long bolt in a calibrator to determine the number of refusals at the Verification Tension listed in Table 00560-2. The Reject the lot if the number of refusals shall not exceedexceeds the values listed under Maximum Verification Refusals in Table 00560-2. AnotherVerify another DTI from the same lot shall then be verified with the short bolt in a convenient hole in the work. Tension the bolt until the 0.005 inch feeler gauge is refused in all spaces and a visible gap exists in at least one space. Remove the bolt from the tension-

measuring device. ~~The~~Run the nut ~~shall be able to be run~~ down by hand ~~for~~ the complete thread length of the bolt excluding the thread runout. Reject the DTI lot if the nut cannot be run down for this thread length.

~~c~~**b. Installation** - Install DTI fastener assemblies using ~~DTI's~~DTIs in two stages. ~~Hold~~Do not allow the stationary element ~~against rotation during each stage of the installation.~~ to rotate.

First, snug the connection with all bolts installed in all holes of the connection and ~~tensioned sufficiently~~tension to ~~bring all~~achieve a snug tight condition by snugging in multiple cycles. If the ~~plies of the connection into firm contact. The~~ number of spaces in which a 0.005 inch feeler gauge is refused in the DTI after snugging ~~shall not exceed~~ exceeds those listed under Maximum Verification refusals in Table 00560~~-~~-2~~. If the number exceeds the values in the table~~, remove the fastener assembly and install and snug another DTI.

~~For galvanized DTI's~~Next, for uncoated DTIs under the stationary or turned element, or for coated DTIs used under the stationary element further tension the bolts until the number of refusals of the 0.005 inch feeler gauge is equal to or greater than the number listed under Minimum Installation Refusals in Table 00560~~-~~-2. If the bolt is tensioned so that no visible gap in any space remains, remove the bolt and DTI, and ~~replaced~~replace with a new properly tensioned bolt and DTI.

~~For galvanized DTI's~~Tighten coated DTIs under the turned element~~, the~~ to achieve 0.005 inch feeler gauge ~~shall be refused~~refusal in all ~~spaces~~space locations.

~~**Table 00560-2**~~

~~**Direct Tension Indicators**~~

Table 00560-2

Direct Tension Indicators

Bolt Diameter (inch)	Verification Tension (Kips)	Maximum Verification Refusals	DTI Spaces	Minimum Installation Refusals
1/2	13	1	4	2
5/8	20	1	4	2
3/4	29	2	5	3
7/8	41	2	5	3
1	54	2	6	3
1 1/8	59	2	6	3
1 1/4	75	3	7	4
1 3/8	89	3	7	4
1 1/2	108	3	8	4

~~Table 00560-2 Notes:~~

~~Maximum Verification Refusals are for galvanized DTI's under a stationary element. The maximum number if Verification Refusals for galvanized DTI's under a turned element shall be no more than the number of spaces on the DTI less one.~~

~~Minimum Installation Refusals are for galvanized DTI's under a stationary element. The gauge shall be refused in all spaces when galvanized DTI's are used under a turned element.~~

(4c. **Inspection** - In the presence and at the direction of the Engineer, inspect completed DTI connections.

Select, at random, 10 percent of the DTIs or at least two, whichever is greater, for each separate connection. Probe each DTI washer being inspected with the 0.005 inch feeler gauge and document the number of refusals. If the number of refusals meets the Minimum Installation Refusals listed in Table 00560-2 consider the fastener to be correctly tensioned. If the number of refusals does not meet the Minimum Installation Refusals listed in Table 00560-2, test each DTI in the connection with the 0.005 inch feeler gauge and tighten to meet the Minimum Installation Refusals requirements.

(2) **Tension Control Fasteners Tightening** - WhenTest, install, and inspect tension control fasteners automatically provideat the tension required by Table 00560-project site.

a. Testing:

1 and have been qualified**. Rotational Capacity Testing** - Perform Rotational Capacity Tests according to Section 02560 are .60.

2. Verification Testing - Perform Verification Testing in a calibrated bolt tension-measuring device. Test a representative sample of not less than three bolt and nut assemblies of each diameter, length, and grade to be installed, checkused.

Use a special round head insert in place of the typical hex head insert.

Repeat Verification Testing when the condition of fasteners are altered, when changes in method, equipment or personnel occur, or as directed.

Conduct verification tests in two stages:

First, demonstrate the method for estimating the snug-tight condition to be used on the final product. Record the snug-tight tension.

Next, apply a representative sample of not less than five bolts of each diameter, length and grade at the Project Site in a device capable of indicating bolt tension. Include flat hardened washers in the test assembly, if required in the actual connection, arranged as in the actual connections to be tensioned. Demonstratetension control shear wrench to demonstrate that each bolt develops a tension not less than 5% percent greater than required by Table 00560--1. Follow manufacturer's installation procedure for installation of bolts in the calibrating device and in all. Record the final tension.

3. Inspection Torque - Determine Inspection Torque in a calibrated bolt tension-measuring device. Provide a torque wrench with sufficient capacity to perform testing. Match the sampled fastener conditions to the conditions under inspection. Test at least three randomly sampled bolt, nut, and washer assemblies for each diameter, length, and grade used. Tension the sampled bolts to the specified tension in Table 00560-1 by any convenient means. Apply the Inspection Torque wrench to the tensioned bolt to determine the torque required to turn the nut 5 degrees (approximately 1 inch at a 12 inch radius) in the tensioning direction. Calculate the Inspection Torque by averaging the three bolt, nut and washer assemblies of each diameter, length, and grade.

Repeat the Inspection Torque determination when the fasteners conditions are altered, when changes in method, equipment, or personnel occur, or as directed.

b. Installation - Install tension control fasteners in two stages.

First, Using the method developed in the Verification Testing procedure, snug the connection with all bolts installed in all holes of the connection and tension to achieve snug-tight condition.

Next, apply the tension control shear wrench until the spline fractures.

c. Inspection - In the presence and at the direction of the Engineer, inspect completed connections using the Inspection Torque wrench and visually inspect splines for each bolt in the connection. Conduct inspection tests before loss of lubricant and before corrosion begins.

~~When using tension control fasteners which automatically provide the tension, install fasteners in all holes of the connection and initially tighten sufficiently to bring all plies of the joint into firm contact, but without yielding or fracturing the control or indicator element of the fasteners. Then further tighten all fasteners in sequence, progressing from the most rigid part of the connection to the free edges in a manner that minimizes relaxation of previously tightened fasteners. Proper tensioning of the fasteners may require more than a single cycle of partial tightening (snug-tightening) before final tightening of individual fasteners.~~

~~(5~~Select at random 10 percent or at least two, whichever is greater, of the tensioned bolts and nuts on the structure for each separate connection. Apply the Inspection Torque to each nut in the tensioning direction. If the Inspection Torque does not turn the bolt or nut, the connection will be considered properly tensioned. If the Inspection Torque turns the bolt or nut, apply the Inspection Torque to all the bolts and nut in the connection. Re-tension and re-inspect all bolts and nuts that turned at this inspection. The Contractor may re-tension all the bolts in the connection and resubmit it for inspection, provided fasteners assemblies are not damaged.

(3) Turn-of-Nut Fastener Tightening - Test, install, and inspect turn-of-nut fasteners at the Project site.

a. Testing:

1. Rotational Capacity Testing - Perform Rotational Capacity Tests according to 02560.60.

2. Verification Testing - Perform verification testing ~~using~~in a calibrated bolt tension-measuring device. Test a representative sample of not less than three bolt and nut assemblies of each diameter, length, and grade used ~~at the start of work in a device capable of indicating bolt tension. Demonstrate that~~.

Repeat Verification Testing if the condition of fasteners are altered, when changes in method, equipment or personnel occur, or as directed.

Conduct verification tests in two stages:

First, demonstrate the method for estimating the snug-tight condition ~~and controlling~~using the ~~turns from snug-tight~~ same method to be used ~~by~~on the ~~bolting crew develops a~~ final product. Record the snug-tight tension ~~not less than 5% greater than the tension required by Table 00560-1~~. Match mark the bolt, nut, and plate.

~~Install bolts in all holes of the connection and bring to a snug-tight condition. Sequence snug-tightening from the most rigid part of the connection to the free edges, and then retighten~~

~~the bolts of the connection in a similar manner until all bolts are simultaneously snug-tight and the connection is fully compacted. Then tighten all bolts in the connection further by the amount of rotation specified in Table 00560-3. During the tightening operation prevent rotation of the part not turned by the wrench. Sequence tightening from the most rigid part of the joint to its free edges.~~

~~TABLE 00560-3~~

~~Nut Rotation from Snug-Tight Condition~~ [1]

	~~Disposition of Outer Faces of Bolted Parts~~		
~~Bolt Length (underside of head to end of bolt)~~	**~~Both faces normal to bolt axis~~**	**~~One face normal to bolt axis and other sloped not more than 1:20 (beveled washer not used)~~**	**~~Both faces sloped not more than 1:20 from normal to bolt axis (beveled washer not used)~~**
~~Up to and including 4 diameters~~	~~1/3 turn~~	~~1/2 turn~~	~~2/3 turn~~
~~Over 4 diameters but not exceeding 8 diameters~~	~~1/2 turn~~	~~2/3 turn~~	~~5/6 turn~~
~~Over 8 diameters but not exceeding 12 diameters~~ [2]	~~2/3 turn~~	~~5/6 turn~~	~~1 turn~~

~~[1] Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by one-half turn and less, the tolerance shall be plus or minus 30°; for bolts installed by two-thirds turn and more, the tolerance shall be plus or minus 45°.~~

~~[2] No research has been performed by the Research Council on Structural Connections to establish the turn-of-nut procedure for bolt lengths exceeding 12 diameters. Therefore, the required rotation shall be determined by actual test in a suitable tension measuring device according to 00560.29(c-5).~~

~~**(6) Lock-Pin and Collar Fastener Tightening** - Install lock-pin and collar fasteners by methods and procedures as recommended by the manufacturer and approved.~~

~~When using lock-pin and collar fasteners, install lock-pins in all holes of the connection and initially snug-tighten sufficiently to bring all plies of the joint into firm contact, progressing systematically from the most rigid part of the connection to the free edges in a manner that minimizes relaxation of previously tightened fasteners. After all fasteners in the connection are snug-tight, fully tighten the fasteners, progressing systematically from the center most rigid part of the connection to its free edges. Ping the fasteners with a hammer for soundness. Remove and replace loose or relaxed fasteners with new fasteners to the satisfaction of the Engineer.~~

~~**(d) Inspection** - Before installing fasteners in the work, the Engineer will check the marking, surface condition and storage of bolts, nuts, and washers, and DTI's if used, and the faying surfaces of joints for compliance with 00560.29(c-1). The Engineer will observe calibration and/or testing procedures required in 00560.29(c-2) through 00560.29(c-5), as applicable, and will monitor the installation of fasteners in the work to~~

~~confirm that the procedure~~Next, apply a tensioning wrench to achieve the nut rotation requirement of Table 00560-3 and develop a tension of not less than 5 percent greater than required in Table 00560-1. If necessary, increase rotation to meet these requirements. Record all tension and rotation readings.

3. Inspection Torque - Determine Inspection Torque in a calibrated bolt tension-measuring device. Provide a torque wrench with sufficient capacity to perform testing. Match the sampled fastener conditions to the conditions under inspection. Test at least three randomly sampled bolt, nut, and washer assemblies for each diameter, length, and grade used. Tension the sampled bolts to the specified tension in Table 00560-1 by any convenient means. Apply the Inspection Torque wrench to the tensioned bolt to determine the torque required to turn the nut 5 degrees (approximately 1 inch at a 12 inch radius) in the tensioning direction. Calculate the Inspection Torque by averaging three bolt, nut, and washer assemblies of each diameter, length, and grade.

Repeat the Inspection Torque determination when the fastener conditions are altered, when changes in method, equipment, or personnel occur, or as directed.

b. Installation - Install fasteners using Turn-of-Nut method in two stages:

First, using the method developed in the Verification Testing procedure, snug the connection with all bolts installed in all holes of the connection and tension to achieve snug-tight condition by snugging in multiple cycles. Match mark each fastener bolt, nut and plate.

Next, apply the tensioning wrench to achieve the nut rotation determined during the Verification Testing. Do not allow the bolt to turn during the tightening process.

c. Inspection - In the presence and at the direction of the Engineer, inspect completed connections using the Inspection Torque wrench and the match marked nut rotation for each bolt in the connection. Conduct inspection tests before loss of lubricant and before corrosion begins.

Select at random 10 percent or at least two, whichever is ~~properly used and that, when so used with the fastener assemblies supplied, the tensions specified in Table 00560-1 are provided.~~

~~The Engineer will monitor the installation of fasteners in the work to assure that the selected installation method, as demonstrated in the initial testing to develop the specified tension, is routinely followed.~~

~~Either the Engineer or the Contractor, in the presence of the Engineer and with the Engineer's approval, shall inspect~~ greater, of the tensioned bolts ~~using an inspection torque wrench, unless alternate fasteners or direct tension indicators are used, allowing verification by other methods. Conduct inspection tests in a timely manner prior to prevent possible loss of lubrication, and before corrosion influences torque.~~

~~Place three fastener assembly lots, in the same conditions as those under inspection, individually in a device calibrated to measure bolt tension. Perform this calibration operation at least once each inspection day. There shall be a washer under the turned element in tensioning each bolt if washers are used on the structure. If washers are not used~~and nuts on the structure~~, the material used in the tension-measuring device that abuts the part turned shall be of the same specification as that used on the structure. In the calibrated device, each bolt shall be tensioned by any convenient means to the specified tension. Apply the inspecting wrench to the tensioned bolt to determine the torque required to turn the nut or head 5 degrees (approximately 1 inch at a~~

~~12 inch radius) in the tensioning direction. Take the average of the torque required for all three bolts as the job inspection torque.~~

~~Select at random ten percent (at least two) of the tensioned bolts on the structure represented by the test bolts in each~~ for each separate connection. Apply the ~~job inspection torque~~Inspection Torque to each ~~with the inspecting wrench turned in~~nut the tensioning direction. If ~~this torque turns no~~ the Inspection Torque does not turn the bolt ~~head~~ or nut, the ~~bolts in the~~ connection will be considered ~~to be~~ properly tensioned. ~~However, if~~If the ~~torque~~Inspection Torque turns ~~one or more~~the bolt ~~heads~~ or ~~nuts~~nut, apply the ~~job inspection torque~~Inspection Torque to all bolts in the connection. ~~Retension~~Re-tension and ~~reinspect any bolt whose head or nut turns~~re-inspect all bolts and nuts that turned at this ~~stage~~inspection. The Contractor may~~, however, retension~~ re-tension all the bolts in the connection and resubmit it for inspection, provided ~~DTIs are not over-tensioned or fasteners~~fastener assemblies are not damaged.

Table 00560-3

Nut Rotation from Snug-Tight Condition [1]

		Disposition of Outer Faces of Bolted Parts	
Bolt Length (underside of head to end of bolt)	**Both faces normal to bolt axis**	**One face normal to bolt axis and other sloped not more than 1:20 (beveled washer not used)**	**Both Faces sloped not more than 1:20 from normal to bolt axis (beveled washer not used)**
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters [2, 3]	2/3 turn (1 1/6 turn)	5/6 turn (1 1/2 turn)	1 turn (1 5/6 turn)

[1] Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by one-half turn and less, the tolerance shall be plus or minus 30°; for bolts installed by two-thirds turn and more, the tolerance shall be plus or minus 45°.

[2] No research has been performed by the Research Council on Structural Connections to establish the turn-of-nut procedure for bolt lengths exceeding 12 diameters. Therefore, the required rotation shall be determined by actual test in a suitable tension measuring device according to 00560.29(d-3).

[3] Values in parentheses are twice the rotation as defined in 02560.60(a-1) and 02560.60(a-2) for zinc coated ASTM A 325 bolts only.

Labor

00560.30 Fabricators - Structural steel bridge fabricators shall have an American Institute of Steel Construction (AISC) Major Steel Bridges (Cbr) certification. For fracture critical structures, the fabricator shall also have an AISC Fracture Critical Endorsement (F). All fabricators of earthquake restraints shall have either a current AISC Cbr certification or a Simple Steel Bridge Structures (Sbr) certification.

Construction

00560.40 Members Work:

(a) General - Fabricate members true to line and free from twists, bends and open joints.

(b) End Connection Angles - Fabricate floor beams, stringers and girders having end connection angles to exact length shown, as measured between the heels of the connection angles, with a permissible tolerance of ~~plus~~ + 0 to ~~–~~ − 1/16 inch. Where continuity is required, face end connections. Provide connection angles with a thickness of not less than 3/8 inch, nor less than shown after facing.

(c) Stiffeners - Fabricate end stiffeners of girders and stiffeners intended as supports for concentrated loads to have full bearing (either milled, ground, or on weldable steel in compression areas of flanges, welded as specified) on the flanges to which they transmit load or from which they receive load. Fabricate stiffeners not intended to support concentrated loads, according to paragraph 3.5.1.10 of AWS D1.5, unless specified otherwise.

(d) Abutting Members - Mill, saw-cut or flame cut abutting members carrying compression at joints in trusses, columns and girder flanges, to give a square joint and uniform bearing. At joints not required to be faced, the opening shall not exceed 1/4 inch.

(e) Annealing and Stress Relieving - Perform finished machining, boring and straightening on structural members which are specified to be annealed or normalized subsequent to heat treatment. Normalize and anneal (full annealing) according to ASTM A 941. Maintain the temperatures uniformly throughout the furnace during the heating and cooling so the temperature at no two points on the member will differ by more than 100 °F at any one time.

Make a record identifying the pieces in each furnace charge and show the temperatures and schedule actually used. Provide proper instruments, including recording pyrometers, for determining at any time the temperatures of members in the furnace. Provide the records of the treatment operation to the Engineer.

Stress relieve members, such as bridge shoes, pedestals or other parts that are built up by welding sections of plate together according to paragraph 4.4 of AWS D1.5, when specified.

(f) Facing of Bearing Surfaces - The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall conform to ANSI surface roughness requirements according to ANSI B46.1, Surface Roughness, Waviness and Lay, Part I, and the following table:

Member	Maximum Surface Roughness
Steel slabs	2,000 microinch
Heavy plates in contact with shoes to be welded	1,000 microinch
Milled ends of compression members, milled or ground ends of stiffeners and fillers	500 microinch
Bridge rollers and rockers	250 microinch
Pins and pin holes	125 microinch
Sliding bearings	125 microinch

(g) Pins and Rollers - Turn pins and rollers to the dimensions shown. Make them straight, smooth and free from flaws. Pins and rollers more than 9 inches in diameter shall be forged and annealed carbon-steel shafting. Pins and rollers 9 inches or less in diameter may be cold-finished or forged and annealed carbon-steel shafting.

In pins larger than 9 inches in diameter, bore a hole not less than 2 inches in diameter full length along the axis after the forging has cooled to a temperature below the critical range, under conditions that prevent injury by too rapid cooling, and before annealing.

Provide threads for all bolts and pins for structural steel construction according to ASME B1.1, Unified Inch Screw Threads, Class 2A for external threads and Class 2B for internal threads, except for pin ends having a diameter of 1 3/8 inch, or more, use a thread pitch of 6 threads per inch.

(h) Pin Holes - Bore pin holes true to the specified diameter, smooth and straight, at right angles to the axis of the member and parallel with each other unless otherwise specified. Produce the final surface by a finishing cut.

The diameter of the pin hole shall not exceed that of the pin by more than 0.02 inch for pins 5 inches or less in diameter, or by 0.03 inch for larger pins.

The distance outside-to-outside of end holes in tension members and inside-to-inside of end holes in compression members shall not vary from that specified more than 1/32 inch. Bore holes in built-up members after the fabrication is completed.

(i) Shear Connectors - Fabricate shear connector studs with material, welding and inspection according to Section 7 of AWS D1.5.

00560.41 Repair of Defects - Do not begin the repair of defects in the fabricated material until the proposed corrective procedure has been approved.

00560.42 Cambering - Provide a smooth, unbroken curve or camber over the full length of the member when shown.

Camber roll beams in the fabricating shop by use of heat or hydraulic jacks. The temperature of the heated area shall not exceed 1,200 °F as controlled by pyrometric stick (temperature crayon) or thermometers. Do not quench to accelerate cooling.

Trim web plates of cambered plate girders before assembly.

Camber truss spans according to 00560.46.

00560.43 Shop Assembling:

(a) General - Assemble in the shop the field connections of main members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders and rigid frames with milled ends of compression members in full bearing, and then ream their subsize holes to specified size while the connections are assembled. Use full truss or girder assembly, unless progressive truss or girder assembly, full chord assembly, progressive chord assembly, or complete structure assembly is specified.

Make check assemblies with numerically controlled punched or drilled field connections and template drilled field connections of rolled beam stringers continuous over floor beams or cross frames according to 00560.43(g).

Obtain approval for each assembly, including camber, alignment, accuracy of holes and fit of milled joints before reaming is commenced or before a numerically controlled drilled check assembly is dismantled.

Furnish a camber diagram, prepared by the fabricator, showing the camber at each panel point in the cases of trusses or arch ribs, and at the location of field splices and fractions of span length (quarter points minimum, tenth points maximum) in the cases of continuous beam and girders or rigid frames. When the shop assembly is Full Truss or Girder Assembly or Complete Structure Assembly, show the camber measured in assembly. When any of the other methods of shop assembly is used, show calculated camber.

(b) Full Truss or Girder Assembly - Assemble all members of each truss, arch rib, bent, tower face, continuous beam line, plate girder or rigid frame at one time.

(c) Progressive Truss or Girder Assembly - Assemble, initially for each truss, bent, tower face or rigid frame, all members in at least three connecting panels, but not less than the number of panels in three connecting chord lengths.

Assemble, initially for each arch rib, continuous beam line or plate girder, at least three connecting shop sections.

Make successive assemblies with at least one panel or section of the previous assembly (repositioned if necessary and adequately pinned to assure accurate alignment) plus two or more panels or sections added at the advancing end.

In the case of structures longer than 150 feet, make each assembly not less than 150 feet long regardless of the length of individual continuous panels or sections.

The sequence of assembly may start from any location in the structure and proceed in one or both directions, so long as the preceding requirements are satisfied.

Obtain approval for assemblies consisting of less than three panels or shop sections.

(d) Full Chord Assembly - Assemble, with geometric angles at the joints, the full length of each chord of each truss or open spandrel arch, or each leg of each bent or tower, then ream their field connection holes while the members are assembled, and ream the web member connections to steel templates set at geometric (not cambered) angular relation to the chord lines. Mill at least one end of each web member or scribe normal to the longitudinal axis of the member and accurately locate the templates at both ends of the member from one of the milled ends or scribed lines.

(e) Progressive Chord Assembly - Assemble connecting chord members in the manner specified for Full Chord Assembly and in the number and length specified for Progressive Truss or Girder Assembly.

(f) Complete Structure Assembly - Assemble the entire structure, including the floor system.

(g) Check Assemblies with Numerically Controlled Punched and Drilled Field Connections - A check assembly consists of at least three connecting shop sections, or in a truss, all members in at least three connecting panels, but not less than the number of panels in three connecting chord lengths; that is, the length between field splices. Check assemblies shall be based on the proposed order of erection, joints in bearings, special complex points such as the portals of skewed trusses, and similar considerations, as directed. Check assemblies shall be the first such sections of each major structural type to be fabricated.

Use geometric angles (giving theoretically zero secondary stresses under dead-load conditions after erection) or cambered angles (giving theoretically zero secondary stresses under no-load conditions) as shown or specified.

No match-marking and no shop assemblies other than the check assemblies are required.

If the check assembly fails to demonstrate that the required accuracy is being obtained, further check assemblies may be required at no additional cost to the Agency. Acceptance of the check assembly does not relieve the Contractor of the responsibility for assuring accurate fit-up during erection.

(h) Match-Marking - Match-mark connecting parts assembled in the shop for the purpose of reaming holes in field connections, and furnish a diagram showing such marks to the Engineer.

00560.44 Coatings:

(a) Galvanizing - Galvanize as shown or specified according to 02530.70.

(b) Other Coatings - Unless otherwise shown or specified, prepare and coat all steel surfaces according to Section 00594.

00560.45 Marking and Transporting to Site - Handle members and transport to the Project Site according to 00560.24 and the following:

- Mark each member with an erection mark for identification and furnish an erection diagram showing the erection marks.
- Mark the weight of members weighing more than 6,000 pounds on the member.
- Load structural members on trucks or cars so they may be transported and unloaded without being excessively stressed, deformed or otherwise damaged.
- Ship fasteners (bolts, nuts, and washers) according to 02560.60(a-3).
- Do not allow welding to be done on the steel members for the purpose of transporting anchorage.
- List and describe the contained material plainly on the outside of each shipping container.
- Furnish as many copies of material orders, shipping statements and erection diagrams as directed and show the weights of the individual members on the statements.
- Brace the girders properly and adequately, so as to eliminate cyclic out-of-plane bending stresses in the web gap between the end of stiffener on the web and the girder flange due to cyclic swaying motion in transit. Take care to minimize dynamic loads transmitted to girder support points during transit.
- Furnish the Engineer stamped detail plans of loading, unloading, supporting and bracing of the steel plate girders on trucks or cars for shipment to the Project Site, according to 00150.35. The review will not relieve the Contractor of responsibility for safe transportation of steel members.

00560.46 Erecting:

(a) General - Erect the metalwork, remove temporary construction and do all work required to complete the ~~structure(s),~~structures, including the removal of the old ~~structure(s)~~structures according to Section 00501, if specified.

(b) Methods and Equipment - Before starting the erection work, the erection method proposed and the amount and character of equipment to be used will be reviewed. This review will not relieve the Contractor of the responsibility for the safety of the method or equipment, or from carrying out the work in full according to the plans and specifications. Do not perform work until approval has been obtained.

(c) Falsework - Design, construct, maintain and remove falsework according to 00540.41, 00540.42, and 00540.52. Review of the Contractor's plans will not relieve the Contractor of any responsibility.

(d) Field Inspecting and Testing - All erecting work is subject to the Engineer's inspection. Provide all facilities required for a thorough inspection of the work. Material not previously inspected, as well as previously inspected material, will be inspected after delivery to the construction Site.

(e) Handling and Storing Materials - Handle and store materials at the erection site according to 00560.24 and 00560.45.

(f) Bearings and Anchorages - Test, furnish and place structure bearings according to Section 00582. Construct rockers, hangers and other anchorages made entirely of structural steel according to the following:

- Drill holes for anchor bolts and set them in portland cement grout, or preset them as specified.
- Locate anchors and set rockers or rollers considering variation from mean temperature at the time of setting, and anticipated lengthening of bottom chord or bottom flange due to dead load after setting. As nearly as practical, at mean temperature and under dead load, the rockers and rollers shall stand vertically and anchor bolts at expansion bearings shall center their slots.
- Provide full and free movement of the superstructure at moveable bearings. Make sure it is not restricted by improper setting or adjustment of bearings or anchor bolts and nuts.

(g) Assembling Steel - Handle the material carefully so no parts will be bent, broken or otherwise damaged.

Do not perform hammering which will injure or distort the members.

Prepare bearing surfaces and surfaces to be in permanent contact before the members are assembled.

Assemble the parts accurately as shown, following any match-marks.

Unless erecting by the cantilever method, erect truss spans on blocking that gives the trusses proper camber. Leave the blocking in place until the tension chord splices are completed and all other truss connections are pinned and bolted.

Use fitting-up bolts of the same nominal diameter as the high-strength bolts, and cylindrical erection pins 1/32 inch larger.

Fill 50~~%~~ percent of the holes in splices and field connections with equal numbers of fitting-up bolts and cylindrical erection pins before bolting with high-strength bolts. Fill 75~~%~~ percent of the holes in splices and connections carrying added construction loads during erection with equal numbers of fitting up bolts and erection pins.

Tighten permanent bolts in butt-jointed splices of compression members and in railings after the span, if movable, has been swung.

Perform all field welding according to AWS D1.5 and all interim specifications.

(h) Pin Connection - Use pilot and driving nuts when driving pins. Drive pins so the members take full bearing on them. Screw pin nuts up tight and burr the threads at the face of the nut with a pointed tool.

(i) Misfits - The correction of minor misfits involving small amounts of reaming, cutting, and chipping will be considered a legitimate part of the erection. However, immediately report to the Engineer any error in the shop fabrication or deformation resulting from handling, storage and transportation which prevents the proper assembling and fitting up of parts by the moderate use of drift pins, or by a moderate amount of reaming and slight chipping or cutting. Have the correction method approved. Make the correction in the Engineer's presence. The Contractor shall be responsible for all misfits, errors and injuries. Make the necessary corrections and replacements as approved by the Engineer.

Finishing and Cleaning Up

00560.70 Finish (Non-Coated Weathering Steel Only) - Sandblast all exposed surfaces of AASHTO M 270 (ASTM A 709), Grade 50W non-coated weathering steel, according to SSPC-SP6, Commercial Blast Cleaning, SSPC's Steel Structures Painting Manual. The appearance of the blast-cleaned surface shall approximate Pictorial Standard Sa 2 of SSPC-VIS 1, Pictorial Surface Preparation Standards for Painting Steel Surfaces, except no mill scale particles will be allowed; only rust or mill scale stains down in the profile will be allowed. The use of acids to remove scale and stains in the field is not allowed.

Promptly clean exposed surfaces of steel contaminated with stains, oil or foreign material after the above sand blasting cleaning process, as directed, to preserve conditions for uniform weathering of steel.

Measurement

00560.80 Measurement - No measurement of quantities will be made for work performed under this Section. Estimated quantities of structural steel will be listed in the Special Provisions.

00560.81 Miscellaneous Metal - Minor metal parts such as access hole covers, frames, ladders, hangers, anchor bolts, scuppers, conduits, ducts, bearing devices and other structural steel shapes, unless otherwise provided, will be classified as structural steel.

The weight of miscellaneous metal will be included in the estimated quantity of structural steel specified.

Payment

00560.90 Payment - The accepted quantities of ~~structural steel~~work performed under this Section will be paid for at the Contract ~~lump sum amount~~unit price, per unit of measurement, for the ~~item "~~following items:

Pay Item	Unit of Measurement

(a) Steel Plate Girder ..... Lump Sum
(b) Steel Plate Girder with Haunch ..... Lump Sum
(c) Horizontal Curved Steel Plate Girder ..... Lump Sum
(d) Steel Box Girder ..... Lump Sum
(e) Trapezoidal Steel Box Girder with Haunch ..... Lump Sum
(f) Horizontal Curved Steel Box Girder ..... Lump Sum
(g) Steel Rolled Beam ..... Lump Sum
(h) Structural Steel". Maintenance ..... Lump Sum

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- bolts, studs or bearing devices made entirely of structural steel (such as rockers and hinges)
- fabricating, transporting and erecting the structure(s)structures
- furnishing, erecting, and removing falsework
- preparing and coating

Section 00570 - Timber Structures

Description

00570.00 Scope - This work consists of furnishing and installing timber and glue -laminated timber in bridges and other timber structures as shown or directed. Timber and lumber will be identified as timber in this Section.

The terms "hardware" and "fastenings" include nails, spikes, bolts, washers and nuts, dowels, lag screws, timber connectors, truss rods and shoes, and all other metal used in timber construction.

Materials

00570.10 Materials - Furnish materials meeting the following requirements:

Coatings for Steel	00594
Coatings for Timber	02210
Connectors and Fasteners	02150
Driven Piles	00520
Galvanizing	02530.70
Glued Laminated Timber	02140
Preservative Treatment	02190
Timber	02130

When preservative treatment of timber is required, the plans or Special Provisions will indicate the type and kind of treatment.

00570.11 Metal Parts - Hot-dip galvanize all hardware and all other metal parts after fabrication according to 02530.70 or coat all hardware and all other metal parts after fabrication according to Section 00594.

00570.12 Timber Fabrication:

- Use either split ring or shear plate timber connectors as specified. Install in precut grooves of dimensions as recommended by the manufacturer.
- Fabricate all members including holes, grooves, and special cuts, requiring timber connectors before treatment.
- When prefabricating from templates or shop details, bore bolt holes not more than 1/16 inch from specified location and perpendicular to the face of the timber. Bore bolt holes according to 00570.41.
- Submit unstamped working drawings for review, according to 00150.35, for prefabricated material before fabrication.

00570.13 Timber Storage - Store timber on the site in orderly piles or stacks. Provide protection from the weather or direct sun by a suitable covering.

Open-stack untreated timber on supports at least 12 inches above the ground surface and sticker to permit air circulation between the tiers and courses. Provide 1/2 inch thick by 1 1/2 inch wide stickers. Place stickers with the wide face bearing against the timber and at a spacing that provides adequate support for the members for their full length. Align stickers vertically to prevent uneven support and warp during storage.

Store timber after fabrication in a manner that prevents alignment changes of the members before assembly.

Store, protect, and handle glue -laminated timber according to the American Institute of Timber Construction AITC 111 "Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection".

Construction

00570.40 Treated Timber - Handle treated timber that prevents dropping, breaking of outer fibers, bruising, or penetrating the surface with tools. Use nylon slings to handle treated timber. Do not use cant hooks, peaveys, pikes or hooks.

When treated timbers are to be placed in a marine or brackish environments, field treated and untreated cuts, borings and other joint framings will not be allowed below high-water elevation.

Do not cut, frame, or bore treated timber after treatment unless necessary. If untreated wood is exposed by cutting, planing, sanding, or any other means, trim all cuts and abrasions in timber, and cover with two applications of a field preservative according to 02190.30.

Pour field preservative into all holes bored after treatment, or treat the holes with field preservative with an approved pressure hole treater. Treat all unfilled holes with field preservative and plug with treated plugs. Field treat according to 02190.30 and the recommendations of the manufacturer.

When forms or temporary braces are attached to treated timber with nails or spikes, fill the resulting holes by driving larger size galvanized nails or spikes flush with the surface, or plug holes as required for unfilled bolt holes.

00570.41 Fasteners:

- Bore holes for drift pins, drift bolts, and dowels either 1/32 inch smaller than or the same size of the actual pin diameter.
- Bore holes for bolts 1/32 inch to 1/16 inch larger than the bolt diameter. Accurately align holes in main members and side plates. Do not force drive bolts.
- Bore holes for truss rods with a bit 1/16 inch larger than the rod.
- Drive nails and spikes with sufficient force to set the heads flush with the surface of the wood. Deep hammer marks in wood surfaces are evidence of poor work and sufficient cause for removal of damaged material.
- Bore holes for lag screws in two parts as follows:
  - Bore the lead hole for the shank the same diameter as the shank and the same depth as the length of the unthreaded shank.
  - Bore the lead hole for the threaded portion a diameter equal to approximately two-thirds of the shank diameter.
- Use a malleable iron washer of the size and type designated under all bolt heads and nuts in contact with wood except under button-head bolt heads.
- Lock all nuts after final tightening with a second nut or use self-locking nuts.
- Countersink where smooth faces are required. Coat recesses formed for countersinking with field preservative according to 02190.30 and the manufacturer's directions. After the bolt or screw is in place, fill horizontal recesses with asphalt roofing cement.
- Install all fasteners and connections according to the manufacturer's recommendations.

00570.42 Framing - Cut and frame all timber to a close fit so that the joints have even bearing over the entire contact surfaces. Shimming will not be allowed.

(a) Pile Bents - Drive piles according to Section 00520. No shimming on tops of piles will be allowed.

Select the piles for any one bent as to size, to avoid undue bending or distortion of the sway bracing.

Distribute the piles of varying sizes to secure uniform strength and rigidity in the bents of any given structure.

(b) Framed Bents - Provide true and even bearing of sills on pedestals or piles. Finish concrete pedestals so the sills or posts support framed bents with even bearing.

Fasten posts to sills as shown. Remove all earth from contact with all timber so there will be free air circulation around them.

(c) Caps - Place timber caps to obtain an even and uniform bearing over the tops of the supporting posts or piles.

(d) Bracing - Bolt or lag screw intermediate intersections of bracing.

00570.43 Stringers - Place stringers according to the following:

- Knots near edges will be in the top portions of the stringers.
- Outside stringers may have butt joints, but lap interior stringers to take bearing over the full width of the floor beam or cap at each end. Do not extend the stringer end more than 6 inches beyond the floor beam or cap.
- Separate the lapped ends of untreated stringers at least 1/2 inch and securely fasten where shown or specified.
- Stagger joints when stringers are two spans in length.
- Frame cross-bridging between stringers as shown, with full bearing at each end against the sides of stringers, and securely toe-nail with at least two nails in each end.

00570.44 Decking - Unless otherwise shown or specified, construct decking with 4 inch x 12 inch planking and covering materials.

(a) Planking - Provide planking that is surfaced on four sides (S4S).

Place planking heart side down with 1/4 inch opening between planks for seasoned material and with tight joints for unseasoned material. Spike planks securely to each stringer with a minimum of one 3/8 inch x 8 inch spike placed 3 inches in from each edge.

(b) Covering Materials - Cover the planking with one of the following:

- 2 inch x 2 inch timber strips, placed transverse to the planking and nailed with 16d galvanized common nails at 12 inch centers. Cover deck with a warranted spray waterproofing membrane according to Section 00591 and a Level 2, 1/2 inch ~~Dense HMAC~~ACP wearing surface according to ~~Section~~Sections 00744 and 00745, as applicable; or
- 1 inch thick tongue and groove structural CD exterior grade plywood. Nail the plywood with face grain parallel to stringers using 10d galvanized or zinc coated ring shank nails. Place nails at 6 inch centers along all edges and 12 inch maximum centers intermediate. Fasten expanded metal grillage with a minimum opening of 1/4 inch and a minimum thickness

of 1/8 inch to the top of the plywood for the entire roadway area. Minimum fastening shall be at 12 inch centers each direction using 8d galvanized common nails. Cover deck with a warranted spray waterproofing membrane according to Section 00591 and a Level 2, 1/2 inch ~~Dense HMAC~~ACP wearing surface according to ~~Section~~Sections 00744 and 00745, as applicable.

00570.45 Wheel Guards and Railings - Frame wheel guards and railing as shown, and erect true to line and grade.

Unless otherwise specified, provide wheel guards, rails, and rail posts that are surfaced on four sides (S4S).

Lay wheel guards in sections not less ~~then~~than 12 feet long unless otherwise shown.

For trusses, build railings after the removal of the falsework and the adjustment of the trusses to correct alignment and camber.

00570.46 Trusses - Finished trusses shall show no irregularities of line. Chords shall be straight and true from end to end in horizontal projection and show a smooth curve through panel points conforming to the correct camber. Fit all bearing surfaces accurately. Uneven or rough cuts at the points of bearing will be cause for rejection of the piece containing the defect.

00570.47 Coating - When specified, coat timber bridges according to the manufacturer's recommendations.

Measurement

00570.80 Measurement - The quantities of all timber, except piling and glue ~~-~~laminated timber, incorporated into the permanent, finished structure, will be measured on the volume basis, based on the nominal dimensions of the members and the actual dimensioned length. No allowance will be made for waste.

The quantities of glue ~~-~~laminated timber members will be measured on the volume basis, based on the net dimensions of the members.

Driven piles will be measured according to 00520.80.

Warranted spray waterproofing membrane will be measured according to 00591.80.

Asphalt concrete wearing surface will be measured according to 00744.80 and 00745.80, as applicable.

Payment

00570.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Timber and Lumber	MFBM
(b) Glued Laminated Timber	MFBM

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Driven piles will be paid for according to 00520.90.

Warranted spray waterproofing membrane will be ~~pair~~paid for according to 00591.90.

Asphalt concrete wearing surface will be paid for according to 00744.90 and 00745.90, as applicable.

No separate or additional payment will be made for hardware, fastenings, preservative treatment, and coatings.

Section 00581 - Bridge Drainage Systems

Description

00581.00 Scope - This work consists of furnishing and installing metal deck drains, drain pipe and appurtenances for bridges as shown, specified or directed.

Materials

00581.10 Materials - Furnish steel pipe of standard weight meeting the requirements of ASTM A 53 and galvanized after fabrication according to AASHTO M 111 (ASTM A 123).

Furnish deck drains, hangers, clamps, and other incidentals meeting the requirements of Section 02530 and Section 02560.

Construction

00581.40 General - To prevent movement during concrete placement, support the pipe and deck drains by ties and other approved devices according to 00530.41.

00581.42 Appurtenances - Provide a watertight connection to the deck drains in the bridge deck as shown or directed.

00581.50 Test Bridge Drainage Systems - Test bridge deck drains and pipe connections to the storm drain system according to Section 00445 to ensure that the drains and drain pipe are water tight and free of obstructions.

Measurement

00581.80 Measurement - The quantities of bridge deck drains will be measured on the unit basis of each deck drain installed.

Payment

00581.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per each, for the item "Bridge Drains".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for drain pipe connected to bridge drains or for water used in testing the drain systems.

Section 00582 - Bridge Bearings

Description

00582.00 Scope - This work consists of ~~the following:~~furnishing and installing composite bridge bearings, elastomeric bridge bearings, and rockers and hangers for bridges as shown, specified, or directed.

~~**(a) Composite Bearings** - Design, fabricate, test and install composite bearings according to the latest AASHTO LRFD Design Specifications and Section 02570. The bearing fixity (fixed bearing, guided bearing, nonguided bearing) and restrictions about type of bearing (disc, fabric pad, pot, spherical) will be shown or specified.~~

~~**(b) Elastomeric Bearings** - Furnish, test, and install elastomeric bearings according to the AASHTO LRFD Construction Specifications and Section 02571.~~

~~**(c) Rockers and Hangers** - Furnish and install bearings, such as rockers and hangers, which consist entirely of structural steel, according to Section 00560.~~

00582.02 Definitions:

Composite Bearing - Bearing having a rotational element between an upper and a lower unit. This includes disc bearings, fabric pad bearings, pot bearings and spherical bearings.

Disc Bearing - Composite bearing whose rotational element is comprised of a polyether urethane disc with an upper and lower unit.

Elastomeric Bearing - Bearing consisting of a single layer of elastomer (plain) or of several layers of elastomer alternated with steel plates (reinforced).

Fabric Pad Bearing - Composite bearing whose rotational element is a preformed fabric pad.

Fixed - Restrained against all horizontal structural movement.

Guide Bars - The elements that restrain the lateral movement of a sliding bearing.

Guided - Able to accommodate structural movement in a specified horizontal direction.

Nonguided - Able to accommodate structural movement in all horizontal directions.

Pot Bearing - Composite bearing whose rotational element is a piston supported on an elastomeric disc, totally confined within a base pot cylinder.

Spherical Bearing - Composite bearing whose rotational element consists of an upper plate with a spherical concave bottom surface and a lower plate with a spherical convex top surface.

00582.03 Design - Design and fabricate composite bridge bearings according to the latest edition of the AASHTO LRFD Design Specifications.

Materials

00582.10 Materials - Furnish composite bridge bearing materials meeting the requirements of Section 02570. Furnish elastomeric bridge bearings from the QPL and meeting the requirements of Section ~~02570 and Section~~ 02571~~, as applicable~~.

Furnish rockers and hangers, constructed entirely of structural steel, according to Section 00560.

00582.20 Composite Bearings - ~~Unless otherwise shown, use~~Provide only one type of composite bearing ~~per~~from the QPL for each bridge, subject to the following requirements:

- Make composite bearings, including all plates except distribution plates and masonry plates, removable and replaceable.
- Provide rotational elements between upper and lower units to meet the following:
  - **Upper Unit** - The upper unit shall consist of a distribution plate that is permanently attached to the superstructure and a sole plate attached to the distribution plate with cap screws. For a guided or nonguided bearing, a stainless steel sheet shall be welded to the bottom surface of the sole plate.
  - **Lower Unit** - The lower unit shall consist of a masonry plate permanently anchored to the structural support and a base plate attached to the masonry plate with cap screws. A separate masonry plate and base plate are not necessary for fabric pad bearings fabricated as outlined in 00582.27, third paragraph.
  - **Bearing-to-Base Connection:**
    - The base pot of a pot bearing, the lower bearing plate of a disc bearing, or the convex plate of a spherical bearing shall be welded to the base plate.
    - For guided or nonguided bearings, a polytetrafluoroethylene (PTFE) sheet shall be recessed into and bonded to the top surface of the piston of a pot bearing, the upper bearing plate of a disc bearing, the top surface of the concave plate of a spherical bearing, or a steel backing plate bonded to the top surface of a fabric pad forming a sliding surface with the stainless steel surface of the sole plate.
    - For fixed bearings, the piston of a pot bearing, the upper bearing plate of a disc bearing, or the concave plate of a spherical bearing shall be welded to the sole plate.

  Provide bearings that accommodate the loads, movements, and rotations as shown.

  Use schematic drawings, and/or details of bearings shown, to describe the attachment of the upper unit to the superstructure, and the attachment of the lower unit to the substructure.

00582.21 Disc Bearings - Design disc bearings according to the following:

- The shear restriction mechanism shall allow free rotation but prevent any shear being applied to the rotational element.
- Each guided bearing shall resist the total horizontal load at the bent or hinge where it is located.

00582.25 Composite Bearings with Polytetrafluoroethylene ~~(PTFE)~~ Sliding Surface:

(a) ~~PTFE~~Polytetrafluoroethylene Sliding Surfaces - Recess PTFE 1/16 inch into the material it is bonded to for all composite bearings.

Bond PTFE to the steel substrate sufficiently to develop a horizontal force as shown and not less than 10~~%~~ percent of the vertical design capacity shown, in addition to the shear force developed as a result of the natural bearing friction shear force.

(b) ~~PTFE~~Polytetrafluoroethylene Rotational Surface for Spherical Bearings - Use only woven PTFE having a minimum thickness of 1/8 inch. The PTFE shall be recessed 1/16 inch into the spherical element.

PTFE fabric minimum thickness shall be 1/16 inch when measured according to ASTM D 1777.

(c) Stainless Steel Sliding Surfaces - Provide a flat stainless steel sliding surface which completely covers the PTFE surface in all operating positions, plus at least 2 inches more in every direction of possible movement.

Provide a spherical stainless steel rotational surface attached to the convex surface of the spherical convex plate of each spherical bearing so that it completely covers the convex surface of the plate.

00582.26 Guide Bars for Composite Bearings - Provide a sliding surface between the guide bars and the guide element made of polished stainless steel against virgin PTFE. The virgin PTFE shall be bonded and mechanically fastened to the guide bars. Provide guide bars that:

- Resist the horizontal design forces on the bearing, but not less than 10~~%~~ percent of the vertical design load of the bearing.
- Resist the total horizontal load at the bent or hinge where it is located. Do not include the resistance due to bearing friction as part of the horizontal load capacity of guided bearings and fixed bearings.
- Are Integral and machined from a solid plate, or attached by welding or with cap screws, or fabricated from a single steel plate.
- Have a space equal to 3/16 inch plus or minus 1/16 inch to the guided member.
- Allow the guided member to be always within the guides at all points of translation and rotation of the bearing. Avoid guiding the member off the fixed base or any extension of it where transverse rotation is anticipated.

00582.27 Sole, Base, Distribution, and Masonry Plates for Composite Bearings - Make the bottom surface of sole plates flat and level. Make the top surface flat, and sloped as required to mate with the bottom surface of the distribution plate.

Use 3/4 inch minimum plates, except sole plates may taper to 5/8 inch at the thinnest edge.

For fabric pad bearings, keeper bars at least 1/4 inch thick shall be fastened to the top surface of the base plate, around the perimeter of the fabric pad, with high-strength cap screws. Provide a gap at all bar ends to allow drainage.

Provide studded anchors or threaded bolts, as shown or specified, to anchor the masonry plates to the supported and supporting members. Locate anchoring devices to avoid conflict with metal reinforcement and prestressing systems.

00582.30 Fabrication - Fabricate bearings according to the reviewed working drawings and these Specifications.

(a) Working Drawings - Submit unstamped working drawings according to 00150.35 for both composite bearings and elastomeric bearings.

(1) Composite Bearings - For composite bearings, include:

- Complete details of the anchor layout

- Plan and elevation of the bearing showing dimensions and tolerances
- Complete details of all components with sections showing all materials incorporated into the bearing
- All ASTM or other material designations
- Vertical and horizontal force capacity
- Compressive stresses on all sliding surfaces, and on elastomeric polyether urethane and cotton duck surfaces, at maximum and minimum design loads
- Rotational capacity
- Translation capacity for guided and nonguided bearings
- Instructions for installation of the bearing

(2) Elastomeric Bearings - For elastomeric bearings, include:

- The overall dimensions of the bearings
- The durometer hardness of the elastomer and the ASTM designation of reinforcing materials, if any
- The thicknesses of the components of reinforced bearings and the cover over edges of reinforcements

(b) Minimum Requirements for Composite Bearings:

(1) Edges - Grind edges of all parts of the bearing so that sharp edges are eliminated.

(2) Welding - Perform all welding and inspection of welding for structural steel according to 00560.26.

(c) Special Requirements for Horizontal Capacity of Composite Bearings - Submit stamped calculations supporting the design for horizontal force capacity, according to 00150.35. Calculations are not required when the design horizontal capacity is less than, or equal to, 10~~%~~ percent of the design vertical capacity. A horizontal proof load test report may be submitted instead of engineer's calculations. See ~~00257~~02570.20(b) for test requirements.

00582.31 Disc Bearings - Fabricate upper and lower bearing plates as follows:

- Connect the lower bearing plate to base plate by means of a fillet weld around entire perimeter of the lower bearing plate.
- For a fixed bearing, connect upper bearing plate to the sole plate by means of a fillet weld around the entire perimeter of upper bearing plate.

00582.32 Fabric Pad Bearings - Fabricate fabric pad bearings according to the following:

(a) Steel Backing Plate - Minimum thickness of the steel backing plate shall be 3/8 inch.

Bond the backing plate to the top surface of the fabric pad under controlled conditions and according to the written instructions of the manufacturer of the adhesive system specified by the fabric pad manufacturer.

Finish the surface of steel recess to a surface roughness of 250 microinches or better, and to Class A flatness:

(b) Fabric Pad - Maximum allowable bearing pad thickness is 4 inches. For pads over 2 inches thick, place an 11 gauge steel shim at mid-depth.

00582.33 Pot Bearings - Fabricate pot bearings according to the following:

(a) Pot - Fabricate the pot from one solid plate by machining.

Finish the top and bottom surfaces of the pot cylinder to Class A flatness.

Connect the pot cylinder to the base plate by means of a fillet weld around the entire perimeter of the pot cylinder.

(b) Piston - Fabricate the piston from one solid plate by machining.

Finish the top surface to Class A flatness.

Finish the bottom surface to Class C flatness.

For a fixed bearing connect the piston to the sole plate by means of a fillet weld around the entire perimeter of the piston.

(c) Elastomeric Disc - Make the disc in one piece.

Recess the upper edge of the elastomeric disc to accommodate the flat brass sealing rings.

Lubricate the disc with a material compatible with the elastomer.

00582.34 Spherical Bearings - Fabricate spherical bearings according to the following:

(a) Spherical Concave Plate:

Finish top surface to a roughness of 125 microinches or better, and Class A flatness.

Fabricate the concave radius of the bottom surface to have a positive tolerance not to exceed 0.010 inch according to ANSI Y14.5.

For a fixed bearing, connect to the sole plate by means of a fillet weld around the entire perimeter of top surface of spherical concave plate.

(b) Spherical Convex Plate - Fabricate the top convex stainless surface from one of the following:

- Solid stainless steel ASTM A 240, Type 304 or 304L
- Stainless steel weld overlay a minimum of 3/32 inch thick

Fabricate convex radius of the top surface to have a negative tolerance not to exceed 0.010 inch according to ANSI Y14.5.

Finish the top surface to a roughness of 20 microinches or better, and other surfaces to a roughness of 250 microinches or better.

Finish the bottom surface to Class B flatness.

Connect to base plate by means of a fillet weld around entire perimeter of bottom surface of spherical convex plate.

00582.35 Composite Bearings with Polytetrafluoroethylene ~~(PTFE)~~ Sliding Surfaces:

(a) ~~PTFE~~Polytetrafluoroethylene Sliding Surfaces - Bond PTFE to steel substrate under controlled conditions and according to the written instructions of the manufacturer of the adhesive system specified by the PTFE manufacturer.

After completion of the bonding operation, the PTFE surface shall be smooth and free of bubbles.

(b) Stainless Steel Sliding Surfaces - Attach stainless steel to steel substrate by a seal weld around entire perimeter of stainless steel sheet. Clamp stainless steel sheet down to have full contact with the steel substrate during welding. Fabricate so welds do not protrude beyond the sliding surface of the stainless steel.

00582.36 Guide Bars for Composite Bearings - Construct guide bars parallel to the surface on which they bear and to other guide bars to within a tolerance of plus or minus 1/32 inch for the full length of the bar.

The tolerance for section dimensions is plus or minus 1/16 inch.

If guide bars are welded to the sole plate, weld before attaching the stainless steel surface.

00582.38 Coatings for Steel Bearings - Coat all exposed steel surfaces, except stainless steel, according to Section 00594.

00582.39 Elastomeric Bearings - Fabricate elastomeric bearings according to the following:

(a) Pads - Pads 1/2 inch and less in thickness shall be made entirely of elastomer. Pads over 1/2 inch in thickness shall consist of alternate laminations of elastomer and metal.

(b) Pad Sizing - Mold pads individually to the sizes required. No shearing to size or drilling of holes will be allowed except pads 1/2 inch and less in thickness may be sheared.

(c) Tolerances and Finishes - Tolerances and finishes shall be according to ~~00257~~02571.20(d).

00582.40 Shipping and Handling - Protect all bearings from damage during shipment, and keep them dust-free. Protect composite bearings as follows:

- Fully assemble each bearing at the manufacturing plant and deliver to the construction site as a complete unit ready for installation.
- Mark centerlines on the sole plate and base plate for checking alignment in the field.
- Hold bearings together with removable restraints so the sliding surfaces are not damaged.
- Ship and store bearings in lightproof, moisture-proof and dustproof packages.

Construction

00582.50 Installation - Use only one type of bearing on any one bridge unless shown, specified or directed otherwise.

(a) Composite Bearings - Install composite bearings as follows:

- Obtain approval of the bearing assembly proposed for use before constructing the upper portions of the supporting structure so bearing elevations may be properly determined.

- Before constructing bridge bearing seats, inform the Engineer in writing, of the total bearing thickness.
- Do not place bridge bearings on concrete bearing areas that are irregular or improperly prepared.
- Install bearings level and according to the manufacturer's recommendations, subject to these Specifications.
- Install bearings in exact positions, and with full and even bearing.
- Protect the sliding surfaces of PTFE bearings from contact with concrete or other foreign matter.
- To prevent gouging and contamination, install bearing with the stainless steel surface on top of the PTFE interface.

(b) Elastomeric Bearings - Construct bearing seats for elastomeric bearings parallel to the bottom surfaces of the members which will bear on them. Install as follows:

- Set elastomeric bearing pads directly on the concrete pad surface.
- Provide for a uniform bearing over the entire area of the bearing seat and over the entire area of the superstructure member in contact with the bearing pad.
- Keep pads in correct position during erection of superstructure members.

(c) Cleanup - Remove all forms and debris that interfere with the free action of the bearing assemblies.

Measurement

00582.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Composite Bearings - Composite bearings will be measured on the unit basis, of bearing devices in place which includes all components from the bearing seat attachment through the superstructure attachment.

(b) Elastomeric Bearing Pads - Elastomeric bearing pads will not be measured.

Payment

00582.90 Payment - The accepted quantities of bridge bearings will be paid for according to the following:

(a) Composite Bearings - Composite bearings will be paid for at the Contract unit price, per each, for the item "Bearing Devices, Bent ___".

The bent number will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary for complete the work as specified.

No separate or additional payment will be made for designing, fabricating, and testing composite bearings.

(b) Elastomeric Bearing Pads - No separate payment will be made for elastomeric bearing pads. This item is included in one or more of the listed items.

Section 00583 - Electrical Conduit In Structures

Description

00583.00 Scope - This work consists of furnishing and installing electrical conduit in structures as shown or as directed.

Materials

00583.10 Materials - Furnish galvanized rigid metal or intermediate metal conduit meeting the requirements of 02920.10, and nonmetallic schedule 40 conduit meeting the requirements of 02920.11. Furnish other materials meeting the requirements of Section 00960 and Section 02920.

Construction

00583.40 General - Install conduit as shown and specified, according to the applicable portions of 00530.41 and Section 00960.

Install galvanized steel conduit on all runs externally attached to structures, and all runs stubbing out of the structure or entering conduit expansion devices. Where nonmetallic conduit is installed elsewhere in the run, the conduit segment stubbing out or entering the expansion device shall have a minimum length of 5 feet of galvanized rigid metal embedded within the concrete.

Install embedded conduit in concrete members with 2 inch clearance from the nearest face of concrete.

Measurement

00583.80 Measurement - The quantities of electrical conduit in structures will be measured on the length basis, including the stub-outs if shown.

Payment

00583.90 Payment - The accepted quantities of electrical conduit in structures will be paid for at the Contract unit price, per foot, for the item " ____ inch Electrical Conduit".

The size of the conduit will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for junction boxes, cabinets, expansion joints, fittings, or fasteners.

Section 00584 - Elastomeric Concrete Nosing

Description

00584.00 Scope - This work consists of furnishing and placing elastomeric concrete nosing to form a bulkhead at bridge ends or at expansion joints, including cleaning and preparing the concrete or steel surfaces as shown and specified.

Materials

00584.10 Materials - Furnish elastomeric concrete nosing using materials from the QPL and the following:

Provide materials delivered in their original, undamaged containers bearing the manufacturer's label with the following information:

- Product name
- Component part
- Name and address of manufacturer
- Date of manufacture
- Use-by date
- Batch number
- Mixing ratio

Provide sufficient materials in storage at the site prior to beginning construction to complete the entire elastomeric concrete nosing as detailed on the plans or as directed. Store the materials to prevent damage by the elements and to ensure the materials maintain their original quality.

Store the materials so that the storage space is dry and maintains a temperature as recommended by the manufacturer. Use only stored materials that meet these requirements at the time of use.

If used, the promoter/initiator for the methacrylate resin may consist of a metal drier and peroxide. Do not mix the metal drier directly with the peroxide. Store the containers so that no leakage from one material contacts the containers of the other materials.

When making repairs to or filling voids in the existing deck, use epoxy from the QPL.

Equipment

00584.20 Equipment - Use equipment recommended by the product manufacturer and approved by the Engineer.

Labor

00584.30 Manufacturer's Representative - Provide a manufacturer's representative on-site during the installation of the elastomeric concrete nosing. The manufacturer's representative shall be either someone independent of the Contractor's work force or a member of the Contractor's work force that possesses certification from the manufacture that the Contractor's representative has the knowledge, skills, and training to install the elastomeric concrete nosing. Discuss the work to be done with the manufacturer's representative to review the methods of installation and the equipment needed before beginning the work.

The representative shall advise both the Engineer and the Contractor on proper installation procedures to assure correct installation of the elastomeric concrete nosing.

Mix, place, and cure the elastomeric concrete nosing according to the recommendations of the manufacturer's representative.

Construction

00584.40 General - Construct elastomeric concrete nosing according to the following:

(a) Training - Use installers trained in application methods and in the health and safety requirements specific to the materials used.

(b) Safety - Make available to workers any manufacturer's safety precautions for hazardous chemicals. Ensure that all workers wear appropriate impermeable protective clothing when using hazardous chemicals.

(c) Weather Conditions at Time of Installation - Do not proceed with installation until the weather conditions meet the requirements of the manufacturer's representative.

00584.41 Surface Preparation - Ensure that all surfaces to receive elastomeric concrete nosing material are sound, dry, clean, frost free, and sand blasted at the time of nosing installation. Sandblast steel contact surfaces to SSPC-10, "Near-White Blast Cleaning", immediately before constructing the nosing. Prepare the deck surface according to these Specifications and the material manufacturer's recommendations.

00584.42 Existing Concrete Repair - Perform existing concrete repair before installing elastomeric concrete nosing or expansion joints. Repair the expansion joint edges or concrete deck surface as shown and the following:

- Remove all cracked, spalled, and unsound concrete from the expansion joint area, without damaging existing reinforcement, and replace with elastomeric concrete. At armored corners, weld damaged areas of steel armoring, and epoxy-inject all voids left by removal of unsound concrete. Replace existing armor as directed. Complete welding of existing armor prior to epoxy injection.
- Remove existing expansion joint material and reconstruct the joint edges as shown. Remove all existing joint anchorage material from the joint areas, as required for installation of new elastomeric concrete nosing.

00584.43 Elastomeric Concrete Placement - When an asphaltic concrete overlay is to be used as the wearing surface, place a bond breaker on the area where the concrete nosings are to be constructed before placing the asphaltic concrete overlay over the bridge deck joints. After the overlay is placed, sawcut the overlay to the width shown on the plans, remove the overlay material in the joint area and construct the elastomeric concrete nosing.

Prepare the elastomeric concrete nosing material by mixing the aggregate at the recommended temperature with the mixed binder. Clean and dry the bonding surfaces and prepare joint surfaces according to the manufacturer's recommendations. Place the properly mixed elastomeric concrete into the prepared area on each side of the expansion joint. Compact and trowel the elastomeric concrete to the required shape.

Form and cast the elastomeric concrete nosing to smoothly match the surface of the finished roadway. Finish the surface to a moderately rough texture such as that produced by a wood float.

Protect the elastomeric concrete nosing material from damage, and allow the nosing to cure properly prior to opening the work area to traffic. Do not open up to traffic without the approval of the manufacturer's representative.

~~**00584.75 Warranty** - Provide a manufacturer's warranty that the elastomeric concrete will not delaminate, debond, rut, or otherwise fail to perform for two years. Acts of god, or failures adjacent to the installation would not be included. The manufacturer will replace or repair the installation using specification materials.~~

~~The Warranty period will start on the date the Engineer accepts the work and authorizes final payment.~~

~~The Warranty shall recite that the manufacturer is required to repair or replace, at the discretion of the Engineer, all elastomeric joint nosings that fail during the warranty period at no additional cost to the Agency. The repairs shall be made within six months of the Agency's written request to do so.~~

~~Perform Warranty repair work when weather permits. At the discretion of the Engineer, temporary repairs may be required at the manufacturer's expense to protect traffic until permanent repairs can be made.~~

Measurement

00584.80 Measurement - The quantities of elastomeric concrete nosing will be measured on the length basis, from face of curb to face of curb taken along the centerline of the joint, between the outer limits of the installed material. Only one measurement will be taken along each installed joint, regardless of the number of recesses, openings, or voids filled with the elastomeric concrete nosing material.

The estimated quantities of elastomeric concrete nosing ~~is~~and elastomeric concrete nosing repair are based on a nominal depth of 2 inches.

The quantities of elastomeric concrete nosing repair deeper than 2 inches will be measured on the volume basis ~~to the nearest 0.05 cubic yard~~.

Joint seal material will be measured according to 00585.80.

Payment

00584.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Elastomeric Concrete Nosing	Foot
(b) Repair Elastomeric Concrete Nosing	Foot
(c) Elastomeric Concrete Nosing Material for Repair	Cubic Yard

Item (a) includes elastomeric concrete nosing installed to the depths shown.

Item (b) includes elastomeric concrete nosing repair installed to a nominal depth of 2 inches.

Item (~~b~~c) includes materials only for concrete nosing repair depths greater than 2 inches.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

~~Payment for the elastomeric concrete nosing will be limited to 75% of the amount due until the Agency has received the signed warranty.~~

Joint seal material will be paid for according to 00585.90.

No separate or additional payment will be made for providing the manufacturer's representative ~~or for furnishing the warranty~~.

Section 00585 - Expansion Joints

Description

00585.00 Scope - This work consists of ~~the fabrication, joint preparation, and installation of~~fabricating, preparing, and installing expansion joints as shown or specified.

00585.01 Definitions:

Armored Corner - Steel armoring to protect the vertical edges of a joint~~ opening. The armor may be steel angles or steel shapes~~.

Asphaltic Plug ~~Joint~~Seal - A ~~closed expansion and contraction~~sealed joint~~ system~~ composed of aggregate and flexible binder material placed over a steel bridging plate.

Closed ~~Expansion~~ Joint - A sealed or filled joint ~~in which a seal material is placed~~designed to prevent water ~~or~~and debris from ~~entering~~passing through the joint.~~ This includes poured joint seals, preformed compression joint seals, asphaltic plug joints, performed strip seal systems, and modular expansion joint systems.~~

Compression Seal - A preformed elastomeric device that is precompressed in the gap of a joint.

Edgebeam - Steel armoring to protect the vertical edges of a joint opening including recesses to accept elastomeric seals.

Filled Joint - A joint using a preformed expansion joint filler, poured joint filler, traffic loop sealant, or a combination of these materials.

~~**Modular Expansion**~~**Open Joint**~~ System~~ - A ~~closed expansion and contraction~~ joint ~~using a series of continuous preformed polychloroprene strip seals inserted into steel shapes~~designed to ~~seal~~allow water and debris to pass through the joint.

Poured ~~Joint~~ Seals - A ~~closed expansion and contraction~~ seal made of materials that remain flexible which is poured into the gap of a joint ~~sealed with a rapid cure~~and adheres to the sides of the gap.

Sealed Joint - A joint using a compressible or expandable seal including asphaltic plug seals, compression seals, poured ~~joint sealant~~seals, and strip seals.

~~**Preformed Compression Joint Seal**~~**Strip Seals** - A ~~closed expansion and contraction joint~~ sealed joint with ~~a continuous preformed polychloroprene~~ an extruded elastomeric ~~compression gland.~~

~~**Preformed Strip Seal System** - A closed expansion and contraction joint using a continuous preformed polychloroprene elastomeric gland (strip~~ seal~~) inserted into an extruded or formed steel retainer bar with steel anchors~~ retained by edgebeams that are anchored to the structural elements.

Materials

00585.10 Materials - Furnish expansion joints using materials from the QPL and meeting the following requirements:

Asphaltic Plug ~~Joint Binder as specified or as recommended~~Seals 02440.19
~~by the manufacturer~~
~~Asphaltic Plug Joints .....02440.19~~
Backer Rod 02440.14
Compression and Strip Seals.....02440.20
Elastomer 02570.10
Hot Poured Joint Filler.....02440.30
Lubricant/Adhesive.....02440.15
Polytetrafluoroethylene (~~TFE~~PTFE) 02570.10
Poured ~~Joint Sealant~~Seals 02440.11
Preformed Joint Filler for Concrete.....02440.10
~~Preformed Joint Seals .....02440.20~~
Stainless Steel Sliding Surfaces.....02570.10
Structural Steel.....02530
Traffic Loop Sealant 00990

00585.11 Approval of Materials - Submit QPL listed products to the Engineer for Project specific approval.

00585.12 Concrete for Blockout Opening - Fill blockout openings with the same class and type of concrete used in the deck or as shown.

Equipment

00585.20 Equipment - Use approved equipment as recommended by the product manufacturer.

Labor

00585.30 Closed ~~Expansion~~ Joint Installers - ~~Use~~Provide installers that have been trained by the joint manufacturer in application methods of materials and health and safety to install closed expansion joints as detailed. Provide a written statement from the joint manufacturer that the installers have been trained.

00585.31 ~~Closed Expansion~~Sealed Joint Manufacturer's Representative - Provide a manufacturer's representative on-site during the installation of ~~closed expansion~~sealed joints. The manufacturer's representative shall be either someone independent of the Contractor's work force or ~~a member of the Contractor's work force that possesses certification from the manufacturer that the Contractor's representative has the knowledge, skills, and training to install the expansion joints~~someone having a manufacturer's certified proof of sealed joint installation.

The representative shall discuss the work to be done, the methods of installation, and the required equipment as well as advise both the Engineer and the Contractor on proper installation procedures to assure correct installation of expansion joints.

Construction

00585.40 Filled and Closed Joint Tolerances - The following apply to all filled and closed joints:

- **Relative Alignment** - Locate joint openings through members within 1/2 inch of plan location.
- **Joint Edges** - Construct all joint edges straight, parallel, and without deviation from a true line by more than 1/4 inch horizontal over the length of the joint.
- **Joint Width** - Construct all joint widths within 1/8 inch of planned joint width.

- **Deck Roadway Texturing** - Do not groove within 6 inches of joint blockouts and bridge ends. For skewed bridges, additional ungrooved portions at joint blockouts and bridge ends are allowed to accommodate the width of the gang saw.

00585.41 Filled Joints - Unless otherwise specified, form filled joints with preformed joint filler by placing concrete directly against the preformed joint filler material. Provide formwork behind the preformed joint filler material firm enough to prevent deflection of the joint material when placing the concrete, or place preformed joint filler against formed concrete. If shown or specified, place traffic loop sealant or pour joint filler at the top of the joint.

00585.~~41~~42 Closed ~~Expansion~~ Joints - The following requirements apply to all closed ~~expansion~~ joints:

(a) Submittals - Submit stamped working drawings according to 00150.35 for each ~~expansion~~ joint at least 21 calendar days before beginning work.

(1) Design - ~~Joints shall be designed~~Design joints to:

- Prevent the entrance of water and ~~incompressible materials~~debris into the joint.
- Produce no appreciable elevation changes in the deck surface plane with the expansion and contraction movements of the structure.
- Accommodate the required structure movements shown~~ on the plans~~.
- Support a wheel load (plus impact) corresponding to the design load shown~~ on the plans~~.

(2) ~~Shop~~Working Drawings - ~~Submit shop~~Include the following details with the working drawings~~ including, but not limited to~~:

- Plan, elevation and section of the joint system with dimensions and tolerances.
- Complete details of all joint materials with all ASTM, AASHTO or other material designations.
- Method of installation including sequence and installation details at traffic barriers, roadway surfaces, curbs and sidewalks.

~~**(3) Additional Submittals for Modular Joints** - See 00585.47(b) for submittals for modular joints.~~

~~(4~~(3) Notification - Notify the Engineer in writing at least ~~seven~~7 calendar days ~~prior to installation of~~before installing the joint. Include the Contract number, bridge number, joint seal material, product name, and the approximate date of installation.

~~**(5) Certificate of Compliance** - Provide the Engineer with a certificate of compliance 21 calendar days before beginning work, including the manufacturer's name, prior to joint installation, verifying that the materials as furnished will meet the requirements of these Specifications.~~

(b) Safety - ~~21 calendar days before beginning work~~Before installing joints, provide safety precautions from the manufacturer for hazardous chemicals. Wear appropriate impermeable protective clothing when using hazardous chemicals.

(c) Joint Preparation - Prepare the joint surfaces as directed in this Section and the material manufacturer's recommendations. Ensure that all joint surfaces to receive a seal are sound, dry,

clean and frost-free at the time of joint installation. Remove ~~expansion~~ joint material from existing joints and construct the required joints as detailed. Repair existing joints of spalled, cracked, or deteriorated concrete as shown or as directed to provide a uniform and smooth surface along the joint.

(d) Weather Conditions at Time of Installation - Install joint seals when the joint is dry and meets the manufacturer's ~~technical~~ representative's approval~~.~~.

(e) Leakage Check - Check joints for leakage ~~after rainfall has occurred or~~ by flooding the joint with water. If leakage is observed, repair the joints at no additional cost to the Agency and according to the manufacturer's recommendations.

00585.~~42~~43 Armored Corners - Provide joint corner armoring and anchors as shown or specified, and according to the following:

~~**(a) Tolerance -**~~

(a) Tolerance - Install armored corners that are straight and do not deviate from a true line by more than 1/4 inch horizontal and 1/8 inch vertical over the length of the joint, nor more than 1/16 inch in either direction from a 12 foot straight edge.

Maintain a minimum cross sectional thickness of ~~3/8~~ 1/2 inch ~~when measuring the vertical backwall and the flanges of the steel retainers that act as the locking edge rails for strip seal joints.~~. The steel retainer ~~rails~~edgebeams may be manufactured from rolled shapes and plates or may be hot~~-~~-rolled steel with the gland groove milled after rolling.

(b) Installation - Furnish armored corners in the longest practical length as controlled by transportation and installation.

Fabricate steel according to Section 00560. Sandblast steel shapes just prior to installation. Use welding procedures conforming to AWS D1.1.

For new construction, install armored corners in preformed blockouts ~~a minimum of~~at least 14 days after the deck is cast with the joint opening as shown. Support the armored corners securely in position before placing concrete ~~or elastomeric concrete~~ in the joint blockout. Install the preformed seal ~~a minimum of seven~~ at least 7 days after the concrete blockouts have been cast and after the deck concrete reaches 3,000 psi~~. For elastomeric concrete installations, install the preformed seal a minimum of 24 hours after placing the strip rails in the elastomeric concrete~~.

00585.~~43~~44 Asphaltic Plug ~~Joints~~Seal - ~~Furnish and install~~Install asphaltic plug ~~joints~~seals according to the following:

- ~~**(a) General -**~~ Provide a plane surface on which to place the steel bridging plate. Use either an elastomeric concrete or a structural patching product form the QPL as needed to repair the deck surface of new or existing concrete.

- ~~**(b) Installation Procedures -**~~ Install asphaltic plug ~~joints~~seals according to the ~~binder~~ manufacturer's recommendations.
- Place poured ~~joint~~ sealant in curbs and sidewalks.

00585.~~44~~45 Poured ~~Joint Seals~~Seal - Install poured joint seals according to the manufacturer's recommendations.

00585.~~45 Preformed~~ 46 Compression ~~Joint Seals~~Seal - Install ~~preformed~~ compression ~~joint~~ seals according to the manufacturer's recommendations and the following:

- ~~In~~Install in one continuous strip that extends across the full roadway width and into the curbs without splices.
- ~~So~~Install so they remain in compression throughout the design movement range. Provide for maximum and minimum compressive pressures according to AASHTO M 297 (ASTM D 3542).

Base the compression ~~joint~~ seal nominal size on the design movement of the joint and the seal's anticipated compression set.

00585.~~46 Preformed~~ 47 Strip Seal ~~Systems~~ - Install ~~preformed~~ strip ~~seal systems~~seals according to the manufacturer's recommendations and the following~~:~~.

~~**(a) General** -~~ Use steel retainers acting as the ~~locking edge rails that have a minimum cross sectional thickness of 3/8 inch for the vertical backwall and flanges. The steel retainers may be manufactured from extruded or hot-rolled steel.~~

- ~~Furnish steel extrusions in the longest practical length as controlled by transportation and installation. Make steel extrusion splices with an approved weld~~edgebeams according to ~~AWS D1.1.~~ 00585.43(a).
- Field weld rail segments that are too long to ship in one piece according to AWS D1.1.
- Base the joint opening between ~~retainer bars~~edgebeams on structure temperature at the time of joint placement and the designed temperature movement rating.

- ~~**(b) Installation Procedure** -~~ Install seals in one continuous strip, extending across the full roadway width and into the curbs without splices.
- Remove all lubricant/adhesive from the top of the installed seal before the adhesive sets.

~~**00585.47 Modular Expansion Joint Systems** - Design, fabricate, install, inspect, and water test modular expansion joint systems according to the manufacturer's recommendations and the following:~~

~~**(a) General** - Furnish factory-fabricated modular expansion joints of multi-cell assemblies preset by the manufacturer before shipment, according to the approved working drawings.~~

~~Use expansion joint seals of one continuous strip extending across the full roadway width and into the curbs as shown.~~

~~Field weld rail segments that are too long to ship in one piece.~~

~~**(b) Submittals** - In addition to the requirements of 00585.41(a), submit the following to the Engineer for review or approval at least 21 calendar days before beginning work:~~

~~**(1) Manufacturer's Experience** - Written certification that the joint manufacturer has at least three years experience in designing and manufacturing modular expansion joints. Include the following:~~

- ~~Bridge locations~~
- ~~Names of owning agencies or other entities~~
- ~~Names, addresses and telephone numbers of the owners' representatives~~

~~**(2) Shop Drawings and Calculations** - In addition to the requirements of 00585.41(a-1) and 00585.41(a-2), stamped drawings and calculations according to 00150.35, including the following:~~

- ~~Design calculations for all structural elements including springs and bearings, including fatigue design for all structural elements, connections and splices. Show all details for welded splices on the shop drawings.~~
- ~~Requirements for storage of the joint and details of temporary support of the joint for shipping, handling and job site storage.~~
- ~~Installation procedures.~~
- ~~Allowance for replacement of parts subject to wear in the design. Submit a written maintenance and part replacement plan prepared by the joint manufacturer to the Engineer for approval. Include a list of parts and instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, procedures for replacing worn parts and procedures for replacing the watertight seals.~~
- ~~Modification of blockout reinforcing to accommodate the expansion joint unit.~~
- ~~Tables showing the total anticipated movements for each joint and the required setting width of the joint assemblies at various structure temperatures.~~

~~**(3) Certificates of Compliance** - The following certifications:~~

- ~~A manufacturer's certificate of compliance with the AISC Quality Certification Program, Simple Steel Bridges.~~
- ~~A manufacturer's certificate of compliance verifying that the materials as furnished will meet the requirements of these Specifications.~~
- ~~Manufacturer's certification that all polytetrafluoroethylene (PTFE) sheeting, PTFE fabric and elastomer meet the requirements of Section 18 of the AASHTO LRFD Bridge Construction Specifications. Do not use reprocessed material.~~
- ~~Certification that welding inspection personnel are qualified and certified as welding inspectors under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.~~
- ~~Certification that personnel performing nondestructive testing (NDT) are qualified and certified as NDT Level II under the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1a.~~
- ~~Mill test reports for all steel and stainless steel in the joint assemblies with shop drawings and calculations.~~

~~**(4) Quality Assurance Inspection Program** - Arrange for an independent inspection agency to provide quality assurance inspection. Submit the forms to be used by the independent inspection agency and the proposed Quality Assurance Inspection Program to the Engineer for approval prior to the start of fabrication. Quality assurance inspection is not required to be full-time inspection, but shall cover each phase of the manufacturing process. Include the frequency of inspection in the Quality Assurance Inspection Program.~~

~~**(c) Shipping and Handling** - Deliver the expansion joint units to the job site and store according to the manufacturer's written recommendations and as approved by the Engineer.~~

~~Do not weld lifting mechanisms, temperature setting devices and construction adjustment devices to the centerbeams or edgebeams.~~

~~Damage to the joint unit during shipping and handling will be cause for rejection of the joint.~~

(d) Design Requirements:

(1) General - Design and fabricate modular expansion joints from steel components so:

- Individual components conform to the applicable portions of 00585.46.
- Metal to metal contact surfaces meet the requirements of Section 00560 and welded according to AWS D 1.5.
- That joint openings of all individual cells remain equal throughout the full movement range of the joint.
- Sliding surfaces of internal joint components are made of stainless steel and polytetrafluoroethylene (PTFE).
- The expansion joint seals do not protrude above the top of the extrusions. Split extrusions may be used at curb upturns.

Design the elastomeric or urethane springs and bearings so that they are removable and replaceable. Provide for the removal and reinstallation of the strip seal from above the joint by using a 1 1/4 inch minimum joint gap width.

Account for the effects of vertical and horizontal rotations and longitudinal movements of the superstructure.

(2) Limit States Fatigue Wheel Loads - Design the centering beams or transverse seal separation beams, including edge beams, support bars, bearings and other structural elements for the simultaneous application of the vertical and horizontal limit states fatigue wheel load ranges shown below:

Limit States Fatigue Vertical Wheel Load Range (Normal to the roadway surface)	Limit States Fatigue Horizontal Wheel Load Range (Parallel to the roadway surface)
26,000 pounds/wheel	8,100 pounds/wheel

These limit states fatigue wheel loading ranges include impact. Increase the limit states fatigue wheel loading range for the effect of roadway grades when the grade exceeds 4%. For roadway grades 4% or less, the loads shown can be used without modification.

Alternate wheel load ranges may be used, providing that the absolute magnitude of the wheel load ranges (i.e., sum of positive and negative loads along the same axis) is not less that the total wheel load ranges shown above.

(3) Application of Limit States Fatigue Wheel Load Ranges - For the design of the center beams and edge beams, apply simultaneously the two vertical and horizontal load ranges described above, spaced 6 feet apart, at the roadway surface as a rectangular patch loading.

Use a rectangular patch 9 inches in length in the direction of traffic and 20 inches in width perpendicular to the direction of traffic. When the roadway grade exceeds 4%, add the additional horizontal component due to grade to the horizontal limit states fatigue wheel range described previously.

As shown below, the percentage of the load applied to the center beams and edge beams is based on the midrange position of the seals and the width of the top flange of the center beams.

Width of Top Flange of Center Beams or Edge Beams	Percentage
2 1/2 inches	40
3 inches	50
4 inches	60

(4) Fatigue Limit States Design - Design the expansion joint structural steel members, connections both welded and bolted, and steel components to remain free of cracks after 100 million cycles, which represents the endurance limit. Perform fatigue testing to satisfy the fatigue limit states equation shown below for all expansion joint steel structural members, connections both welded and bolted, and steel components.

$(0.5)f_{sr\ calc} \leq F_{sr\ test}$ Fatigue Limits States Equation

where:

$f_{sr\ calc}$ = calculated stress range based on the simultaneous application of two sets of vertical and horizontal limit states fatigue wheel ranges at 6 feet spacing.

$F_{sr\ test}$ = allowable limit states fatigue stress range at the endurance limit of 100 million cycles.

(5) Fatigue Testing - Perform constant amplitude fatigue testing to determine $F_{sr\ test}$, for all structural members, connections both welded and bolted, and components.

Base the allowable limit states fatigue stress range at 100 million cycles with a survival probability of 95%.

Apply the test loadings so that the vertical and horizontal loadings are applied simultaneously. Perform testing so that the horizontal load is 20% of the vertical load.

Use an independent testing laboratory for the fatigue testing. Contact the Engineer for information on facilities capable of performing fatigue testing.

(e) Fabrication - Fabricate the modular joint seals according to the dimensions, shapes, designs and details shown in the approved shop drawings. All modular joint seals for the Project shall be fabricated by the same manufacturer. Weld seal retainer clips continuously on the top and bottom, if welded to the seal separation or edge beams.

(1) PTFE Sliding Surface - Bond the PTFE under controlled conditions and according to written instructions provided by the manufacturer of the PTFE. Complete the bonding operation so that the PTFE surface is smooth and free from bubbles.

(2) Stainless Steel Sliding Surface - Finish the stainless steel sliding surface to a finish of 8 microinches (RMS) or less.

Weld the stainless steel sheet all around to the steel backing plate by a tungsten-arc welding process according to the current AWS specifications. Clamp the stainless steel sheet so that it has full contact with the steel backing plate during welding. Stop the welds so that they do not protrude beyond the sliding surface of the stainless steel.

(f) Installation - Install the joint assembly according to the shop drawings submitted under 00585.47(b-2), and as follows:

- ~~Install so that the joint matches the roadway profile and grade.~~
- ~~Fill the blockout opening with the same class of concrete that is used in the deck. Place concrete after the modular expansion joint has been set to final line and grade.~~
- ~~Construct the bottom inside edge of the outside extrusions so that the concrete-steel interface below the joint is at the same elevation and distance from the centerline of the joint, full length of the joint.~~
- ~~Place modular expansion joint seal units only in preformed blockouts. Coordinate the shop drawings with Agency-furnished details to provide a proper fit. Protect the joint unit and the blockout from damage prior to installation and after installation. Submit to the Engineer for approval details for bridging the joint for construction loads. Do not subject the joint to construction loads for a minimum of seven days after placing the blockout concrete.~~
- ~~Set the modular expansion joint unit to the proper width for the structure temperature at the time of installation. Record the temperature of the underside of the concrete deck slab on both sides of the expansion joint. Take the average of the readings to adjust the joint width for the ambient temperature setting. In lieu of surface readings, internal slab temperature readings may be taken by drilling a 1/4 inch diameter hole 3 inches deep into the deck slab; filling the hole with water and inserting a probe thermometer. Read the probe thermometer after 30 minutes. See the plans for change in joint opening per change in structure temperature from ambient temperature.~~
- ~~Remove all forms and debris that interfere with the free action of the expansion joint unit after casting the joint blockouts.~~
- ~~Any mechanical devices supplied by the manufacturer to set the joint unit to the proper joint width shall remain the property of the fabricator.~~

~~**(g) Inspection and Acceptance** - Expansion joint units will be accepted after satisfying the following three levels of inspection. The manufacturer shall provide for both Quality Control inspection and Quality Assurance inspection. A description of the three levels of inspection follows:~~

~~**(1) Quality Control Inspection** - During the fabrication of major components, the manufacturer shall provide full-time quality control inspection to ensure that the materials and workmanship meet or exceed the requirements of the Contract.~~

~~**(2) Quality Assurance Inspection** - Provide quality assurance inspection according to the plan submitted under 00585.47(b-4).~~

~~No kinks or bends are allowed in the expansion joint units, except those necessary to match the roadway grades. Remove any expansion joint unit exhibiting bends or kinks, other than those shown on the approved shop drawings from the Project Site.~~

~~Replace polychloroprene strip seals not fully bonded to the steel extrusions with fully bonded seals at no additional cost to the Agency.~~

~~Perform fatigue testing of all structural members, splices, connections and components according to 00585.47(d-5). Retest any revised details of material substitutions developed after the initial fatigue testing.~~

~~**(3) Field Inspection** - The manufacturer's representative shall provide full-time quality control inspection to ensure that workmanship meets these specifications.~~

~~**(4) Acceptance** - Expansion joint units shall satisfy each of the three levels of inspection described above prior to acceptance. Replace or repair expansion joint units that fail any one of the three levels of inspection at no additional cost to the Agency.~~

~~Submit any proposed corrective procedures to the Engineer for approval before undertaking corrective work.~~

00585.48 Hot-Dip Galvanizing - Hot-dip galvanize steel expansion joint surfaces, except stainless steel, according to AASHTO M 111 (ASTM A 123).

The contact surfaces at all galvanized slip critical structural bolted connections shall meet Class C (slip coefficient 0.33) surface preparation requirements.

~~**00585.75 Manufacturer's Warranty** - Furnish a Manufacturer's Warranty according to 00170.85(c-1), for a Warranty period of two years.~~

~~For purposes of the Warranty, expansion joints will be deemed to have failed when:~~

- ~~Leakage is detected~~
- ~~Delamination is detected~~
- ~~Debonding is detected~~
- ~~Rutting that is greater than the surrounding pavement surfaces is detected~~

~~The Warranty shall recite that, upon written notification by the Agency, that the expansion joint, or portions of the expansion joint, used according to the manufacturer's recommendations, have failed, the manufacturer will replace expansion joint or portions of the expansion joint, within 6 months of the Agency's written notification.~~

~~The Warranty shall also recite that if the manufacturer fails to replace the expansion joint of portions of expansion joints within the given 6 month period after written notification, the Agency at it's discretion, will replace the expansion joints or portions of the expansion joint, or have the expansion joints or portions of the expansion joint replaced by an independent contractor, with the total cost of replacement, including all materials, equipment, labor, associated mobilization, and traffic control costs will be paid for by the manufacturer.~~

~~Provide materials and use procedures to replace failed expansion joints that meet the specifications in effect at the time of original installation, or if no longer available, use current expansion specifications.~~

Measurement

00585.80 Measurement - No measurement of quantities will be made for ~~closed~~ expansion joints. Estimated quantities of ~~closed~~ expansion joints will be listed in the Special Provisions.

The estimated quantities of asphaltic plug ~~joints~~seals is based on a nominal depth of 2 1/4 inches.

The quantities of asphaltic plug ~~joint~~seal material for joints deeper than 2 1/4 inches will be measured on the volume basis.

~~No measurement will be made for elastomeric concrete used to provide a plane surface on which to place the steel bridging plate.~~

Payment

00585.90 Payment - The accepted quantities for work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Asphaltic Plug ~~Joint~~ Seals	Lump Sum
(b) Asphaltic Plug ~~Joint~~ Seal Material	Cubic Yard
(c) Poured ~~Joint~~ Seals	Lump Sum
(d) Type _____ ~~Preformed Polychloroprene~~ Compression ~~Joint~~ Seals	Lump Sum
(e) ~~Performed Elastomeric~~ Strip Seals	Lump Sum
~~(f) Type _____ Modular Expansion Joint Seals~~	~~Lump Sum~~

Item (a) includes sawcutting, steel bridging plate, and installation of the asphaltic plug ~~joint~~seals to a nominal depth of 2 1/4 inches.

Item (b) includes materials only for asphaltic plug ~~joint~~seal depths greater than 2 1/4 inches.

In ~~items~~item (d~~) and (f~~), the type of ~~joint~~compression seal will be inserted in the blank.

Payment will not be made before joints have passed the leakage ~~test~~check of 00585.~~41~~42(e). No payment will be made for any material installed as replacement material for that removed, unless the Engineer determines that the reason for the removal was beyond the Contractor's control, or that the plans specifically required the removal.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

~~Payment for work under this Section will be limited to 75% of the amount due until the Agency has received the signed warranty.~~

No separate or additional payment will be made for:

- elastomeric concrete or structural patching material used to provide a plane surface on which to place the steel bridging plate
- preformed expansion joint filler, poured joint filler, traffic loop sealant, or sawcutting
- providing the manufacturer's representative ~~or for furnishing the warranty~~

Section 00586 - Expansion Joints, Modular

Description

00586.00 Scope - This work consists of designing, fabricating, testing, and installing modular bridge joint systems (MBJS) according to the geometry and movements shown and specified.

00586.01 Acceptable Manufacturers - Acceptable manufacturers will be listed in the Special Provisions.

00586.02 Design Requirements - Design MBJS according to the AASHTO LRFD Bridge Design Specifications and interim revisions and the following:

- Design and detail MBJS to provide inspection and maintenance access to all internal components.
- Detail MBJS to provide at least 3 inches of concrete, with reinforcement over the top of support boxes. Provide sufficient top plate thickness to prevent concrete cracking over the support boxes.
- Detail MBJS and bridge deck steel reinforcement to assure concrete consolidation can be achieved underneath all support boxes.
- Detail expansion joint seals so that they do not protrude above the top of the expansion joint system under any service condition. Split extrusions may be used at curb upturns.
- Design elastomeric or urethane springs and bearings to be removable and replaceable. Provide extruded elastomeric seals that can be removed and reinstalled from above the joint with at least a 1 1/4 inch gap width. Install seals in one continuous strip, extending across the full roadway width and into the curbs without splices.
- Design MBJS to be watertight.
- Design and detail MBJS to accommodate all movements shown.

00586.03 Submittals - Submit stamped working drawings, design calculations, and the following for the MBJS:

- Plan, elevation, and section of the MBJS for each movement rating and bridge deck width. Specify all dimensions and tolerances.
- Sections showing all materials composing the MBJS with complete details of all individual components including all bolted and welded shop splices and connections.
- All ASTM, AASHTO, or other material designations.
- Installation plan including sequence, lifting mechanisms and locations, details of temporary anchorage during setting, temperature adjustment devices, opening dimensions relative to temperature, installation details at curbs, and seal installation details.
- Plan for achieving and testing watertightness.
- Details and material designations pertinent to the corrosion protection system.
- Requirements and details related to temporary support of the MBJS for shipping, handling, and job site storage.
- Design calculations for all structural elements including all springs and bearings. Include calculations for fatigue design for all structural elements, connections, and splices.
- Welding procedures comply AWS D1.5.
- A written maintenance and part replacement plan, including drawings, to facilitate replacement of parts subject to wear. Include a list of parts, instructions for maintenance inspection,

acceptable wear tolerances, methods for determining wear, procedures for replacing worn parts, and procedures for replacing seals.

- Any required modifications to blockout reinforcing steel to accommodate the MBJS.
- Design and details for MBJS temperature adjustments. Specify each MBJS gap width set to correspond with the ambient temperature at the time of setting.
- Design and details for positioning the MBJS in the block-outs to provide a minimum of 3 inches clearance between the block-out surface and the bottom of support boxes for concrete placement.
- Documentation that the manufacturer is certified through the AISC Quality Certification Program under the category Simple Steel Bridge Structures.
- Documentation that welding inspection personnel are qualified and certified as welding inspectors according to AWS QC1.
- Documentation that personnel performing nondestructive testing (NDT) are qualified and certified as NDT Level II under the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1a.
- Manufacturer's certificate of compliance for all polytetrafluoroethylene (PTFE) sheeting, PTFE fabric, and elastomer.
- Certified mill test reports for all steel and stainless steel in the MBJS assemblies.
- Certified test reports confirming that the springs and bearings meet the design load requirements.
- A Quality Assurance Inspection program performed by an independent inspection agency provided by the MBJS manufacturer. Include the name of the independent inspection agency, details of the proposed inspection program including inspection frequency, and all applicable reporting forms.
- A temporary bridging method for each MBJS where traffic is anticipated to cross before joint concrete has fully cured.

Materials

00586.10 Materials - Furnish MBJS materials meeting the following requirements:

Elastomeric Strip Seal	02440.20
Lubricant and Adhesive	ASTM D 4070
Polytetrafluoroethylene (PTFE)	02570.10
Stainless Steel Sliding Surfaces	02570.10
Structural Steel	02530.20

00586.20 Check Samples - Provide check samples of all steel materials used for fabrication of the MBJS.

00586.21 Tests - Test MBJS according to AASHTO LRFD Bridge Construction Specifications, Appendix A19. Perform the following tests:

- Open Movement and Vibration (OMV) Test
- Seal Push-Out (SPO) Test
- Fatigue test

Labor

00586.30 Manufacturer's Representative - Provide a manufacturer's representative on-site during installation of each MBJS.

The representative duties include:

- Discussing the work to be done, the methods of installation, and the required equipment to use.
- Advise the Engineer and the Contractor on proper installation procedures to assure correct installation of each MBJS.

Construction

00586.40 Installation - Install MBJS according to the manufacturer's approved working drawings and the recommendations of the manufacturer's representative and the following:

- Install each MBJS to match the finished bridge deck profile and grades.
- Protect each MBJS from damage and protect concrete blockouts and supporting systems from damage and construction traffic prior to installation. Do not apply any construction loads on the MBJS until installation is complete.
- Set each MBJS gap width to correspond with the ambient temperature at the time of setting.
- Remove all forms and debris that may impede movement of the MBJS.

00586.47 Watertightness Test - Test each MBJS for watertightness after installation. Flood each completed MBJS with water to at least 3 inches deep for 1 hour. If leakage is observed, repair the joint at no additional cost to the Agency according to the manufacturer's recommendations. Repeat the watertightness test after repairs are complete.

00586.48 Manufacturer's Representative Certification - When the MBJS installation is complete and accepted, provide written certification from the manufacturer's representative stating that each MBJS was installed according to the manufacturer's recommendations and the approved working drawings.

Measurement

00586.80 Measurement - No measurement of quantities will be made for modular bridge joints. The estimated quantities of modular bridge joints will be listed in the Special Provisions.

Payment

00586.90 Payment - The accepted quantities for work performed under this Section will be paid for the Contract lump sum amount for the item "Modular Bridge Joint Systems".

Payment will not be made before joints have passed the watertightness test. No payment will be made for any material installed as replacement material for that removed, unless the Engineer determines that the reason for the removal was beyond the Contractor's control, or that the plans specifically required the removal.

Payment will be payment in full for designing, furnishing, and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for providing the manufacturer's representative.

Section 00587 - Bridge Rails

Description

00587.00 Scope - This work consists of constructing bridge rails of the material or combination of materials shown or specified.

Bridge rails will be classified as concrete or steel according to the predominant material used in the rail.

Materials

00587.10 Materials - Furnish materials meeting the following requirements:

Cast Steel Posts	02810.40
Concrete	02001
Concrete Coating	02210~~.30~~
Galvanizing	02530.70
Grout	02080.30
Reinforcement	00530
Structural Steel	02530
Structural Steel Tubing	02810.20
Thrie Beam Rail	02810.50
Tube	02810.30

Construction

00587.40 General - Construct bridge rails:

- True to line, grade and dimensions shown or established, with a smooth, even top rail without following any unevenness in the superstructure.
- Vertical, rather than normal to the deck, whether the deck is superelevated or not, unless shown otherwise.
- After falsework has been removed, so that the span is self-supporting.

00587.42 Concrete Rails:

(a) General - Construct concrete rails according to Section 00540 and the following:

- Cast-in-place rails may be slipformed as the Contractor elects subject to paragraph (c) of this subsection.
- Construct expansion joints which permit freedom of movement. After all other work is completed, use a sharp chisel to remove all loose or thin shells of concrete likely to spall under movement at expansion joints.

(b) Fixed Forms - Forms shall be smooth and tight fitting, rigidly held in line and grade, and removed without damage to the concrete. Make form joints in vertical planes. Construct all moldings, panel work, and bevel strips as shown. Make corners in the finished work true, sharp and free from cracks, spalls or other defects.

(c) Slipformed - Concrete rails may be slipformed if the plans contain details for slipforming. Before slipforming any permanent rail, the Contractor shall meet one or both of the following requirements (1) and (2) as directed:

(1) Cast a test section at least 20 feet long as follows:

- Place the test section off the structure.
- Use the same section and reinforcement as detailed for use on the structure.
- Include one typical contraction or open joint.
- Remove at no additional cost to the Agency.

(2) Identify, for the purposes of evaluating work quality, at least two recent slipformed rail projects completed by the Contractor.

The Engineer will make the final decision about the use of slipforming on the Project based on work quality. If slipforming is used, conform to the following:

- Provide concrete with a slump of 1 inch ± 1/2 inch.
- Keep the top and faces of the finished rail free from sags, humps, and other irregularities.
- Maintain contraction joints, open joints, and expansion joints to the dimensions shown until the concrete sets.
- Use slipforming only for sections of rail with constant dimensions. Use fixed forms where dimensions vary, as at luminaire or signal supports and at rail end transitions.
- Brush-finish exposed rail surfaces with vertical strokes. Do not grind brush-finished surfaces that are to receive a Class 1 finish.
- Remove and replace any unsatisfactory work at no additional cost to the Agency.

(d) Surface Finish - Give all exposed concrete surfaces a general surface finish followed by a Class 1 surface finish (ground and coated) according to 00540.53 except as provided in 00587.42(c).

(e) Latex Paint Cure for PCC - As an option to curing cast-in-place or slipformed bridge rails, according to the Specifications, the following procedure may be used:

- Allow free moisture to flash off, but only until the concrete surface does not glisten, and never for more than ~~one~~1 hour.
- Apply the first coat of a latex paint ~~approved for bridge use and meeting the requirements of 02210.30(c)~~ at an application rate of 150 square feet per gallon.
- Allow the first coat to air-dry for ~~one~~1 hour.
- Apply the second coat of latex paint at the same rate as above, with application direction transverse to the direction of the first coat.

00587.43 Metal Rails:

(a) Construction - Provide structural steel tubing, tube or metal thrie beam rail as shown or specified. Fabricate and erect metal rails according to Section 00560. Adjust metal rails before fixing in place to ensure proper matching at abutting joints and correct alignment and camber throughout their length.

(b) Coating - Unless otherwise specified, galvanize steel portions of the railing. Galvanize after fabrication of the rail according to 02530.70. If galvanized portions of the rail are to be coated, coat according to Section 00594.

Measurement

00587.80 Measurement - No measurement of quantities will be made for work performed under this Section. Estimated quantities of bridge rails will be listed in the Special Provisions.

Payment

00587.90 Payment - The accepted quantities of bridge rails will be paid for at the Contract lump sum amount for the appropriate bridge rail items listed in the Contract Schedule of Items.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for anchor bolts and anchorage devices, except those cast in precast concrete members.

Payment for anchor bolt and anchorage devices in cast-in-place concrete members and for reinforcement extending from a precast unit, cast-in-place deck, wall or bridge end panel into the rail will be included in payment made for the precast unit, cast-in-place deck, wall or end panel, as appropriate.

Payment for guardrail terminal connectors, connection plates, spacer blocks and other connection hardware will be included in the payment for the guardrail transition item according to 00810.90.

Section 00591 - Spray Waterproofing Membrane

Description

00591.00 Scope - This work consists of furnishing and placing ~~bridge deck~~spray waterproofing membrane on ~~the~~bridge decks ~~of bridges~~ as shown.

Materials

00591.10 Materials - Furnish a warranted spray waterproofing membrane system from the QPL that complies with the maximum profile grades and superelevations shown. Profile grade and superelevation limitations for products are listed in the QPL and are available from the manufacturer.

(a) Concrete ~~Patching~~Repair Material - ~~If~~Furnish concrete ~~repairs are required, furnish a PCC patching~~repair material ~~from the QPL~~ that is compatible with the membrane~~.~~ according to the following:

- ~~(b~~For repairing decks where the top reinforcement is not exposed, use a polymer patching material recommended by the membrane manufacturer.
- For repairing decks where the top reinforcement is exposed, use a PCC repair material meeting the requirements of Section 02015.

(b) Concrete Primer - Furnish concrete primer as recommended by the manufacturer.

(c) Broadcast Aggregate - Furnish broadcast aggregate as recommended by the manufacturer.

(d) Tack Coat - Furnish hot asphalt tack coat meeting the requirements of 00745.11(a~~),~~) or ~~a primer coat~~ as recommended by the membrane manufacturer. ~~An~~Do not use an emulsified tack ~~will not be allowed~~.

Labor

00591.30 Manufacturer's Representative - Provide the services of a manufacturer's representative authorized to sign a warranty on behalf of the manufacturer to observe the installation of each membrane system, including the wearing course. The manufacturer's representative may be an employee of the Contractor if written documentation from the manufacturer is provided stating that the Contractor is certified to install warranted materials and the identified employee is certified to serve as the manufacturer's representative. Follow the recommendations of the manufacturer's representative ~~in all matters pertaining to proper installation of~~when installing the spray membrane system. Instruct the manufacturer's representative to ~~immediately~~ alert the Contractor and the Engineer of anything that could affect the performance of the spray waterproofing membrane or the warranty.

00591.31 Applicator Qualifications - Provide manufacturer authorized applicators. Re-certify the manufacturer authorized applicators yearly.

Construction

00591.40 General - Do not begin membrane installation until all materials and equipment necessary to perform the installation and ~~any~~all required repairs are at the job site.

(a) Weather and Other Restrictions - Place ~~tack coats,~~ surface patching, concrete primer and ~~waterproofing membrane~~tack coat when the deck is dry, the air temperature is between 40~~°~~ °F and 90~~°~~ °F~~,~~ and the deck surface temperature ~~of the deck~~ is below 120~~°~~ °F.

Install spray waterproofing membrane when:

- The concrete substrate is dry and has a moisture content less than 5 percent. Test the concrete moisture content with a non-destructive concrete moisture meter.
- The ambient temperature, deck surface temperature, and relative humidity meet the recommendations of the manufacturer.

(b) Handling Materials - ~~Load and unload waterproofing membrane and primer without damage to the materials.~~ Store spray membrane ~~indoors~~ at a temperature between ~~60 °~~55 °F and ~~120 °~~ 95 °F ~~until it is placed on the bridge deck. Do not allow the membrane to sit in direct sunlight longer than necessary~~or as recommended by the manufacturer.

(c) Pre-Placement Meeting - Hold a pre-placement meeting with the Engineer at least ~~ten~~10 calendar days ~~prior to application of~~ before applying each membrane. For each spray membrane proposed for use, submit for the Engineer's approval a manufacturer approved procedure for preparing the deck surface, applying the membrane, and placing an ~~asphalt concrete protective course if one is~~ aggregate coating when it is required. Include ~~details such as~~in the procedure the number of persons required, equipment, installation sequence, traffic control, and the estimated time schedule for installing the membrane and opening the bridge to traffic. For bridges with curbs or concrete rails, submit unstamped manufacturer shop drawings according to 00150.35, detailing membrane placement at the curbs or rail. Do not proceed with the work until the proposed procedure, and shop ~~drawing~~drawings, if applicable, have been approved by the Engineer.

(d) Area of Application - On bridges without curbs, apply the spray waterproofing membrane from outside edge to outside edge of the deck, or within the limits of the AC wearing course.

On bridges with curbs or concrete bridge rails, apply the spray waterproofing membrane the full width of the AC limits and 3 inches vertically up the face of the curb or rail, or as directed.

Protect adjacent surfaces not to be covered with the membrane from spatter or coating.

00591.42 Preparing ~~Existing~~ Bridge Decks:

(a) Surface Removal - ~~Unless otherwise specified, remove~~Remove the existing asphalt concrete wearing surface from the deck, according to Section 00503~~, before placing~~.

Prepare concrete surfaces according to SSPC SP13/NACE No. 6 Surface Preparation of Concrete. Roughen the ~~waterproofing membrane. Ensure that the deck is smooth and free of obstructions. Small areas~~existing concrete surface to an exposed aggregate surface texture depth profile of ~~asphalt and asphalt stain need not be removed if smooth and tightly bonded to the deck, as~~ at least 1/16 inch, determined according to ASTM E 965 (standard volumetric test) or as recommended by the ~~Engineer. The nominal thickness of the wearing surface on the bridge(s) will be identified in the plans.~~manufacturer.

~~Completely remove any existing paint and pavement markers.~~

Prepare metal surfaces to SSPC SP10 Near White Blast.

Remove ~~any~~all spalled ~~or~~and loose surface concrete to sound concrete. Prepare the deck surface so that it is ~~smooth and~~ free of voids, sharp projections, form release agents, concrete curing agents, and other contaminants.

~~Prior to~~Before placing the membrane, verify that the deck is free from loose rocks, or other debris. Clean the deck with compressed air ~~immediately prior to~~or as recommended by the manufacture before placing the membrane.

Dispose of all removed materials according to 00290.20.

(b) ~~**Surface Patching** - Leave the final surface smooth enough to allow placing the waterproofing membrane directly on the deck, yet rough enough to provide good adhesion.~~

~~Use hand-placed grout or other approved~~**Concrete Repair** - When concrete repair material ~~to smooth or fill all gaps, breaks, or edges that are more than 1/4 inch deep, including the offset in adjacent slabs with different camber, vertical edges adjacent to different milling passes or striations left by milling machine teeth. If a water-based grout~~ is used, allow ~~for proper~~it to cure ~~time~~, as recommended by the membrane manufacturer, ~~prior to~~before applying the membrane.

~~**00591.43 Tack Coat** - Place a hot tack coat, or primer as applicable, on a dry deck only.~~

00591.45 Installation - ~~Construct~~Install spray waterproofing membrane according to the ~~manufacturer's recommendations and~~ following:

- Spray, squeegee, or roll primer at a rate of 1 gallon per 100 to 200 square feet of surface area or as recommended by the manufacturer. Allow the primer to go tack free before applying the spray waterproofing membrane. Re-apply the primer if it sets for 24 hours or longer.
- Spray membrane over primed surfaces at a rate of 1 gallon per 20 square feet of surface area or as ~~approved~~recommended by the manufacturer. Use a system to apply the spray membrane recommended by the manufacturer.

Release bubbles or pockets of trapped air or vapor and repair in a manner satisfactory to the Engineer.

00591.46 ~~**Protection During Construction:**~~

~~**(a) General** - Do not use the waterproofing membrane as a temporary wearing~~**Bond Test** - Test prepared surface ~~or haul road. Until the membrane is protected by pavement, keep Contractor traffic on the membrane~~ to ~~a minimum. Allow Contractor traffic only with the approval of the Engineer and the membrane manufacturer.~~

~~Immediately repair and damage to the membrane caused by the paving operation. Make repairs before resuming paving.~~

~~**(b) Protective Course and Tack Coat** - If the wearing course will be 3/4 inch open-graded HMAC, place a protective course of 3/8 inch dense-graded HMAC conforming to Section 00744, at least 3/4 inch thick, over the membrane. Treat the top surface of the membrane with a hot asphalt tack coat~~primer bond according to ~~the membrane manufacturer's recommendations prior to placing the protective course, or prior to placing a 3/4 inch or 1/2 inch dense-graded HMAC wearing course, if applicable. The mix may be Level 3 or Level 4 as directed~~ASTM D 4541. Minimum bond strength is 150 psi or substrate failure.

00591.47 Dry Film Thickness Test - Test spray membrane dry film thickness according to SSPC PA2 Measurement of Dry Coating Thickness.

00591.48 Leakage Test - ~~As soon as~~Before opening the deck ~~is ready for~~to traffic, ~~flood~~test for membrane leakage by flooding the deck with water~~ to test the membrane for leakage.~~. No water

leakage will be allowed. Make ~~appropriate~~ repairs and re-test, at no additional cost to the Agency, until no leakage is detected.

00591.49 Tack Coat - Place a hot tack coat between membrane and the asphalt concrete surface as recommended by the manufacture.

00591.75 Manufacturer's Warranty~~ -~~ - Furnish a manufacturer warranty~~, for a warranty period of two years, from the manufacturer and signed by a manufacturer's representative,~~ according to 00170.85(c-1) against failure of the product or the installation, conforming to the following requirements:

(a) Warranty Period - The warranty period ~~will begin on the date the Engineer authorizes final payment for the Work under this Section~~shall be for 2 years.

~~When the Agency makes written request to the manufacturer for repair or replacement, the Warranty period will stop until the requested repair(s) or replacement(s) are made and accepted.~~

(b) Failure - For purposes of the warranty, failure is defined as:

- Leakage of the membrane, or
- Delamination of the membrane from the ~~underlying~~substrate or overlying pavement.

(c) Remedy - Upon notification by the Engineer of a failure as defined above, provide the following remedy:

- Repair failures within 60 days at no additional cost to the Agency.
- Use materials and procedures meeting these Specifications.
- Match repairs to finished grade.
- Coordinate timing of repair work with the Engineer.

(d) Traffic Control; Agency's Right to Make Repairs - If, in the opinion of the Engineer, a failure of the membrane causes a traffic hazard, the failure may be temporarily corrected by Agency or other forces at the manufacturer's expense. Replace temporary repairs with permanent repairs at the manufacturer's expense and according to these Specifications.

Measurement

00591.80 Measurement - The quantities of spray waterproofing membrane will be measured on the area basis, and will be the sealed surface area, ~~excluding curb and rail faces,~~ and will be limited to the neat lines and dimensions shown or directed.

Payment

00591.90 Payment - The accepted quantities of spray waterproofing membrane will be paid for at the Contract unit price, per square foot, for the item "Warranted Spray Waterproofing Membrane".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals required to complete the work as specified.

Payment for work done under this Section will be limited to 75~~%~~ percent of the amount due until the Agency has received the signed warranty.

~~No separate or additional payment will be made for:~~

- ~~overlaps~~
- ~~removing the existing asphalt concrete wearing surface and pavement markings, preparing the surface, surface patching, asphalt used as a protective course, and for providing tack coat, and primer~~
- ~~providing the manufacturer's representative, furnishing the warranty~~

Section 00593 - Powder Coating Metal Structures

Description

00593.00 Scope - This work consists of preparing and powder coating new and existing metal structures and features, including all steel, galvanized, aluminum, and other specified surfaces.

00593.01 Abbreviations, Definitions, and References:

(a) Abbreviations:

AAMA - American Architectural Manufacturers Association

(b) Definitions:

Apparent Magnetic Surface - The magnetic surface that a magnetic gauge senses, somewhere between the peaks and valleys of the profile, after the steel is roughened by abrasive cleaning.

Cleaning - Removing detrimental material in preparation for coating.

Coat - Apply powder to a substrate to form a single uniform layer. A coat is comprised of as many applications as necessary to achieve the specified coat thickness.

Coating - Protective material after it is applied to a structure.

Coating System - All specified coats applied separately in a predetermined order.

Hold Point - A time at which the Contractor is required to stop a particular activity until a phase of work is inspected or tested. If the Engineer finds this phase conforms to the Specifications, the subsequent phase of work may proceed.

Manufacturer's Recommendation - The written specifications and instructions provided by a manufacturer of a coating material concerning the handling, mixing, and application of the coating material.

Phase - An activity or step of the preparation and coating procedures to be inspected or tested. The transition from one phase to another represents a hold point.

Preparation - Measures taken to provide a suitable surface ready to coat.

Substrate - A surface to which a coating is to be applied. This may be the prepared surface of the metal structure or a previous coating.

Surface Profile - Roughness of a cleaned steel surface. The height of the profile is measured from the bottom of the valleys to the top of the peaks in mils.

00593.03 Precoating Conference - Before beginning work, the Contractor's supervisory personnel, together with any subcontractors and their supervisory personnel who are to be involved in the preparation and coating work, and a representative from the coating manufacturer shall meet with the Engineer for a precoating conference at a time mutually agreed upon. Submit the following 14 calendar days before the precoating conference:

- The name, location, and contact information (mail address, phone, and e-mail) for the firm performing the powder coating operation.

- Quality assurance and quality control (QA/QC) programs established and followed by the firm performing the powder coating operation.
- A product data sheet and material safety data sheet of each type of coating material to be used, including the products to be used for field repair of damaged areas.
- Project specific powder coating plan, including a specific cleaning, surface preparation, pre-heating, application, curing, shop and field coating repair, handling, and storage processes to be taken for the assemblies being coated for the Project.
- Letter from galvanizer that neither water quenching nor a chromate conversion coating will be used on the surfaces that are to be powder coated.

00593.04 Notice - Notify the Engineer, in writing, at least ~~seven~~7 calendar days in advance of the date that preparation and coating operations are to begin.

Materials

00593.10 Materials - Furnish material meeting the requirements of this Section and the Special Provisions.

(a) Coating Systems:

(1) Steel Substrates - Provide a two coat system for steel substrates consisting of a zinc-rich epoxy primer and a polyester topcoat.

(2) Galvanized and Other Non-Steel Metallic Substrates - Provide a two coat system for galvanized and non-steel metallic substrates consisting of an epoxy primer and polyester topcoat.

(b) Specifications - Furnish an epoxy powder primer meeting the following requirements:

Test	Zinc-rich Epoxy	Epoxy
Adhesion (ASTM D 3359, Method B)	B5 (no failure)	B5 (no failure)
Flexibility (ASTM D 522, Method B)	Pass 1/4" Mandrel Bend	Pass 1/8" Mandrel Bend
Pencil Hardness (ASTM D 3363)	H Plus	H Plus
Specific Gravity (ASTM D 792)	2.30 minimum	1.25 minimum
Zinc in Dry Film (calculated weight)	50% minimum	–

Furnish a polyester topcoat meeting the requirements of the American Architectural Manufacturers Association (AAMA) Specification ~~2605~~2604.

Before notice required by 00593.04, submit a manufacturer's certification stating that each coating material in the coating system:

- Meet the requirements of this Section.
- Meet the specifications of the manufacturer's data sheets.
- Are compatible, including coating repair materials.

The color of the topcoat will be specified in the Special Provisions. Obtain approval of the Engineer before applying any coating.

00593.12 Caulking - Furnish structural steel caulking from the QPL and approved for use by the coating manufacturer. The caulking color shall be clear or match the color of the top coating.

Furnish industrial grade polystyrene or polyurethane backing material of sufficient diameter to fill the crevices or gaps as required.

Obtain the Engineer's approval of the caulking and backing material before using.

Construction

00593.40 General - Structures to be prepared and powder coated include new and existing steel, galvanized, and non-steel metallic substrates.

00593.41 Special Fabrication, Preparation, and Coating:

(a) Inaccessible Surfaces - Coating inside of rolled sections, such as poles and rail tubes, is not required unless otherwise specified.

(b) Fabrication Areas - Schedule fabrication, preparation, and coating so that the coating system is not damaged by the welding or fabricating process.

Neutralize weld areas and remove smoke stain and spills according to SSPC-SP 1. Remove weld slag and spatter by mechanical means before blast-cleaning. Supplement blast-cleaning by other treatment as recommended by the manufacturer of the coating system and as required in 00593.42.

Do not apply coatings within 4 inches of the weld before finishing the welding operation.

00593.42 Preparation of Surfaces:

(a) Steel Substrates - Clean new and existing steel surfaces to be coated according to SSPC-SP 10, "Near-White Blast Cleaning". The appearance of the final blast-cleaned surface shall closely approximate Pictorial Standard SP 10 of SSPC-Vis 1 and have a 1.0 to 2.5 mil profile finish.

Apply a phosphate conversion coating as a surface treatment immediately after blasting. Use heat to dry the phosphate coating immediately after it is applied.

(b) Galvanized Substrates - Clean and prepare galvanized surfaces to be coated according to ASTM D 6386, the approved project specific powder coating plan, and the following:

- **Newly Galvanized Steel** - Smooth and clean surfaces according to ASTM D 6386, Section 5 and prepare surfaces according to ASTM D 6386, Section 5.4.1.

- **Partially Weathered Galvanized Steel** - Check and prepared according to ASTM D 6386, Section 6, then smooth and clean surfaces according to ASTM D 6386, Section 5, then prepare surfaces according to ASTM D 6386, Section 5.4.1.

- **Weathered Galvanized Steel** - Prepare according to ASTM D 6386, Section 7.

(c) Other Non-Steel Metallic Substrates - Solvent clean non-steel metallic substrate surfaces according to SSPC-SP 1 then either light brush blast, according to SSPC-SP 7, with a non-ferrous blasting media or hand sand. The prepared surface shall have a 1.0 to 2.5 mil profile finish.

(d) All Substrates - Remove fins, tears, slivers, and sharp edges, plus hardened or damaged edges resulting from flame cutting, shearing, or similar operations.

00593.43 Coating Metal Structures:

(a) Description - When not in conflict with this Section and the Special Provisions, perform powder coating application according to the following:

- The recommendations of the coating manufacturer.
- The best practices of the trade.

(b) Application of Coating - Apply the powder coating system according to the following requirements:

(1) Surface Condition - Ensure that the surface to be coated is free of moisture, dust, grease, rust, or other substance which would prevent the bond of succeeding applications. Prepare contaminated surfaces to the Engineer's satisfaction before applying the coating.

(2) Application Methods - After surface preparation, apply the two coat system according to the powder coating manufacturer's recommendations, the approved Project specific powder coating plan and the following:

- Pre-heat surface.
- Apply the epoxy primer coat, followed by a partial cure.
- Apply the polyester finish coat, followed by the finish cure.

Apply each coat in a uniform layer, completely covering the preceding coat. Finish each individual coat by the manufacturer in a sufficiently different shade so that skips and holidays can be easily detected. Correct skips or other deficiencies before application of succeeding coats.

(c) Coating Requirements:

(1) Minimum Dry Film Thickness - Apply all coats to the following minimum thicknesses:

- **Primer:** 2.5 mils
- **Topcoat:** 2.5 mils

(2) Coating Thickness and Coverage Requirements - Each coat shall consist of as many applications as necessary to cover the work and achieve the minimum thickness specified. Apply each coat in sufficient thickness to achieve uniform and complete coverage and appearance. If all thickness measurements are not within the specified minimum dry film thickness, or if the visual inspection does not satisfy the Engineer, make additional applications, as necessary, to meet the thickness and coverage required. Film thickness will be measured above the peaks of the profile of the anchor pattern in the steel substrate.

The dry film thickness will be measured for acceptance using a Type 2 gauge according to SSPC-PA 2. If a question arises about an individual coat thickness or coverage, it will be verified using a Tooke gauge, according to ASTM D 4138. If the Tooke gauge shows a prime coat to be less than the specified minimum thickness the total coating system will be rejected even if the thickness of the total system equals or exceeds the total specified thickness.

(3) Additional Top Coat Requirements - Even if the total thickness of prime coat exceeds the prime coat specified thickness, apply the top coat to at least the minimum required topcoat thickness, as well as provide uniform and complete coverage and appearance.

(d) Time of Application - Apply the prime coat within 4 hours of the final cleaning and before any visible indication of rust forms.

(e) Caulking - Apply the caulk after complete application of the top coat. Fill and seal crevices and gaps between structural shapes and plates, around bolt heads or nuts, and similar areas that would retain moisture with the following:

- Caulk, if the crevice or gap cannot be filled with coating materials.
- Backing material and caulk to fill the crevices and gaps that exceed 1/4 inch. Apply caulk over the backing material to form a watertight seal.

00593.44 Inspecting and Testing - The powder coating firm shall conduct or make arrangements for powder coating tests required in the approved Project specific powder coating plan. Tests include the following:

Test	Test Method
Cleanness of Abrasive Material	ODOT TM 616
Cleanness of Compressed Air	ASTM D 4285
Pictorial Surface Preparation Standards	SSPC-VIS 1
Surface Profile by Replica Tape	ASTM D 4417
Hardness	AAMA ~~2605~~2604 and ASTM D 3363
Dry Film Thickness by Magnetic Gauge	SSPC-PA 2
Dry Film Thickness by Tooke Gauge	ASTM D 4138
Pull-off Strength of Coating [min. 400 psi] (Test Method B)	ASTM D 4541

Provide access to the Engineer, at the powder coating facility, to visually inspect the assemblies for the presence of coating holidays and other unacceptable surface imperfections, and to witness the coating thickness testing, the hardness testing, and the adhesion testing.

Provide documentation of the QA/QC testing to the Engineer.

Assemblies failing these tests will be rejected. Repair and recoat the rejected assemblies as directed.

Do not ship assemblies to the Project site without Engineer's approval.

00593.45 Protecting Against Damage:

(a) Contaminated Surfaces - If the prepared surface becomes contaminated by material other than rust, clean the surface in a manner satisfactory to the Engineer before making the succeeding application. If the prepared surface becomes contaminated by rust, prepare the contaminated area again according to 00593.42 and recoat with all specified coats. Clean, ~~reprepare~~re-prepare and recoat at no additional cost to the Agency.

(b) Surfaces Not to Be Coated - Protect surfaces that are not to be coated from blast-cleaning, overspray, and drippings. Remove or repair unintended coatings or other damage on these surfaces to the Engineer's satisfaction at no additional cost to the Agency.

(c) Handling, Shipping, or Surface Damage - After curing and acceptance, individually wrap the coated assemblies with multiple layers of bubble wrap, or other protective wrapping materials specified in the approved Project specific powder coating plan.

During storage and shipping, separate each wrapped assembly with expanded polystyrene spacers and other spacing materials specified in the approved plan.

After erection, repair marred and damaged coated surfaces due to the Contractor's shipping, storage, handling, and erection operations according to 00593.60.

00593.60 Repair of Damaged and Unacceptable Coatings - Repair damaged surfaces as follows:

(a) Surface Preparation - Prepare the surface according to SSPC-SP 1, SSPC-SP 2, and SSPC-SP 3. Use a solvent that is acceptable to the paint manufacturer or approved by the Engineer. Extend the prepared area at least 2 inches into adjacent, tightly adhering, intact coating.

(b) Feathering of Repair Areas - Feather the existing coating system surrounding each repair location. Feather the repair area for a distance of 1 inch to 2 inches to provide a smooth, tapered transition into the existing intact coating.

(c) Coating Application in Repair Areas - When steel substrate is exposed in the repair area, apply a coat of zinc rich primer before applying the topcoat.

When the damage does not extend to the bare substrate, apply only the affected coats.

Measurement

00593.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00593.90 Payment:

(a) New Metal Structures - No separate payment will be made for preparing and powder coating new metal work. Payment for this work, including correction of damages, will be included in payment made for furnishing and placing the new metal structures.

(b) Existing Metal Structures - The accepted quantities for preparing and powder coating existing metal structures will be paid for at the Contract lump sum amount for the item "Prepare and Powder Coat Existing Structures".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for correction of damages described in 00593.44.

Section 00594 - Preparing and Coating Metal Structures

Description

00594.00 Scope - This work consists of preparing and coating new metal structures and features in the shop and in the field, and preparing and coating existing metal structures. This includes all:

- Interior and exterior steel surfaces
- Steel railings, bridge bearings, and bridge expansion joint assemblies
- Other miscellaneous steel
- Galvanized and aluminum surfaces

00594.01 Abbreviations, Definitions, and References:

(a) Abbreviations:

AAMA ~~–~~ - American Architectural Manufacturers Association

DFT ~~–~~ - Dry Film Thickness

FTMS ~~–~~ - Federal Test Method Standard

WFT - Wet Film Thickness

(b) Definitions:

Apparent Magnetic Surface - The magnetic surface that a magnetic gauge senses, somewhere between the peaks and valleys of the profile, after the steel is roughened by abrasive cleaning.

Cleaning - Removing detrimental material in preparation for coating.

Coat - ~~Apply~~An application, or applications, of paint or other protective material to a substrate to form a specific single ~~uniform layer. A coat is comprised of as many applications as necessary to achieve the specified~~ coat thickness.

Coating - Protective material after it is applied to a structure.

Coating Material - Protective material in the liquid state before application.

Coating System - All specified coats applied separately in a predetermined order.

Field Coating - The on-site coating of new or existing metal structures before or after erection.

Hold Point - A time at which the Contractor is required to stop a particular activity until a phase of work is inspected or tested. If the Engineer finds this phase conforms to the Specifications, the subsequent phase of work may proceed.

Maintenance Coating - The coating of existing steel structures that have been previously coated and need recoating.

Manufacturer's Recommendation - The written specifications and instructions provided by a manufacturer of a coating material concerning the handling, mixing, and application of the coating material.

Paint - A pigmented liquid, applied as a thin layer, which is converted to a solid colored film after curing. This film provides a decorative and protective coating to the substrate. The binder is a resin that may or may not be modified with natural vegetable oils, fish oils, or other ingredients.

Phase - An activity or step of the preparation and coating procedures to be inspected or tested. The transition from one phase to another represents a hold point.

Preparation - Measures taken to provide a suitable surface ready to coat.

Shop Coating - The coating of steel surfaces in the fabrication shop before the metal is transported to the erection site.

Skin - A solid or semi-solid membrane that forms on paint in a container.

Skimming - The process in which a film forms over a liquid coating, either during storage or after application.

Stripe Coat - Separate, independent coating that is applied to complex details and irregular surfaces before the application of the full coat. Complex details and irregular surfaces include but are not limited to edges, seams, corners, gaps, crevices, weld lines, pitted surfaces, holes, nuts, bolts, rivets, and threads. Brushes are used to push the coating around and into complex details and irregular surfaces. Each stripe coat is a different color than the preceding and subsequent full coat, extends a minimum of 1 inch from the irregular surface, and completely hide the substrate.

Solvent - Liquid used to solvate or put materials into solution or to clean equipment and tools.

Substrate - A surface to which a coating is to be applied. This may be the prepared surface of the metal structure or a previous coating.

Surface Profile - Roughness of a cleaned metal surface. The height of the profile is measured from the bottom of the valleys to the top of the peaks in mils.

Thinner - Volatile liquids used to thin compatible coating materials. Thinners may be a blend of solvents.

Wet Film Thickness - Coating layer dimension determined with a wet film thickness gauge immediately after application and before curing.

(c) References - In this Section, references such as SSPC-SP 1 and SSPC-PA 1 refer to Volume 2, "Systems and Specifications", of SSPC's "Painting Manual".

In these Specifications, references are made to FTMS 141, "Paint, Varnish, Lacquers, and Related Materials: Methods of Inspection, Sampling and Testing", which is distributed by the U.S. General Services Administration.

00594.02 Design Services - Provide structural design services by a civil or structural engineer licensed to practice in the State of Oregon.

Provide marine design services by an engineer licensed in the State of Oregon to practice in the field of naval architecture or marine engineering.

00594.03 Precoating Conference - Before beginning any preparation and coating work, meet with the Contractor's supervisory personnel~~, together with any subcontractors and their~~ and quality control manager, any preparation or coating subcontractors' supervisory personnel ~~who are to be~~

~~involved in the preparation and coating work and~~, a representative from the coating manufacturer, ~~shall meet with~~and the Engineer ~~for a precoating conference~~ at a ~~time~~ mutually agreed upon~~. 14~~ time. At least 21 calendar days before the precoating conference, submit a plan for accomplishing all phases of the preparation and coating work, including ~~but not limited to~~ the following:

- ~~ventilation~~
- ~~containment~~
- ~~surface~~Ventilation
- Containment
- Surface preparation
- ~~painting~~
- ~~coating~~Painting
- Coating materials
- ~~quality control plan~~
- ~~waste~~Quality Control Plan
- Waste handling and disposal
- All other pertinent information

If the Contractor's key personnel change, or if the Contractor proposes a significant revision to the plan for accomplishing the preparation and coating work, the Engineer may require additional precoating conferences.

Do not begin any preparation or coating work before the plan for completing the work has been approved.

00594.04 Notice - Notify the Engineer, in writing, at least ~~seven~~ 7 calendar days in advance of the date that preparation and coating operations are to begin.

00594.05 Access and Containment For Field Preparation and Coating~~ - Contain work debris that is generated from dry blast cleaning operations according to the Class 1A requirements of SSPC-Guide 6, with the following parameters~~**:**

(a) Abrasive Blast Cleaning - Contain work debris that is generated from abrasive blast cleaning operations according to the Class 1A requirements of SSPC-Guide 6 and the following requirements:

- Type A1 rigid containment material with Type C1 rigid support structure in locations adjacent to traffic.
- Type A1 rigid containment floor decking.
- Type A2 flexible containment materials may be used where rigid containment materials are not specified. Provide flexible containment materials that are air impenetrable and have tear strength of at least 200 pounds per foot and tensile strength of at least 300 pounds per foot.
- Type H1 instrument verification of air pressure in rigid containment.
- Type H2 visual verification of air pressure in flexible containment.
- Type I1 minimum specified air movement 50 feet per minute cross draft. Use portable fans as needed to provide air movement in stagnant areas.

- Type J1 exhaust air filtration 99~~%~~ percent cleaning efficiency for particulate diameters above 39 microinches and less than 2 grains of particulate per thousand cubic feet of exhaust air ~~(~~or air recycled to the work area~~)~~.
- Operate dust collection, air flow, and air movement equipment during blowdown to prevent dust from settling ~~of dust~~ on the structure or within the containment.

(b) Water Jet Cleaning - Contain work debris that is generated from water jet cleaning operations according to the Class 2W requirements of SSPC~~-~~-Guide 6~~, with~~ and the following ~~parameters~~requirements:

- Type A1 rigid containment material with Type C1 rigid support structure in locations adjacent to traffic.
- Type A1 rigid containment floor decking.
- Type A2 flexible containment materials may be used where rigid containment materials are not specified. Provide flexible containment materials that are water impenetrable and have tear strength of at least 200 pounds per foot and tensile strength of at least 300 pounds per foot.
- Ceiling is not required.
- ~~Wall~~Sufficient wall height ~~shall~~to effectively prevent loss of contaminated water.

(c) Tool Cleaning - Contain work debris that is generated from hand tool cleaning or power tool cleaning operations according to the Class 1P requirements of SSPC~~-~~-Guide 6. For hand tool cleaning or vacuum shrouded power tool cleaning, ground covers or free-hanging tarpaulins are an acceptable alternate means of containment provided the debris is captured and controlled to the same degree as Class 1P. Provide Type A1 rigid ~~flood~~floor decking work access platforms regardless of containment methods.

(d) Emissions - Emission from various containment systems will be assessed visually. Address any visible emissions immediately.

(e) Traffic Clearance - Maintain all traffic clearances shown. Do not allow the containment~~ and~~, cables, hoses, supplies, and equipment to encroach on the indicated traffic clearances at any time.

(f) Forced Air Ventilation - For containment using forced air ventilation, submit to the Engineer for review a sketch showing the size (length x width x height) and location of each containment that will be used~~,~~ and identifying the air moving equipment (manufacturer, model, and capacity in cubic feet per minute) for each containment, ~~to the Engineer for review 21~~ 21 calendar days ~~prior to~~before the precoating conference. Do not begin any containment work that requires forced air ventilation before the submittals have been approved by the Engineer.

(g) Structural ~~design requirements include:~~

~~Dead~~**Design Requirements -** Include dead load, live load, and wind load when designing loads for containment structures and work platforms. Dead load is the self~~-~~-weight of the containment and work platforms, live load is all personnel, equipment, and materials, including collected debris, required for normal operations, and wind load is a basic wind speed of 90 mph applied in the most critical direction.

Design a factor of safety of at least 6 for wire ropes and connecting hardware and at least 4 for all other components for containment structure and work platform components. Factor of safety is the ultimate failure load of the component divided by the maximum working load combination applied to the component.

Verify structural adequacy of the bridge with added loading from containment structures and work platforms using either AASHTO Standard Specifications for Highway Bridges, Group II, III, V, and VI load combinations, or AASHTO LRFD Bridge Design Specifications, Strength III loading combination.

Submit for review, according to 00150.35, at least 21 calendar days before the precoating conference the containment structure plans, specifications, shop drawings, welding procedures, and design calculations assuring that the containment system, work platforms, and the structural members of the bridge can safely resist the combined effects of dead loads, live loads, and wind loads. The plans, specifications, and calculations shall be prepared and stamped by a civil or structural engineer licensed to practice in the State of Oregon, who has previously designed at least one bridge painting containment structure.

(h) Materials - Construct all containment decks with new materials.

(i) Navigation Lights - Maintain all navigation lights in operational condition at all times during the project and temporarily relocate them if necessary in order to remain visible to marine traffic.

(j) Spill Response - Comply with Section 00290 for spill response, spill containment, and cleanup of spills~~,~~ and contamination.

(k) OSHA Requirements - Comply with all applicable requirements of the Occupational Safety and Health Administration, including but not limited to applicable portions of 29 CFR Ch. XVII, Sections 1926.55 through 1926.57, 1926.62, 1926.65, 1926.450 through 1926.454, and 1926.500 through 1926.503.

00594.06 Waste Handling and Disposal - Dispose of waste material according to 00290.20, and the requirements of SSPC Guide 7 that do not conflict with 00290.20.

Materials

00594.10 Materials - Furnish materials meeting the requirements of this Section, the Special Provisions, and the applicable portions of SSPC-PA 1, "Shop, Field and Maintenance Painting", when not in conflict with either this Section or the Special Provisions.

00594.11 Coating Materials:

(a) Coating System - Furnish coating materials from the QPL and according to the following requirements:

- ~~Shop~~For shop coating of steel or iron surfaces, furnish a 3 coat system with organic or inorganic zinc primer.
- ~~Shop coating or~~For maintenance coating of steel or iron surfaces, furnish a 3 coat system with organic zinc primer.
- ~~Field~~For field rehabilitation of coated steel or iron surfaces, furnish a 3 coat system with surface tolerant organic zinc primer.
- ~~Shop~~For shop coating or maintenance coating of non-ferrous surfaces, furnish a 2 coat system.

~~Application of~~Do not apply coating materials ~~will not be allowed~~ until certifications required by 00165.35(a) and 00165.35(b) have been provided and the materials are accepted for use by the Agency ~~check testing~~.

(b) Manufacturing - Furnish coating material meeting the following requirements:

- ~~Be prepared at the factory ready for application or mixing of~~Prepared by the manufacturer.
- For multi-component coatings~~. Proportion multi-component coating materials by the manufacturer with each component in its correct proportion and furnished~~, be manufactured in separate, properly portioned containers and ready for field mixing. ~~No~~Do not field ~~mixing will be allowed for moisture-cured urethane coating system components~~mix multi-component coatings unless approved by the Engineer.
- ~~Be homogeneous~~Homogeneous, free of contamination, and of a consistency suitable for the specified use.
- ~~Include additives for control of sagging, pigment settling, leveling, drying, dryer absorption, skimming, and other qualities and properties that affect its application and curing.~~
- ~~Not~~Does not require a pretreatment chemical or material prior to application of the prime coat, except as stipulated in these Specifications.
- ~~Include~~Includes required tinting and coloring materials at the time of ~~manufacture.~~manufacturing. Do not use gray for the first prime coat. ~~To provide contrast between coats, when successive coats are specified, use a~~
- A sufficiently different ~~color~~shade for each individual coat ~~of~~ from the manufacturer, so that skips and holidays can be easily detected. Do not tint the ~~system. Use tinting~~ coating material ~~that is compatible with~~ in the ~~coating material and is not detrimental to performance~~field unless approved by the Engineer.
- Unless otherwise specified, ~~conform~~conforms to the following colors:
  - Federal Standard ~~595B~~ 595C color #24272 for ODOT Green top coat.
  - Federal Standard ~~595B~~ 595C color #30059 for weathering steel top coat.
  - Federal Standard ~~595B~~ 595C color #26357 for miscellaneous metal on concrete bridges.
- ~~Not~~Does not vary in composition without prior notice by the manufacturer and approval of the Engineer. ~~No reformulation will be allowed.~~
- ~~Be applied before expiration of~~Has sufficient time remaining on the manufacturer's recommended shelf life~~.~~ to allow for application before expiration of that shelf life.

(c) Packaging - Furnish ~~each container meeting~~unopened containers from the manufacturer that meet the following requirements:

- ~~Be the manufacturer's original unopened container.~~
- ~~Be~~ Constructed of new ~~steel or plastic~~and unused materials.
- Not have a capacity of ~~not~~ more than 6 ~~gallon capacity~~ gallons.
- Meet U.S. Department of Transportation's Hazardous Material Shipping Regulations.
- ~~Be lined, if~~If necessary, constructed with an interior lining to prevent attack by the coating material. The lining shall not delaminate from the container wall so as to contaminate the coating.
- ~~Be labeled~~Labeled with a quality compliance certificate according to 00165.35, showing the following:
  - Manufacturer's name
  - Exact title of coating material

- Manufacturer's batch number
- Date ~~of manufacturer~~manufactured
- Identification of all toxic substances
- Handling and application precautions

(d) Sampling and Testing - Have the coating material manufacturer furnish the following to the ~~Agency's~~ODOT Materials ~~and Research Section~~Laboratory:

- One unopened 1 quart container of each coating material, each component of multi-component coating material, and each thinner, from each batch of each coat. The Agency may, at its discretion, place an inspector at the site of manufacture and obtain check samples at the jobsite.
- Test results certification according to 00165.35 for each batch of each coat, and if the coating material is specified for use on steel-to-steel contact surfaces, certification that the coating material meets the requirements of 00594.11(e).
- A product data sheet for each type of coating material and thinner.
- A material safety data sheet or safety data sheet with the initial sample of each type of coating material and thinner.

Agency testing will include the following tests necessary to ensure that the coating materials conform to Specifications, manufacturer's product data sheet, and other testing as the Agency deems appropriate.

Test	Test Method
Density of Liquid Coatings, Inks, and Related Products	ASTM D 1475
Determination of Zinc in Dry Films of Paints and Coatings	ODOT TM 614
Coarse Particles in Pigments, Pastes, and Paints	ASTM D 185
Consistency of Paints Using the Stormer Viscometer	ASTM D 562
Fineness of Dispersion of Pigment-Vehicle System	ASTM D 1210
Drying, Curing, or Film Formation of Organic Coatings at Room Temperatures	ASTM D 1640
Volatile Content of Paints	ASTM D 2369
Pigment Content of Solvent-type Paints	ASTM D 2371
Volume Nonvolatile Matter in Clear or Pigmented Coatings	ASTM D 2697
Vehicle Solids (Ordinary Centrifuge)	FTMS 141, Method 4051
Nonvolatile vehicle Content	FTMS 141, Method 4053

Agency testing is not to be construed as determining or predicting the performance or compatibility of the individual coating material or the total coating system.

(e) ~~Specifications~~Slip-Critical Connections - The ~~coatings~~primer coat on steel-to-steel contact surfaces at all slip~~-~~-critical structural bolted connections using high strength bolts shall ~~meet~~conform to Class B (slip coefficient of 0.5) coating requirements ~~according to~~in "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints", as adopted by the Research Council on Structural Connections.

00594.12 Caulking - Furnish structural steel caulking from the QPL and approved for use by the coating manufacturer. The caulking color shall be clear, approximate the color of the top coating, or be over coated.

Furnish industrial grade polystyrene or polyurethane backing material of sufficient diameter to fill the crevices or gaps as required.

Obtain the Engineer's approval of the caulking and backing material before using.

00594.13 Chloride Remover - When used, furnish a chloride remover from the QPL that is fully compatible with the coating system according to the recommendations of the coating system manufacturer.

Equipment

00594.20 Barges - Provide and operate barges according to the following operational and safety requirements:

- Provide a barge.
- Provide documentation that the barge has been inspected and is in acceptable condition for the time period of use on the project.
- Anchor the barge using two spuds and a four-point anchorage system. Spuds and anchorages shall have adequate strength to resist expected tidal and weather conditions. Anchorages shall be able to adjust to the highest and lowest tidal elevations without imparting vertical force (either upward or downward) to the barge.
- Operate the barge according to applicable maritime regulations, including removal of the barge to a dock in a safe location when required to avoid extreme weather hazards.
- Have a working bilge pump and backup bilge pump on the barge at all times. Bilge pump operation shall be inspected on a daily basis when the barge is in use. Immediately report inspection results to the Engineer.
- Secure all equipment to the barge deck.
- Adjust ballast to maintain proper balance of the loaded barge.
- Do not overload the barge beyond its safe load capacity.
- Secure hatches in the closed position, except during inspections or transfer of ballast.
- Have a motorized boat available at all times.
- Comply with all applicable U.S. Coast Guard regulations.
- Comply with all applicable Occupational Safety and Health Administration (OSHA) regulations.

Within 30 days of the award of the contract, submit the following according to 00150.35:

- Plans detailing equipment layout, spuds, anchorages, and equipment anchorages.
- Calculations documenting load capacity, balance and stability, strength of spuds and anchorages, and strength of equipment anchorage.
- Documentation describing how the barge will be kept within safe load, balance, and stability limits, and how the outfitting, operation, and maintenance of the barge will comply with the operational, safety and environmental requirements. The plans, documents, and calculations shall be prepared and stamped by an engineer licensed to practice in the state of Oregon, who is qualified in the field of Naval Architecture or Marine Engineering.

Do not begin work that requires a barge until the barge submittals are approved.

Labor

00594.30 Quality Control Personnel - Provide a quality control manager that is responsible for managing all preparation and coating quality control activities. The quality control manager shall not be employed in a supervisory role for any preparation or coating work.

Construction

00594.40 General:

(a) New Steel Structures - Prepare and coat new erected steel structures and features ~~erected at locations shown~~. Except as provided in these Specifications, perform all required preparation and coating at the fabrication shop after completion of fabrication and before transporting to the Project Site.

(b) Existing Steel Structures - Prepare and coat the existing steel structures described in the Special Provisions.

(c) Rehabilitating Coated Steel Structures - Prepare and coat new steel members and existing steel structures impacted by erection. This includes all existing steel surfaces uncovered by the removal of existing steel, wood, and concrete members, except top flanges. Impacted areas include, but are not limited to areas, where rivets or bolts are removed, and existing steel surfaces damaged during erection or other Contractor operations. Except as provided in these Specifications, perform all required preparation and coating of new steel members at the fabrication shop after completion of fabrication and before transporting to the Project Site. Perform preparation and coating of existing steel structures impacted by erection in the field.

(d) Non-Steel Metallic Substrates - Prepare and coat new non-steel substrates and features erected at locations shown. Except as provided in these Specifications, perform all required preparation and coating at the fabrication shop after completion of fabrication and before transporting to the Project Site. Prepare and coat existing non-steel substrates described in the Special Provisions.

(e) Lighting - Provide lighting during all periods of preparation, coating, and inspection according to SSPC-Guide 12, "Guide for Illumination of Industrial Painting Projects".

00594.41 Special Fabrication, Preparation and Coating:

(a) Inaccessible Surfaces - Before fabrication, prepare and coat with all coats steel surfaces inaccessible to preparation and coating after fabrication.

Prepare and coat contact surfaces within slip-critical joints, constructed as part of the work under Section 00560, according to 00594.42 and 00594.43(d-1).

(b) Welded Areas - Schedule fabrication, preparation, and coating so that the coating system is not damaged by the welding or fabricating process.

Neutralize weld areas and remove smoke stain and spills according to SSPC-SP 1. Remove weld slag and spatter by mechanical means before blast-cleaning. Supplement blast-cleaning by other treatment as recommended by the manufacturer of the coating system and as required in 00594.42.

Do not apply ~~coatings~~coating within 4 inches of the weld before ~~finishing~~ the welding operation~~.~~ is complete

00594.42 Preparation of Surfaces:

(a) New Steel Structures - Clean new steel structure surfaces to be coated according to SSPC-SP 10, "Near-White Blast Cleaning", except as modified by this Section. The

appearance of the final blast-cleaned surface shall closely approximate Pictorial Standard SP 10 of SSPC-Vis 1.

(b) Existing Steel Structures - Blast-clean existing steel structure surfaces to be coated according to SSPC~~-~~-SP 10~~,~~ "Near White Blast Cleaning" with the appearance of the blast-cleaned surface to closely approximate Pictorial Standard SP 10 of SSPC~~-~~-Vis 1~~,~~ or clean to SSPC~~-~~-SP ~~12, "High and Ultrahigh Pressure Water Jetting", cleaned~~WJ-2 "Very Thorough Waterjet Cleaning" with the appearance of the water-jetted surface to ~~visual condition WJ-2~~closely approximate Pictorial Standard WJ-2 of SSPC-Vis 4.

(c) Rehabilitating Existing Coated Steel Structures - ~~Clean~~Prepare all existing steel surfaces to be coated according to SSPC~~-~~-SP 15, "Commercial Grade Power Tool Cleaning". The cleaned surface shall have a minimum surface profile of 1 mil.

~~The areas to be prepared shall include all areas of~~Prepare all existing coated surfaces exposed by the removal of the existing components involved in the rehabilitation, all areas in which rivets, bolts, or plates are to be removed, and areas damaged by erection or other Contractor operations. Completely clean all existing lead-based coatings exposed by the removal of any structural or miscellaneous member to SSPC-SP 15 "Commercial Grade Power Tool Cleaning" requirements. Extend all prepared areas at least 2 inches into tightly adhering, intact paint. Overlap the subsequent coating and the still intact coating by a minimum of 2 inches. Lightly sand the overlap area of the intact coating to provide a profile for the subsequent repair coating to adhere to.

(d) Non-Steel Metallic Substrates:

(1) Galvanized Surfaces - Prepare surfaces to be coated according to ASTM D 6386.

(2) Aluminum - Solvent clean surfaces to be coated according to SSPC~~-~~-SP 1~~,~~ then follow by a light brush blast according to SSPC ~~-~~SP 7~~,~~ with a ~~minimum~~maximum nozzle pressure of 75 psi~~, or hand~~. Hand sand the surface to create a minimum 1 mil profile, or clean the surface according to the manufacturer's recommendation.

(e) All Metal Structures - Remove fins, tears, slivers, and sharp edges, plus hardened or damaged edges resulting from flame cutting, shearing, or similar operations.

Clean all surfaces of material detrimental to the application of the coating system as follows:

(1) Cleaning Methods - Blast-clean surfaces using one or more of the following methods to discharge the abrasive:

- A stream of high-pressure air
- A rotating centrifugal paddlewheel
- A stream of high-pressure water

Surfaces shall be dry before cleaning unless a wet blast cleaning method is used. Use methods specified in SSPC-SP 1, "Solvent Cleaning", SSPC-SP 2, "Hand Tool Cleaning", SSPC-SP 3, "Power Tool Cleaning", and SSPC-SP 15 "Commercial Grade Power Tool Clean", as necessary to augment blast-cleaning.

(2) Abrasives - Perform blast-cleaning using an abrasive of a size which will continually produce ~~a~~an angular surface profile of at least 1 mil, but not more than 4 mils, as measured ~~by~~according to ASTM D 4417 using replica tape on the prepared surface. The blast-cleaning

shall result in a roughened steel surface comparable to a Keane-Tator Surface Profile Comparator for sand or grit using ASTM D 4417.

When removing coatings with lead or chromium, use a mineral slag abrasive combined with an approved additive to render the removed coating material non-hazardous. Obtain approval for the specific abrasive blast additive before use.

If a centrifugal wheel with a grit mixer is used for blast-cleaning, inspect each member and for those members not meeting the comparator or profile requirements, perform a final blast-cleaning with high-pressure air with an abrasive to obtain the specified profile.

Provide abrasives that have no corrosion products, water, oil, or any other material detrimental to the application and adherence of the coatings. Provide abrasives that conform to SSPC-AB 1 or SSPC-AB 3. ~~Cleanliness will be tested~~When directed, test cleanliness according to ~~ODOT TM 616~~ASTM D 7393 and ASTM D 4940. The conductivity results from ASTM D 4940 shall not exceed 100 microsiemen/cm. Wet abrasives are allowed if wet sandblasting methods are used.

(3) Air - ~~The high-pressure air used for~~ For blast~~-~~cleaning or blowing down~~ shall be~~, use high-pressure air that is free of water, oil, or any other material detrimental to the coating system. Provide adequate separators and traps. ~~Compressed~~Test compressed air cleanliness ~~will be tested~~daily according to ASTM D 4285~~ by the Engineer~~, or as directed.

(4) ~~**Rust Inhibitor** - If a rust inhibitor is not used with wet surface preparation methods, brush-blast any rust bloom on the surface before applying the coating. If an effective rust inhibitor is used, it shall be compatible with the coating system and be applied to the freshly cleaned surface or contained in the liquid used in~~**Water** - Use water for water jet cleaning~~.~~ that is clean, potable and does not contain more than 75 milligrams per liter of chlorides or 200 milligrams per liter of sulfates. Filter, recycle, and dispose of water when surface soluble salt levels cannot consistently be kept below 70 microsiemen per centimeter, measured with a conductivity meter capable of reading to 1 microsiemen per centimeter.

Use a rust inhibitor ~~from the QPL, or~~that is recommended by the coating manufacturer. Use the rust inhibitor to prepare a test panel at least 14 calendar days before beginning work, to show that the ~~rust~~ inhibitor does not cause loss of bond between the ~~prepared~~ steel substrate and the primer. ~~If bond failure occurs, no further~~Do not use ~~of~~ the rust inhibitor ~~will be allowed.~~product if the test panel does not meet the adhesion requirements of 00594.43(g).

(5) Cleaning Procedures - Perform blast-cleaning operations and pressure washing, as required, without damaging partially or entirely completed portions of the work. Do not blast~~-~~clean adjacent to areas being coated.

~~The~~Examine blast-cleaned ~~surface will be examined~~and pressure washed surfaces for any traces of corrosion, water, oil, grease, soluble salts, and other material deposited during the cleaning operations. If present, remove any detrimental material by solvent cleaning and ~~reblast~~blast-clean the surface again.

(6) Final Preparation - ~~Before~~Do not begin coating~~, the~~ before:

Blowing down prepared ~~surface shall be:~~

- ~~Blown down~~surfaces using high pressure air~~,~~ within the fully enclosed containment, with the specified ventilation operating, and supplemented by brushing if required.
- ~~Free~~Determining that the prepared surfaces are free of all residue.

- ~~Repair any~~Repairing all damaged galvanizing according to ASTM A 780.
- ~~Acceptable to~~ Obtaining approval from the Engineer.

(f) Pack Rust Removal - Remove pack rust by mechanical cleaning, and heating water-saturated pack rust to a minimum of 250 °F and a maximum of 400 °F, or by using 35,000 psi ultra-high pressure water jet.

00594.43 Coating Metal Structures:

(a) Description - When not in conflict with this Section and the Special Provisions, perform coating application according to the following:

- The applicable portions of SSPC-PA 1.
- The recommendations of the coating manufacturer.
- The best practices of the trade~~.~~ according to SSPC Painting Manual, Volume 1, "Good Painting Practice".

(b) Application Site Mixing, Thinning, and Storage of Coating Materials:

(1) Rejection - ~~The~~ Reject and do not use the contents of a container ~~contents will be rejected, and not be used~~ if:

- The material ~~arrives~~does not arrive at the application site in ~~other than~~the original, unopened manufacturer's containers.
- The container is punctured or has a break in the lid seal ~~or a puncture~~.
- The coating materials have begun to polymerize, solidify, gel, or deteriorate in any other manner.
- The recommended shelf life, as stated in the manufacturer's product data sheets, has expired.
- ~~A skin forms on the surface of the material or on the sides of the container and the volume of the skin exceeds 2% of the material. If there is not more than 2% skin, remove and discard only the skin.~~

(2) Mixing - Thoroughly mix coating materials by mechanical means to ensure a uniform composition. Do not mix coating materials by means of air stream bubbling or boxing. Mix in the original container and continue until all pigment or metallic powder is in suspension. Ensure that all solid coating material that may have settled to the bottom of the container is thoroughly dispersed. After mixing, inspect the coating materials for uniformity and to ensure that no unmixed pigment or lumps are present.

Add separately packaged catalysts, curing agents, hardeners, initiators or dry metallic powders to the base coating material only after the base coating material is thoroughly mixed to achieve a uniform mixture with all particles wetted. Add the proper volume of curing agent to the correct volume of base with constant agitation. Use the mixture within the pot life specified by the manufacturer. Discard unused portions at the end of each workday.

(3) Thinning - Do not add additional thinner at the application site unless approved~~. The~~ by the Engineer. If allowed, furnish the amount and type of thinner~~, if allowed, shall conform~~ conforming to the manufacturer's ~~specifications~~recommendations.

(4) Straining - Strain all coating materials after mixing to remove undesirable matter, but not pigment or metallic powder.

(5) Agitation - Constantly agitate coating materials as recommended by the manufacturer, and all inorganic zinc primers during application, using paint pots equipped with mechanical agitators.

(6) Storage - Store the coating material and solvents in original containers. Store the containers in a weather-tight space where the temperature is maintained between 40 °F and 100 °F or according to the manufacturer recommendations, whichever is more restrictive.

(c) Application of Coating:

(1) Surface Condition - Ensure that ~~the surface~~surfaces to be coated ~~is~~are free of moisture, dust, grease or other ~~substance~~substances which would prevent the ~~bond~~bonding of succeeding applications. Protect freshly coated surfaces from contamination by abrasives, dust or foreign materials from any source. ~~Prepare contaminated surfaces to the Engineer's satisfaction before applying~~Do not apply succeeding coats until the Engineer has approved the prepared surface.

(2) Application Methods - Apply coating materials by air or airless spray, brush, roller, any combination of these methods, or as recommended by the coating material manufacturer~~,~~. unless otherwise specified. If air is used for application, ensure that it is free of water, oil, or any other material detrimental to the coating system. Provide adequate separators and traps and test air cleanliness daily according to ASTM D 4285, or as directed. Regardless of which application method is used to apply the coating, use brushes to push the coating into complex details, crevices, gaps, difficult to access areas and ~~areas with brushes~~ where spraying does not adequately cover or penetrate. All application techniques shall conform to Section 7~~,~~ in SSPC~~-~~-PA 1.

Apply subsequent coats of paint in sufficiently different shades so that skips and holidays can be easily detected.

Apply each coat in a uniform layer, completely covering the preceding coat. ~~Each individual coat shall be furnished by the manufacturer in a sufficiently different shade so that skips and holidays can be easily detected. Do not tint the coating material in the field unless approved.~~ Correct runs, sags, skips or other deficiencies before application of succeeding coats. ~~Corrective work may require recleaning~~Perform re-cleaning, application of additional coating, or other measures, as directed by the Engineer, at no additional ~~compensation~~cost to the Agency.

For each applicator, perform at least one WFT test 15 minutes after coating application and one WFT test per hour thereafter. Test immediately after coating application and report results.

(d) Coating Requirements:

(1) Number of Coats and Film Thickness - Apply all coats to the minimum thickness specified in the manufacturer's product ~~date~~data sheet for the coatings.

Apply the coating system in the number of coats specified in the QPL, with each coat consisting of as many applications as necessary to cover the work and achieve the minimum thickness specified for the coat.

~~Apply only a coating of~~ Only apply zinc primer coating to ~~all~~ steel-to-steel and steel-to-concrete contact surfaces, except top flanges, ~~contact surfaces,~~ whether in the shop or field. Apply the full coating system so that it extends 1 inch into the steel-to-concrete contact surface if

accessible. The dry film thickness of the primer on steel-to-steel contact surfaces shall not be less than 3 mils nor more than the manufacturer's class "B" certification allows.

Do not assemble coated joints before the coatings have cured for at least the time used in the qualifying test, or as recommended by the manufacturer.

On steel-to-wood contact surfaces, apply all coatings specified.

(2) Stripe Coats - On maintenance coating projects apply a prime stripe coat before applying the full prime coat and apply an intermediate stripe coat before applying the full intermediate coat. The stripe coat shall be a different color and be approximately 3 mils thick. Each stripe coat will have its own hold point and shall not be used to correct deficiencies in the preceding or subsequent coats.

The full prime coat may be applied prior to the prime stripe coat to prevent flash rusting of the cleaned steel surfaces if approved~~.~~ by the Engineer. In either case, apply the first application of prime coat ~~shall be accomplished~~ by the use of brushes as described in the definition of "Stripe Coat" in 00594.01(b).

(3) Coating Thickness and Coverage Requirements - ~~Coating~~The Engineer will take dry coating thickness measurements ~~will be made by the Engineer~~ after the application of each coat and before application of the succeeding coat. In addition to coating thickness measurements, a visual inspection for complete coverage will be made by the Engineer after each coat. Apply each coat in sufficient thickness to achieve uniform and complete coverage and appearance. If all thickness measurements are not within the specified minimum dry film thickness, or if the visual inspection does not satisfy the Engineer, make additional applications, as necessary, to meet the thickness and coverage required. Film thickness will be measured above the peaks of the profile of the anchor pattern in the metal substrate.

The Engineer will take dry film thickness ~~will be measured for acceptance using~~measurements with a ~~Type~~ type 2 gauge according to SSPC-PA 2. The minimum dry film thickness measurements and frequency of measurements will be ~~based on the following~~according to SSPC-PA 2, modified as follows:

- A single gauge reading will be taken for each 10 square feet of surface area.
- A spot measurement is only taken at locations where a gauge reading is less than 100~~%~~ percent of the Project specified minimum DFT.
- All spot measurements shall meet 100~~%~~ percent of the project specified minimum DFT.
- Additional readings may be required to identify the limits of the non-compliant areas.

If a question arises about an individual coat thickness or coverage, it will be verified using a Tooke gauge, according to ASTM D 4138. If the Tooke gauge shows a prime coat to be less than the specified minimum thickness, or reveals a missing intermediate coat, the total coating system will be rejected even if the thickness of the total system equals or exceeds total specified thickness.

In areas where dry film thickness measurements are impractical, wet film thickness measurements will be made according to ASTM D 4414.

(4) Additional Top Coat Requirements - Even if the total thickness of prime and intermediate coats exceed the prime and intermediate coats specified thicknesses, apply the top coat to at least the minimum required topcoat thickness, as well as provide uniform and complete coverage and appearance.

(e) Time of Application - ~~Within 3 aerial miles of the Pacific Ocean~~Unless otherwise approved by the Engineer, prime existing steel structure surfaces according to one of the following methods:

- Prime on the same day ~~they~~that the surfaces are cleaned~~, apply~~.
- Apply an approved rust inhibitor to the entire surface on the same day as cleaning, and prime within 48 hours after inhibitor application~~, or reblast all surfaces prior to coating~~.

~~Beyond 3 aerial miles of the Pacific Ocean, prime existing steel surfaces as soon as possible within 3 calendar days of cleaning.~~

- ~~All~~Reblast all surfaces prior to coating.

Before priming surfaces ~~shall be~~ prepared by waterjetting, ensure that the surfaces do not exceed "Light" flash rust as defined by the "Wipe Test" in SSPC-SP WJ-2. Ensure that all other surfaces are dry and free of flash rust ~~and dry~~ before priming.

Apply each coat over the preceding coat as soon as possible, allowing for drying time of the preceding coat, weather, temperature, and similar factors, as well as the manufacturer's ~~recommendation~~recommendations. A primer coat that exhibits freckle rust or is exposed to the weather for more than 60 days shall be re-prepared to the requirements of 00594.42.

~~Each~~Allow each coat ~~shall be~~to dry ~~before recoating,~~ and sufficiently ~~cured~~cure before recoating so the succeeding or additional coat can be applied without delamination, blistering, wrinkling, or loss of adhesion or cohesion. Recoat times shall conform to the manufacturer's recommendations unless they conflict with this Section or any coating problems develop. ~~Revision of~~Do not revise recoat times ~~requires~~without receiving approval ~~of~~from the Engineer ~~before recoating~~.

(f) Caulking - Apply the caulk after complete application of the top coat. Fill and seal crevices and gaps between structural shapes and plates, around bolt heads or nuts, and similar areas that would retain moisture with the following:

- Caulk, if the crevice or gap cannot be filled with coating materials.
- Backing material and caulk to fill the crevices and gaps that exceed 1/4 inch.

Apply caulk over the backing material to form a watertight seal.

In areas that collect or channel water, apply caulk even if coating fills the gap.

~~**(g) Adhesion** - Minimum adhesion shall be 350 psi within one week of application of each coat to its substrate. The Engineer will perform adhesion tests according to ASTM D 4541, using test method "B".~~

(g) Adhesion - Perform adhesion tests according to ASTM D 4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers, using "Test Method D, E, or F", as warranted or at the direction of the Engineer. Ensure that a minimum pull-off strength of 650 psi is achieved for zinc rich primers and tar based coatings, and a minimum pull-off strength of 1000 psi is achieved for all other coatings, including those over a zinc rich primer. When testing a coating or coating system with a DFT of more than 12 mils, score around the test fixture.

(h) Environmental Conditions - Apply coating materials only during periods when, according to testing by ASTM E 337, the:

- Air temperature is above 45 °F
- Steel surface temperature is:
  - Greater than 45 °F
  - Less than 115 °F
  - At least 5 °F above the dew point
- Relative humidity is within the manufacturer's recommended range

~~Application of~~Do not apply coating materials~~ will not be allowed~~ if the Engineer determines that conditions are not favorable for proper application and performance of the coating.

If fresh coatings are damaged by the elements, replace or repair at no additional cost to the Agency.

If a coating system allows application in environmental conditions different from those specified, submit a letter from the manufacturer stating the conditions under which the coatings can be applied. Application under conditions other than specified will not be allowed without the Engineer's written approval.

Cover and protect the metal if coating is to be applied in adverse weather conditions. Heat the metal and surrounding air to the temperature specified in this subsection. Continue protecting the newly coated steel until the coating achieves proper cure.

(i) Stenciling - Stencil the month and year of application and the type of coating used in block letters 2 inches high at a location on each end of each span on the structure being coated. The exact location of stenciling will be determined by the Engineer. Use flat black color stenciling unless otherwise directed.

00594.44 Inspecting - The Engineer will inspect each phase of preparation and coating. Do not proceed with succeeding phases until approved. Provide the inspector timely access to areas where work is being performed. Allow adequate time for inspection at each hold point. Hold points are the following:

- Before cleaning operations begin
- After cleaning operations are completed and before application of any coating materials
- After each stripe coat
- After each full coat
- After cleaning in conjunction with coating repairs
- After application of each coat in coating repairs
- After application of last coat, before moving work platforms and containment structures

Repair coating system damages resulting from Agency inspection and testing at no additional cost to the Agency.

Aspects of the preparation and coating process to be inspected and tested include, but are not limited to:

Test	Test Method
Environmental Conditions for Coating	ASTM E 337
~~Cleanness of~~Oil in the Abrasive Material	~~ODOT TM 616~~ASTM D 7393
Ionic Contamination of Abrasive Material	ASTM D 4940
Cleanness of Compressed Air	ASTM D 4285
Pictorial Surface Preparation Standards	SSPC-VIS 1, 3, 4, and 5
Surface Profile by Keane -Tator Comparator	ASTM D 4417
Surface Profile by Replica Tape	ASTM D 4417
Wet Film Thickness	ASTM D 4414
Dry Film Thickness by Magnetic Gauge	SSPC-PA2 (modified)
Dry Film Thickness by Tooke Gauge	ASTM D 4138
Pull-off Strength of Coating	ASTM D 4541 (Method ~~B~~D, E, or F)

00594.45 Protecting Against Damage:

(a) Contaminated Surfaces - If the prepared surface becomes contaminated by material other than rust, clean the surface in a manner satisfactory to the Engineer before making the succeeding application. If the prepared surface becomes contaminated by rust, prepare the contaminated area again according to 00594.42 and recoat with all specified coats. Clean, ~~reprepare~~re-prepare, and recoat at no additional cost to the Agency.

(b) Surfaces Not to Be Coated - Protect surfaces that are not to be coated from blast-cleaning, overspray and drippings. Remove or repair unintended coatings or other damage on these surfaces to the Engineer's satisfaction at no additional cost to the Agency.

Do not clean or coat galvanized steel members such as ladders, safety rails and stanchions unless otherwise directed in the Special Provisions. Protect them from damage during preparation and application operations. Repair damaged galvanizing at no additional cost to the Agency.

Protect navigation lights and conduits. If navigation lights or lenses are damaged by the preparation or coating operations, immediately repair or replace at no additional cost to the Agency. Keep navigation lights operating and visible during the hours of darkness.

(c) Handling, Shipping, or Surface Damage - Exercise care in moving or handling steel in the shop, during shipping and during erection. Do not move or handle coated metal until the coating has cured.

Repair marred or damaged coated surfaces at no additional cost to the Agency, with the same materials and to the same condition as specified. At the completion of all work, the coating shall be complete and the surfaces undamaged and clean.

(d) Other Damage - Prevent, at no additional cost to the Agency, damage resulting from preparation and coating work, including:

- Damage to marine or vehicular traffic or harm to pedestrians in the vicinity of the work.
- Abrasive material or debris falling into an area which would create a traffic hazard.
- Damage to the bridge substructure, superstructure or motorized equipment.
- Damage to other property as a result of the Contractor's operations.

00594.60 Repair of Damaged and Unacceptable Coatings - Repair damaged surfaces and surfaces not in compliance with requirements of 00594.43 as follows:

(a) Surface Preparation - Repair localized damage, corrosion, and unacceptable coatings.

Prepare areas exhibiting coating defects down to the metal substrate, whether exhibiting visible corrosion or not, according to SSPC-SP 10.

If approved by the Engineer, prepare small areas according to SSPC-SP 15 so it does not damage adjacent areas. Extend the prepared area at least 2 inches into adjacent tightly adhering, intact coating.

In areas exhibiting coating defects which do not extend down to the metal substrate remove all loose, delaminating, non-intact, non-sound coating, or otherwise defective coating down to sound, still performing coating. Extend the prepared areas at least 2 inches into adjacent tightly adhering, intact coating.

(b) Feathering of Repair Areas - Feather the existing coating system surrounding each repair location. Feather for a distance of 1 inch to 2 inches to provide a smooth, tapered transition into the existing intact coating.

Verify that the edges of coating around the periphery of the repair areas are tight and intact by probing with a putty knife according to SSPC-SP 3. Roughen the existing coating in the feathered area to ensure proper adhesion of the repair coats overlap the intact, still sound surfaces at least 2 inches.

(c) Coating Application in Repair Areas - When the bare metal substrate is exposed in the repair area, apply all coats of the system to the specified thicknesses.

When the damage does not extend to the bare metal substrate, apply only the affected coats.

Maintain the thickness of the system in overlap areas within the specified total thickness tolerances and overlap the intact, sound existing coating at least 2 inches.

00594.75 Coating System Warranty and Supplemental Warranty Performance Bond - When the Special Provisions identify that a coating system warranty and a supplemental warranty performance bond are required, provide them according to 00170.85(b-1) and the following:

(a) Coating System Warranty - Unconditionally warrant to the Agency that all coating work and the coating systems, above deck and below deck, performed and applied on this Project are and shall be free of all defects for a period of 36 months. Provide a written 36-month warranty using the Agency-supplied coating system warranty form that is included near the front of the Special Provisions booklet. Furnish the written warranty 30 calendar days before the precoating conference. "Unconditionally warrant" means that the warranty covers all defects, regardless of the source or cause of the defect, including without limitation whether the source or cause is or may be related to workmanship, inspection, or choice of materials.

For purposes of the warranty, coating system defects are defined as any one or more of the following conditions:

- Visible rust or rust breakthrough
- Blistering, cracking or alligatoring

- Chalking or fading
- Loss of adhesion
- Cohesive failure

The Agency inspection of any portion of the work during the Contract and during the coating system application, the Agency acceptance of the work, corrections under the warranty, or expiration of the warranty shall not relieve the Contractor of its obligations under this warranty. Within 60 calendar days of written notification of defects, submit a repair plan to the Engineer. Within 120 calendar days of written notification of defects, or within such other time as the Engineer may agree in writing, correct all defects at no additional cost to the Agency.

The 36 month coating system warranty will begin on the date of Second Notification. During this warranty period, the Agency will inspect the coating system for defects three times; at approximately 12, 24, and 36 months after issuance of the Second Notification. The Contractor will be notified in advance of each inspection and will be permitted to accompany the Agency inspector. Make repairs and correct all defects to the coating system. Make all corrections and repairs according to the Contract requirements.

(b) Supplemental Warranty Performance Bond - Provide a supplemental warranty performance bond, in addition to the regular performance bond for the Contract, executed by a surety authorized to do business in the State of Oregon. Furnish the supplemental warranty performance bond 30 calendar days before the precoating conference. The supplemental warranty performance bond dollar amount will be listed in the Special Provisions.

The bond is to secure the performance by the Contractor of correction work on any coating system defects that the Contractor may be directed by the Agency to perform. Use the Agency-provided form included near the front of the Special Provisions booklet, except when the surety is a multiple surety, obtain a co-surety execution form from the Agency. The supplemental warranty performance bond shall be signed by the Surety's authorized Attorney-in-Fact with the Surety's seal affixed to the bond. Attach a power of attorney for the Attorney-in-Fact to the bond, include the bond numbers, and affix the Surety's original seal to the power of attorney. If executed by co-sureties, each surety shall sign, seal, and attach the power of attorney.

The supplemental warranty performance bond shall become effective on the date of Second Notification and continue, in full force and effect, until the Agency has advised the Contractor of either of the following:

- There are no coating system defects at the end of the full warranty period.
- The Contractor has been notified that there are coating system defects, the defects have been repaired by the Contractor to the satisfaction of the Agency as specified under the coating system warranty, and the full warranty period has expired.

Supplemental warranty performance bonds cannot be canceled nor be released due to possible claims.

Measurement

00594.80 Measurement - ~~No~~Except for pack rust removal, no measurement of quantities will be made for work performed under this Section.

Pack rust removal will be measured on the length basis.

Payment

00594.90 Payment:

(a) New Metal Structures - No separate payment will be made for preparing and coating new metal work. Payment for this work, including correction of damages, will be included in payment made for structural steel according to 00560.90 and metal sign supports according to 00930.90 as appropriate.

(b) Existing Metal Structures - The accepted quantities for preparing and coating existing metal structures will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Containment	Lump Sum
(b)	Moving Bridge Containment System	Lump Sum
(c)	Surface Preparation	Lump Sum
(d)	Coating Application	Lump Sum
(e)	Coating Materials	Lump Sum
(f)	Pack Rust Removal	Foot
(g)	Barge	Lump Sum

Item (a) includes designing, erecting, and securing access platforms and containment structure, and containment worker protection requirements.

Item (b) includes moving and removing the access platforms and containment structure.

Item (c) includes preparing existing metal surfaces.

Item (d) includes coating existing metal surfaces.

Item (e) includes the coating material.

Partial payments of items (c), (d), and (e) will be made only for portions of the structure that have been prepared and coated with all coats specified. The partial payment will represent an estimate of the work completed as a percentage of the total coating system work to be done.

No payment for work will be made until the supplemental warranty performance bond and the written 36 month coating system warranty, if required under 00594.75, have been furnished to the Agency.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for correction of damages described in 00594.45 and 00594.60.

Section 00595 - Reinforced Concrete Box Culverts

Description

00595.00 Scope - This work consists of constructing cast-in-place reinforced concrete box culverts (RCBC) and precast reinforced concrete boxes to the lines, grades, and dimensions shown or directed.

Materials

00595.10 Cast-in-Place Materials - For cast-in-place RCBC, cast-in-place ends, and cast-in-place wingwalls and aprons, furnish materials meeting the following requirements:

Reinforcement.....00530
Concrete.....00540

Unless otherwise shown, provide Class 3300 - 1 1/2" or 3/4" portland cement concrete.

00595.11 Precast Materials - For precast boxes, furnish materials meeting the requirements of AASHTO M 259 or AASHTO M 273. Furnish joint seals meeting the requirements of 02440.40.

Unless otherwise shown, provide Class 5000~~ - 1 1/2" or 3/4"~~ portland cement concrete.

Construction

00595.40 Cast-in-Place - Construct cast-in-place RCBC, cast-in-place ends, and cast-in-place wingwalls and aprons according to the following:

(a) Reinforcement - Place reinforcing steel according to Section 00530.

(b) Portland Cement Concrete - Place portland cement concrete according to Section 00540 and the following:

(1) Placing Concrete - Allow base slabs or box culvert footings to set at least 12 hours before constructing the remainder of the box culvert.

When constructing box culverts 4 feet or less in height, the sidewalls and top slab may be constructed as a monolith, with sidewalls constructed full height. If this method is used, place construction joints vertical and at right angles to the axis of the culvert.

When constructing box culverts more than 4 feet in height, place concrete in the walls to at least the bottom elevation of the top slab. Allow ~~three~~3 days before placing the top slab according to 00595.40(b-2).

Construct each wingwall as a monolith.

(2) Removal of Forms and Falsework and Subsequent Loading - Do not remove forms and falsework or place subsequent loads until the following conditions are met:

Form and Falsework Removal	Counting Days [1]
Stems and walls	1
Top Slabs	10

Subsequent Loading [2]	Counting Days [1]
Stems and walls over 4 feet in height	3

[1] From the time of the last placement of concrete in the forms or falsework supports and excluding days when the surrounding temperature is below 40 °F for ~~eight~~ 8 hours or more.

[2] Except loads from form work and reinforcing steel for further concrete placements.

(3) Concrete Finish - Finish all exposed concrete surfaces with a general finish according to 00540.53(a).

00595.41 Precast - Construct precast boxes according to AASHTO M 259 except as shown. A production run will be considered continuous if it is not interrupted for more than ~~three~~3 calendar days.

Place a continuous flexible watertight seal in the joint, on the sides and top, between each precast reinforced concrete box section.

Provide a 3/4 inch chamfer on all concrete edges unless otherwise noted.

Measurement

00595.80 Measurement - The quantities of reinforced concrete box culverts will be measured on the length basis, along the centerline of the box culvert, from end to end of the cast-in-place ends.

No measurement of quantities will be made for wingwalls and aprons.

~~No separate measurement will be made for concrete and reinforcement used in the box culverts.~~ Estimated quantities of concrete and reinforcement will be listed in the Special Provisions.

Payment

00595.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Reinforced Concrete Box Culverts	Foot
(b) Wingwalls and Aprons	Lump Sum

Item (a) includes cast-in-place ends regardless of the type of box culvert constructed.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

~~Section 00596 - Retaining Walls~~

~~Description~~

~~**00596.00 Scope** - This work consists of furnishing and constructing retaining walls as shown or specified, and in close conformity to the lines, grades, and dimensions shown or established.~~

~~The Special Provisions will list the types and locations of walls to be constructed.~~

~~**00596.02 Definitions** - Geosynthetic terms not defined in this subsection are identified in ASTM D 123, ASTM D 4439, or 00350.01. If there is a conflict, definitions in this subsection take precedence.~~

~~**Alternate Fasteners** - Spiral binders or high tensile locking spring steel clip or clamp-on ring type fasteners specified as an alternate to tie wire for assembling and joining gabions.~~

~~**Bin Walls** - Concrete or metal gravity retaining structures filled with granular backfill material. Bin walls consist of interlocking, prefabricated modules or bolted lightweight steel members constructed like building blocks.~~

~~**Company** - In the case of a proprietary retaining wall, the firm or other entity that identifies lawful claim to the retaining wall or design of the retaining wall. In the case of non-proprietary retaining wall, the firm or other entity that produces, provides, or designs the retaining wall.~~

~~**Conventional Segmental Retaining Walls:**~~

- ~~A basic gravity retaining wall type, and~~
- ~~Retaining walls composed of segmental retaining wall units only (i.e., no soil reinforcements).~~

~~**Crib Walls** - Prefabricated, interlocking reinforced or unreinforced gravity retaining structures backfilled with granular backfill material. Crib walls consist of alternating transverse and longitudinal beams.~~

~~**Extensible Tensile Reinforcements** - Reinforcements in which the deformation at failure is comparable to or greater than the deformability of the reinforced backfill (e.g., geotextile and polymeric materials).~~

~~**Gabion Retaining Walls:**~~

- ~~A basic gravity retaining wall type, and~~
- ~~Retaining walls composed of assembled wire baskets, connected together, filled with specified rock, and placed with a riprap geotextile between the back face of the basket and the backfill material.~~

~~**Geogrid** - See 00350.01 for geogrid definition.~~

~~**Geosynthetic** - See 00350.01 for geosynthetic definition.~~

~~**Geotextile** - See 00350.01 for geotextile definition.~~

~~**Inextensible Tensile Reinforcements** - Reinforcements in which the deformation at failure is significantly less than the deformability of the reinforced backfill (for example, metallic materials).~~

~~**Internal Connecting Wires** - Internal wires used to prevent gabions from bulging.~~

~~**Mechanically Stabilized Earth (MSE) Retaining Walls:**~~

- ~~A basic gravity retaining wall type, and~~
- ~~Retaining walls composed of granular backfill and either extensible or inextensible tensile reinforcements in the granular backfill mass. Examples of facing include precast concrete panels, cast-in-place facades, and segmental retaining wall units.~~

~~**Prefabricated Modular Block Retaining Walls** - Unreinforced, prefabricated concrete block gravity (non-MSE) retaining walls composed of concrete blocks greater than 3 cubic feet.~~

~~**Proprietary Retaining Walls:**~~

- ~~Retaining walls in which a private company identifies lawful claim to the product or design of the product,~~
- ~~Retaining wall products typically associated with a trade name or name brand, or~~
- ~~Retaining walls designed by someone other than the retaining wall Contract Documents engineer of record.~~

~~**Retaining Wall or Retaining Structure** - A group of interrelated components designed to resist earth pressures.~~

~~**Rigid Gravity Retaining Walls** - A basic gravity retaining wall type that includes cast-in-place concrete gravity retaining walls.~~

~~**Segmental Retaining Wall Unit** - A machine-formed solid or hollow modular concrete block less than 3 cubic feet.~~

~~**Semi-Gravity Retaining Walls** - A basic gravity retaining wall type that includes cast-in-place concrete cantilever or counterfort retaining walls.~~

~~**Tie Wire** - Wire used to assemble and join gabion units.~~

~~**00596.03 Variables** - The amount and type of work required to construct a proprietary retaining wall varies according to the wall selected. The Contractor is responsible for making a careful study of the work required for each wall and for determining the quantities.~~

~~Variables could involve shoring, excavation, backfilling, excess material, staging work, corrosion protection, utilities and drainage systems adjustments and other details of the work.~~

~~**00596.04 Proprietary Retaining Wall Submittals** - Submit stamped working drawings and design calculations, and field construction manuals and product brochures prepared by the manufacturer of the proprietary retaining wall selected, as necessary, according to 00150.35. Submit this information at least 30 calendar days before beginning retaining wall fabrication or construction. Obtain the Engineer's written approval before fabricating retaining walls.~~

~~**(a) Working Drawings** - Provide working drawings that include at least the following information:~~

~~**(1) General:**~~

- ~~**General Notes** - Necessary information on design and construction of the retaining wall.~~

- ~~**Materials and Quantity Summary List -** Show all items of each wall.~~

- ~~**Plan View** - Show the construction centerline and related horizontal curve data, the offset from the construction centerline to the face of the wall at all changes in horizontal alignment, and the centerline of any utility or drainage structure or pipe that is behind or passes under or through the wall.~~

- ~~**Elevation View** - Show the elevation at the top of the wall at all horizontal and vertical break points, and at least every 65 feet along the wall; vertical curve data; the location of the original and final ground line at both the heel and face of the wall; elevations at the base of the wall (for example, top of cast-in-place footings and leveling pads); the distance along the face of the wall to all steps in the wall base; and the applied bearing pressures.~~

- ~~**Typical Sections** - Show wall construction and limits of backfill.~~

- ~~**Structural and Geometric Details** - The following minimum structural and geometric details:~~

  - ~~Loading conditions~~
  - ~~Footing and/or leveling pad details~~
  - ~~Final front face batter~~
  - ~~Reinforcing bar bend details~~
  - ~~Details for appurtenances not detailed in the plans, including connections to concrete barriers, coping, parapets, soundwalls, fences, and attached lighting~~
  - ~~Construction around utility and drainage facilities, overhead sign support footings, abutment piles, or other structures~~

~~**(2) MSE Retaining Walls:**~~

- ~~**Plan View** - Show soil reinforcement limits.~~

- ~~**Elevation View** - Show the type and size of facing components; the length, size and number of soil reinforcements; and the distance along the face of the wall to where changes in the length of the soil reinforcement occur.~~

- ~~**Typical Section** - Show soil reinforcement limits.~~

- ~~**Facing Components** - Show all dimensions, including thickness; all details necessary to construct the facing components; all reinforcing steel in the component; and the location of tensile soil reinforcement attachment devices embedded in the facing. Show the type of concrete finish.~~

- ~~**Soil Reinforcements -** Show all dimensions and details necessary to construct the soil reinforcements.~~

~~**(b) Design Calculations** - The design calculations shall include but not be limited to:~~

~~**(1) General:**~~

- ~~**Design Input** - Show wall geometry; soil parameters; and both permanent and temporary design loads, including applied loads from pedestrian rails, fencing, guard rail, concrete barrier, soundwalls, sign supports, or luminaire supports.~~

- ~~**External Stability Calculations** - Indicate factors of safety against sliding and overturning.~~

- ~~**Foundation Bearing Pressure Calculations** - Indicate the factor of safety against foundation bearing failure.~~

- ~~**Appurtenances** - Show calculations for the design of pedestrian rails, fencing, guard rail, concrete barrier, soundwalls, sign supports or luminaires when not fully detailed on the plans. Design concrete barriers according to AASHTO Standard Specifications for Highway Bridges, and Interim Revisions, to withstand a horizontal force of 10,000 pounds per 5 feet applied at the top of the barrier and conforming to the National Cooperative Highway Research Program (NCHRP) Report 350, unless otherwise indicated.~~

~~**(2) MSE Retaining Walls:**~~

- ~~**Internal Stability** - Indicate reduction factors and factors of safety against soil reinforcement rupture, pullout, and facing connection strength.~~

- ~~**Local Stability** - Indicate factors of safety against sliding and bulging of segmental retaining wall facing units.~~

~~**(c) Field Construction Manual** - Provide a field construction manual, prepared by the manufacturer of the proprietary retaining wall selected, including step-by-step directions for constructing the retaining wall.~~

~~Materials~~

~~**00596.10 Materials** - Furnish materials meeting the following requirements:~~

~~**(a) Agency Approval** - Use only retaining wall materials, products or systems that have met the requirements of the Agency Retaining Structures Program and have an "Approved" status according to the Agency Retaining Structures Program prior to the Project Bid Opening. Information regarding approval or any other aspect of the Agency Retaining Structures Program may be obtained from the Agency Retaining Structures Coordinator in Salem.~~

~~**(b) Agency-Furnished Designs** - For retaining wall designs shown (i.e., non-proprietary retaining walls), either provide specified materials according to these applicable material Specifications or provide products from the QPL also according to these applicable material Specifications. Obtain like materials for the retaining wall from the same company.~~

~~**(c) Proprietary Retaining Wall Systems** - For proprietary retaining walls, provide products from the selected company according to the company's specifications and these applicable material Specifications. If there is a conflict between the company's specifications and the Agency's Specifications the Agency's Specifications will take precedence. Obtain all materials for the selected proprietary retaining wall from the same company. Use only one proprietary retaining wall on the Project unless different proprietary retaining walls are specified.~~

~~Do not use materials from unlisted sources without written approval. Acceptance will be based on manufacturer's test results and certificates of compliance according to 00165.35, visual inspection and other criteria in this Section.~~

~~**(d) Quality Control** - Provide quality control according to Section 00165.~~

00596.11 Backfill - Furnish backfill meeting the requirements of Section 00510 and the following:

(a) Granular Drain Backfill Material - Provide granular drain backfill material according to 00430.11. Provide a Type 1 drainage geotextile according to Section 02320.

(b) Special Filter Material - Provide special filter material according to Section 02610.

(c) Gabion Retaining Walls - Provide a well-graded 4 inch to 10 inch rock fill material inside the gabion baskets meeting the requirements of 00390.11(b).

Provide granular wall backfill material behind the gabion baskets according to 00510.12.

(d) Metal Bin Retaining Walls - Provide granular structure backfill material for the interior cell of the metal bin retaining wall units according to 00510.13.

Provide granular wall backfill material behind the metal bin retaining wall units according to 00510.12.

(e) Leveling Pads - Provide granular structure backfill material for gravel leveling pads according to 00510.13.

(f) Segmental Retaining Wall Units - Provide granular structure backfill material for the interior cell of hollow segmental retaining wall units according to 00510.13.

Provide backfill material behind the segmental retaining wall units as specified.

(g) MSE Granular Backfill - Provide MSE granular backfill material meeting the following requirements:

(1) Gradation - Gradation shall meet all requirements in Section 02630 and Table 02630-1. Use either 1" - 0 or 3/4" - 0 base aggregate conforming to the requirements of 02630.10(a) through 02630.10(c). Test the MSE granular backfill at the frequency specified in the ODOT Manual of Field Testing Procedures (MFTP) for aggregate base material. Additionally, MSE granular backfill placed in the spread footing foundation support zone shall have between 90 to 100 percent passing the 3/4 inch Sieve for all "Separated Sizes" as determined by AASHTO T27.

(2) Other Requirements:

a. Material Passing No. 200 Sieve - The percent, by weight, passing the No. 200 sieve shall not exceed 15% when tested according to AASHTO T 27 and AASHTO T 11.

b. Plasticity Index - The plasticity index of the material passing the No. 40 sieve shall not exceed 6 when tested according to AASHTO T 90.

c. Electrochemical Properties - The electrochemical properties of the material shall meet the following requirements:

Property	Limits	Test Procedures
pH	5.0 - 10.0	AASHTO T 289
Resistivity	5,000 Ω-cm (min.)	AASHTO T 288

~~MSE granular backfill material with resistivities of less than 5,000 Ω-cm but greater than 3,000 Ω-cm and meeting all other requirements may be accepted if they meet the following additional requirements:~~

~~Property~~	~~Limits~~	~~Test Procedures~~
~~Chlorides~~	~~100 PPM (max.)~~	~~AASHTO T 291~~
~~Sulfates~~	~~200 PPM (max.)~~	~~AASHTO T 290~~

~~**d. Organic Content** - The organic content shall meet one of the following conditions:~~

- ~~Organic content as computed according to AASHTO T 267 for material finer than the No. 10 sieve does not exceed 1.0%.~~
- ~~The ratio (expressed as a percentage) of the weight of organic material (as determined by AASHTO T 267) to the weight of the total sample does not exceed 0.75%.~~

~~**00596.12 Gabion Baskets** - Furnish gabion baskets meeting the requirements of Section 02340.~~

~~**00596.13 Concrete:**~~

~~**(a) ODOT Standard Cast-in-Place Concrete Gravity Retaining Wall** - Provide commercial grade concrete according to Section 00440.~~

~~**(b) ODOT Standard Cast-in-Place Concrete Cantilever Retaining Wall** - Provide structural concrete according to Section 00540.~~

~~**(c) Leveling Pads** - Provide commercial grade concrete according to Section 00440.~~

~~**(d) MSE Retaining Wall Cast-in-Place Concrete Facades** - Provide commercial grade concrete according to Section 00440.~~

~~**(e) MSE Retaining Wall Precast Concrete Facing Panels** - Provide commercial grade concrete according to Section 00440 and the following:~~

~~**(1) Portland Cement Concrete** - Use the class of concrete listed in the Special Provisions.~~

~~**(2) Casting** - Set soil reinforcement connection devices on the rear face of the precast panel and secure to prevent displacement during concrete placement and consolidation. Do not allow devices used to connect soil reinforcements to facing panels (e.g., loop embeds tie strips, etc.) to contact the face panel reinforcement steel. Place concrete in each panel without interruption and consolidate with an approved vibrator.~~

~~Use clear form oil throughout the casting operation.~~

~~**(3) Curing** - Follow the curing procedure given in the Special Provisions.~~

~~**(4) Finish** - Give the front face a general surface finish according to 00540.53(a), unless otherwise specified. Screed the back face to eliminate surface distortions and open pockets of aggregate.~~

~~**(5) Tolerance** - Manufacture all units within the following tolerances:~~

~~**a. Panel Dimensions** - Do not exceed a difference of 1/2 inch between diagonals. All other dimensions are not to exceed a difference of 3/16 inch. Angular distortion, with regard to the height of the panel, is not to exceed 1/8 inch in 3 feet.~~

~~**b. Soil Reinforcement Connection Devices:**~~

~~**1. Tie Strips** - Locate tie strip connection devices within 1 inch of the plan location.~~

~~**2. Loop Embeds** - Locate loop embeds within 3/16 inch of the plan location.~~

~~**3. Retention Slots** - Locate retention slots within 1 inch of the plan location. Slot openings are not to exceed 1/8 inch. Check the slot opening with the supplied "feeler" gauge according to the company's recommendations. Reject panels from which the "feeler" gauge is pulled from the slot.~~

~~**c. Panel Face** - Smooth formed surfaces are not to vary over 3/32 inch when measured over a length of 3 feet. Textured-finished surfaces are not to vary over 3/16 inch when measured over a length of 3 feet.~~

~~**d. Rear Face** - Eliminate surface distortions in excess of 1/4 inch.~~

~~**(6) Acceptance of Panels** - Acceptance will be according to 00540.17 except as follows:~~

- ~~Acceptance of precast panels will be determined based on production sublots. A production sublot will be represented by a single compressive strength sample and will consist of either 40 panels or a single day's production, whichever is less. Cast one set of cylinders for each production sublot.~~
- ~~Acceptability of the precast panel will be determined based on conditional compressive strength tests results, check tests, and visual inspection. Panels may be placed in the wall if 7-day initial strength exceeds 85% of the 28-day requirements. Final acceptance will be based on the 28-day test results.~~

~~**(7) Marking** - Clearly scribe on the rear face of each panel the date of manufacture, the production sublot number, and the piecemark.~~

~~**(8) Handling, Storage, and Shipping** - Handle, store, and ship all units in a manner that eliminates chipping, discoloration, cracks, fractures and connecting device damage. Support stored panels on firm blocking.~~

~~**(9) Rejection** - Any of the following defects will be cause for rejection:~~

- ~~Imperfect molding~~
- ~~Honeycombed or open texture concrete~~
- ~~Exposed reinforcing steel~~
- ~~Improperly installed soil reinforcement connection devices~~
- ~~Broken or chipped concrete~~
- ~~Excessive color variation on front face of panel~~
- ~~Nonspecification strength~~
- ~~Cross-sectional thickness of the wall facing component less than the minimum thickness indicated on the plans or working drawings~~

~~**(f) Segmental Retaining Wall Units** - Provide a minimum compressive strength after 28 days of 4,000 psi and a maximum absorption rate of 5% by weight.~~

~~**(1) Portland Cement** - Use portland cement meeting the requirements of 02010.10.~~

~~**(2) Blended Cement** - Use blended cement meeting the requirements of 02010.20.~~

~~**(3) Aggregate** - Use aggregate meeting the requirements of ASTM C 33.~~

~~**(4) Tolerance** - Molded dimensions are not to differ more than 1/8 inch from the manufacturer's published dimensions, except height, which is not to differ more than 3/16 inch.~~

~~**(5) Color** - Provide gray units unless specified otherwise.~~

~~**(6) Finish** - Provide split-face units unless specified otherwise.~~

~~Provide units that are sound and free of cracks or other defects that would interfere with the proper placement of the unit or significantly impair the strength or permanence of the construction.~~

~~Provide units that are free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused light.~~

~~**(7) Acceptance of Units** - Acceptability will be determined based on compressive strength, moisture absorption, and dimension tests according to ASTM C 140 and visual inspection. Segmental retaining wall units may be placed in the wall if 7-day initial strength exceeds 85% of the 28-day requirements. Final acceptance will be based on the 28-day test results.~~

~~**(8) Marking** - Indicate the date of manufacture and the production lot number on each lot of segmental retaining wall units.~~

~~**(9) Handling, Storage, and Shipping** - Handle, store, and ship all units in a manner that eliminates chipping, discoloration, cracks and fractures.~~

~~**(10) Rejection** - Any one of the following defects will be cause for rejection:~~

- ~~Imperfect molding~~
- ~~Honeycombed or open texture concrete~~
- ~~Broken, cracked or chipped units~~
- ~~Extreme color variation on front face of unit~~
- ~~Nonspecification strength~~
- ~~Absorption~~

~~**(g) Prefabricated Modular Concrete Blocks:**~~

~~**(1) Concrete** - Provide concrete suitable for common structural applications. Concrete tests are not required.~~

~~**(2) Grade** - Provide Standard Grade blocks.~~

~~**(3) Color** - Provide gray blocks unless specified otherwise.~~

~~**(4) Finish** - Provide smooth face blocks unless specified otherwise.~~

~~Provide blocks that are sound and free of cracks or other defects that would interfere with the proper placement of the block or significantly impair construction of the wall.~~

~~Provide blocks that are free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused light.~~

~~**(5) Tolerance** - Molded dimensions are not to differ more than 1/4 inch from the manufacturer's published dimensions, except height, which is not to differ more than 5/32 inch.~~

~~**(6) Handling, Storing, and Shipping** - Handle, store, and ship all blocks in a manner that eliminates chipping, discoloration, cracks and fractures.~~

~~**(7) Acceptance of Blocks** - Acceptability will be determined based on tolerances specified in (5) of this subsection and visual inspection.~~

~~**(8) Rejection** - Any one of the following defects will be cause for rejection:~~

- ~~Concrete not suitable for common structural applications~~
- ~~Imperfect molding~~
- ~~Honeycombed or open texture concrete~~
- ~~Broken, cracked or chipped blocks~~
- ~~Extreme color variation on front face of block~~

~~**00596.14 Steel Reinforcement for Concrete** - Furnish steel reinforcement for concrete meeting the requirements of Section 00530.~~

~~**00596.15 Steel** - Furnish structural steel meeting the requirements of Section 00560 and the following:~~

~~**(a) Metal Bin Retaining Walls** - Provide metal bin retaining walls according to Section 02350.~~

~~**(b) Inextensible Soil Reinforcements, Facing Components and Attachment Hardware** - Shop fabricate true size and defect-free soil reinforcements, facing components and attachment hardware as follows:~~

~~Galvanize soil reinforcements, facing components and attachment hardware according to 02530.70, except where noted. If specified, epoxy coat according to AASHTO M 284 (ASTM A 775), except where noted.~~

~~**(1) Reinforcing Strips** - Use steel reinforcing strips of the required shape and dimensions conforming to ASTM A 36 or equal. Provide a minimum 2.0 ounce per square foot galvanized coating. If specified, provide a minimum 18 mils epoxy coating.~~

~~**(2) Reinforcing Mesh** - Furnish welded wire reinforcement according to 02510.40 supplemented and modified as follows:~~

~~**a. Galvanized Reinforcement** - Provide a minimum 2.0 ounce per square foot galvanized coating for welded wire embedded in either concrete or soil according to ASTM A 641.~~

~~**b. Epoxy Coated Reinforcement** - When specified, provide a Class A coating for welded wire reinforcement embedded in concrete and a Class B coating for welded wire fabric embedded in soil according to ASTM A 884.~~

~~**(3) Tie Strips** - Provide tie strips of steel conforming to the requirements of ASTM A 1011, Grade 50, or equivalent.~~

~~**(4) Loop Embeds** - Fabricate 1 inch loop embeds from cold drawn steel wire conforming to AASHTO M 32 (ASTM A 82). Weld loop embeds according to AASHTO M 55 (ASTM A 185). Galvanize loop embeds according to ASTM B 633 or equal.~~

~~**(5) Fasteners** - Use galvanized high-strength bolts according to 02560.20.~~

~~**(6) Connectors** - Fabricate connectors from cold drawn steel wire according to AASHTO M 32 (ASTM A 82).~~

~~**00596.16 Geosynthetics** - Furnish geosynthetics meeting the following requirements:~~

~~**(a) Gabion Wall Filter** - Provide Type 2 riprap geotextile according to Section 02320.~~

~~**(b) Precast Concrete Facing Panel Joint Cover** - Provide Type 1 drainage geotextile according to Section 02320.~~

~~**(c) Extensible Soil Reinforcements:**~~

~~**(1) Geotextile** - Provide geotextile according to the Special Provisions.~~

~~**(2) Geogrid** - Provide geogrid according to the Special Provisions.~~

~~**00596.17 Elastomeric Bearing Pads for Precast Concrete Facing Panels** - In horizontal joints between precast concrete panels, furnish either preformed ethylene propylene diene monomer (EPDM) rubber pads meeting the requirements of ASTM D 2000, M2AA 810 A13B33C12F17 having a durometer hardness of 80 ± 5, or neoprene elastomeric pads having a durometer hardness of 55 ± 5, or other bearing material as recommended by the supplier, certified by the manufacturer and approved by the Engineer.~~

~~**00596.18 Timber** - Furnish timber meeting the requirements of Section 00570.~~

~~**00596.19 Piles** - Furnish piling meeting the requirements of Section 00520.~~

~~Labor~~

~~**00596.30 Quality Control Personnel** - Provide certified technicians in the following fields:~~

- ~~CAgT~~
- ~~CDT~~
- ~~CEBT~~

~~Construction~~

~~**00596.40 General:**~~

~~**(a) Proprietary Retaining Walls** - Provide for a field representative from the selected proprietary retaining wall company to be present at the start of retaining wall construction. Supervisory personnel of the Contractor, the company field representative, and any subcontractors who are to be involved in the construction of the proprietary retaining wall shall meet with the Engineer for a retaining wall preconstruction conference. At this conference, discuss methods of accomplishing all phases of the work required to construct the proprietary retaining wall. If all representatives are not in attendance, the retaining wall preconstruction conference and start of retaining wall construction shall be rescheduled.~~

~~In addition to the retaining wall preconstruction conference, the company field representative shall be available as needed during the erection of the proprietary retaining wall to provide instructions and recommendations, and to assist the Contractor or Engineer. Follow instructions and recommendations of the representative if approved by the Engineer.~~

~~**(b) All Retaining Walls** - All retaining walls, regardless of design, shall conform to the applicable top of wall profile shown. Retaining walls detailed in the Agency-provided plans shall conform to the applicable bottom of wall elevations shown for walls without footings, the applicable top of footing elevations for walls with footings, or the applicable top of leveling pad elevations for walls with leveling pads. Verify existing ground elevations and bottom of wall elevations for proprietary retaining walls prior to final design.~~

~~**00596.41 Excavation, Backfill, and Compaction Requirements:**~~

~~**(a) General** - Perform structure excavation and backfill for all retaining walls according to Section 00510 to the limits and stages shown.~~

~~Construct all retaining walls on suitable foundation materials. Excavate any unsuitable foundation materials below elevations shown and backfill with suitable material as directed. Grade the foundation for the structure level for a width equal to the width of the footing or the bottom soil reinforcement and facing component thickness, or as shown. Do not reinforce overexcavated foundations with geosynthetic or similar materials without prior approval.~~

~~Do not construct backfill when the backfill, the foundation, or the embankment on which it would be placed is frozen, unstable, or not compacted, unless otherwise directed. Place backfill material in nearly horizontal layers not more than 8 inches thick or to the top of the facing component if the height of the facing component is less than or equal to 8 inches.~~

~~Unless otherwise specified, compact the entire surface of each layer in place with a minimum of three coverages, using equipment made specifically for compaction. Select compaction equipment based on the type of material being compacted and the layer thickness. Normal compaction equipment consists of sheepsfoot rollers, tamping foot rollers, grid rollers, pneumatic tired rollers, and vibratory rollers. Routing of hauling and grading equipment will not be accepted as adequate to achieve compaction.~~

~~Compact backfill material within 3 feet of the backface of the retaining wall using a low weight mechanical tamper, roller or vibratory system.~~

~~Avoid any damage or misalignment of retaining wall components as the backfill is placed. Remove any wall materials that become damaged during backfill placement and replace at no additional cost to the Agency. As directed, correct misaligned units not meeting the limits specified due to backfill placement at no additional cost to the Agency.~~

~~**(b) Testing** - Except for backfill material within 3 feet of the back face of the retaining wall, test for compaction as follows:~~

- ~~**Moisture and Density** - Determine according to AASHTO T 310.~~
- ~~**Optimum Moisture and Maximum Density** - Determine as required by AASHTO T 99 Standard Proctor Method D, with coarse particle correction according to AASHTO T 224.~~

~~Meet each of the following moisture content, density and deflection requirements:~~

- ~~**Moisture Content** - Prepare material to within -4% to +2% of optimum moisture content at the time of compacting. Add water to material that does not contain sufficient moisture and~~

~~thoroughly mix as directed. Remove excess moisture by manipulation, aeration, drainage, or other means before compacting.~~

- ~~**Density:**~~

  - ~~Compact MSE granular backfill to 100% of relative maximum density as determined by AASHTO T 99 Standard Proctor Method D, with coarse particle correction according to AASHTO T 224.~~
  - ~~Where spread footings for bridges or other structures are founded behind free standing retaining walls, including in or on MSE granular backfill material, compact the spread footing foundation zone to 100% of relative maximum density as determined by AASHTO T 99 Standard Proctor Method D, with coarse particle correction according to AASHTO T 224. The spread footing foundation zone depth is twice the footing width or 6 feet, whichever is greater, and extends a horizontal distance equal to the footing width beyond the outside bottom edge of the footing in all directions. Begin compaction of the backfill material at the backface of the wall or the wall facing component.~~

- ~~**Deflection Requirement** - In addition to moisture-density testing, each compacted layer will be observed for deflection or reaction under moving loaded equipment according to ODOT TM 158 to verify that no soft or pumping areas remain in any layer or foundation soil. Correct all such areas at no additional cost to the Agency.~~

~~**00596.42 Cast-in-Place Concrete Retaining Walls:**~~

~~**(a) Wall Drainage Systems** - Construct the retaining wall drainage system according to the applicable sections of 00430 and as shown. A drainage geotextile is required when using granular drain backfill material.~~

~~**(b) ODOT Standard Cast-in-Place Concrete Gravity Retaining Wall** - Construct cast-in-place concrete gravity retaining walls according to Sections 00440 and 00530.~~

~~**(c) ODOT Standard Cast-in-Place Semi-Gravity (Cantilever) Retaining Wall** - Construct cast-in-place concrete semi-gravity retaining walls according to Sections 00530 and 00540.~~

~~**00596.43 Gabion Retaining Walls** - Erect gabion retaining walls according to the Agency-provided plans and approved working drawings, if applicable, and the company's field construction manual as approved, supplemented and modified as follows:~~

~~**(a) General** - Select and use the same style of mesh for the gabion panel bases, ends, sides, diaphragms, and lids; the same method of joining the edges of a single gabion unit; and the same method of tying successive gabion units together throughout each structure.~~

~~If the height of the constructed gabion wall is less than 95% of the design height, add additional gabion baskets as directed to attain the design height, at no additional cost to the Agency.~~

~~Place riprap geotextile according to Section 00350 and the following:~~

- ~~Minimum overlap shall be 12 inches.~~
- ~~Against the back of the gabion wall before placing backfill material.~~

~~**(b) Assembly** - Assemble each style of gabion by rotating the panels into position and joining the vertical edges with tie wire or alternate fasteners.~~

~~If twisted wire panels are tied with tie wire, join the selvage vertical edges with alternating single and double loops at 4 inch nominal spacing.~~

~~If welded wire panels are tied with tie wire, pass the tie wire through each mesh opening along the vertical edges joint and secure with a half hitch locked loop.~~

~~Leave no openings greater than 4 3/4 inches (line dimension) along the edges or at corners of tied or spiral bound gabions of either mesh style. Crimp the edges of spiral binding wire to secure the spiral in place.~~

~~If high tensile fasteners are used in lieu of tie wire, install one fastener in each mesh opening according to the manufacturer's recommendations.~~

~~**(c) Placement** - Set the empty gabions in place and connect each gabion to the adjacent gabion along the top and vertical edges with tie wire or spiral binders. Connect each layer of gabions to the underlying layer along the front, back and sides with tie wire or spiral binders in the same manner as specified for assembly of baskets. Common wall construction will not be allowed.~~

~~Before filling each gabion with rock, remove all kinks and folds in the wire fabric and properly align all baskets. Remove all temporary clips and fasteners. The assembled gabion baskets may be placed in tension before filling.~~

~~**(d) Filling** - Place the rock by hand or machine to ensure proper alignment, avoiding bulges and assuring a minimum of voids. All exposed rock surfaces shall have a smooth, neat appearance with no sharp edges projecting through the wire mesh.~~

~~Place the rock in layers to allow placement of internal connecting wires in each outside cell of the structure or when directed by the Engineer at the following intervals:~~

- ~~None required for 1 foot high baskets~~
- ~~At the 1/2 point for 1 1/2 foot high baskets~~
- ~~At 1/3 points for 3 foot high baskets~~

~~Completely fill the basket so the lid will bear on the rock when it is closed. Secure the lid to the sides, ends, and diaphragms with tie wire or spiral binders in the same manner as specified for assembly of baskets.~~

~~**(e) Repairs** - During construction, repair and secure any breakage of the wire mesh that results in mesh or joint openings larger than 4 3/4 inches (line dimension). Make repairs using 13 1/2 gauge galvanized tie wire as directed.~~

~~Repair any damage to PVC wire coating in a manner that provides the same degree of corrosion resistance as the undamaged wire, according to the manufacturer's recommended repair procedures and as approved.~~

~~**00596.44 Prefabricated Modular Retaining Walls** - Erect retaining wall components according to the Agency-provided plans and approved working drawings, if applicable, and the company's field construction manual as approved , supplemented and modified as follows:~~

~~**(a) Metal Bin Retaining Walls** - Concurrently with the assembly of the bins, backfill within and around the bins of the assembled wall to the limits shown. Keep the backfill around the outside approximately level with the inside fill. Exercise care to completely fill the depressions of stringers and spacers, and compact without displacing them from line and batter.~~

(b) Prefabricated Modular Concrete Blocks:

(1) Leveling Pad - Construct a gravel leveling pad at each foundation level as shown. Compact gravel leveling pads according to 00596.41(b).

(2) Block Installation and Backfill Placement - Place blocks as shown. Blocks should typically be placed in a running bond pattern unless placed perpendicular to the face of the wall. Place blocks so the final position is battered as shown. Place the first course of blocks on top of and in full contact with the prepared leveling pad surface. Closely follow erection of each course of blocks with placement of Granular Wall Backfill material. Remove excess backfill from the top of the blocks prior to installing the next course of blocks.

(3) Construction Tolerances - During construction of the wall and placement of blocks maintain a vertical tolerance and tangent horizontal alignment tolerance not in excess of 1 1/4 inch when measured with a 10 foot straightedge. Check the plumbness and tolerances of each course of blocks before erecting the next course.

00596.45 Conventional Segmental Retaining Walls - Erect retaining wall components according to the Agency-provided plans and approved working drawings, if applicable, and the company's field construction manual as approved, supplemented and modified as follows:

(a) Leveling Pad - Construct a gravel or unreinforced cast-in-place concrete leveling pad at each foundation level as shown. Compact gravel leveling pads according to 00596.41(b). Cure cast-in-place leveling pads for a minimum of 12 hours before placing the segmental retaining wall units.

(b) Segmental Unit Installation and Backfill Placement - Place segmental retaining wall units so the final position is battered as shown. Place the first course of segmental units on top of and in full contact with the prepared leveling pad surface. If applicable, install shear connectors and place unit fill. Closely follow erection of each course of segmental units with placement of granular wall backfill material. Remove excess backfill from the top of the segmental units prior to installing the next course of units. Glue the uppermost row of segmental units or caps to underlying units with an adhesive recommended by the manufacturer. For walls in which the manufacturer does not provide an adhesive for this purpose use an epoxy adhesive from the QPL. Clean the completed wall face of foreign material deposits on exposed horizontal portions of the segmental units.

(c) Construction Tolerances - During construction of the wall and placement of segmental retaining wall units maintain a vertical tolerance and tangent horizontal alignment tolerance not in excess of 1 1/4 inch when measured with a 10 foot straightedge. Check the plumbness and tolerances of each course of segmental retaining wall units before erecting the next course.

00596.46 MSE Retaining Walls - Erect retaining wall components according to the Agency-provided plans and approved working drawings, if applicable, and the company's field construction manual as approved, supplemented and modified as follows:

(a) Leveling Pad:

(1) Precast Concrete Facing Panels - Provide a precast concrete leveling pad, or construct an unreinforced cast-in-place concrete leveling pad at each facing panel foundation level as shown. Place precast concrete leveling pads in full contact with the foundation. Cure cast-in-place leveling pads for a minimum of 12 hours before placing the wall facing panels.

(2) Segmental Retaining Wall Units - Construct a gravel or unreinforced cast-in-place concrete leveling pad at each facing unit foundation level as shown. Compact gravel leveling

~~pads according to 00596.41(b). Cure cast-in-place leveling pads for a minimum of 12 hours before placing the segmental retaining wall units.~~

~~**(b) Facing Components** - Place facing components so the final position is vertical or battered as shown. Place the first course of facing components on top of and in full contact with the prepared leveling pad surface. As backfill placement proceeds place the facing components and applicable hardware in successive horizontal courses in the sequence shown.~~

~~**(1) Precast Concrete Facing Panels** - Erect precast panels using the lifting devices connected to the upper edge of the panel. Attach geotextile joint cover as shown to the rear of the facing panels with an approved adhesive recommended by the company. Use a minimum 12 inch wide geotextile with a minimum overlap of 4 inches. Maintain the panels in position by means of temporary wedges or bracing according to the company's recommendations.~~

~~**(2) Wire Facing Components** - Attach soil retention material as shown to the rear of the facing component as recommended by the company and as approved.~~

~~**(3) Segmental Retaining Wall Units** - If applicable, install shear connectors and place unit fill. Remove excess backfill from the top of the segmental retaining wall units prior to installing the next course of units and/or soil reinforcements. Glue the uppermost row of segmental retaining wall units or caps to underlying units with an adhesive recommended by the company. On walls for which the company does not provide an adhesive for this purpose, use an epoxy adhesive from the QPL. Clean the completed wall face of foreign material deposits on exposed horizontal portions of the segmental units.~~

~~**(c) Soil Reinforcement Components** - Before placing the soil reinforcement components, compact the foundation according to 00596.41. If skewing of the soil reinforcements is required due to obstructions in the reinforced volume, submit design computations to the Engineer justifying the effect of skewing on the performance of the soil reinforcements.~~

~~**(1) Inextensible Soil Reinforcement Components** - Place the soil reinforcement components normal to the face of the wall unless otherwise shown or directed. Repair damaged galvanized or epoxy coated components before placing backfill material, to provide a coating comparable to that provided by 02530.70 or AASHTO M 284 (ASTM A 775), respectively.~~

~~**(2) Extensible Soil Reinforcement Components** - Orient geosynthetic reinforcements with the highest strength axis normal to the face of the wall unless otherwise shown or directed. Prior to placing backfill, pull geosynthetic reinforcements taut, and anchor them. Geosynthetic reinforcements shall be continuous throughout their embedment lengths. Spliced connections will not be allowed.~~

~~**a. Non-Proprietary Geosynthetic Wrapped-Face Retaining Walls** - Construct geosynthetic wrapped-face retaining walls according to 00350.20, 00350.40 and 00350.41 supplemented as follows:~~

~~**1. General** - Begin wall construction at the lowest portion of the excavation and place each layer horizontally as shown. Complete each layer in its entirety before the next layer is started. Seams will be allowed only at the wall face. Either overlap geotextile sheets 24 inches minimum and perpendicular to the wall face, or sew seams parallel to the wall face according to 00350.41(a-3). Stretch the geotextile in a direction perpendicular to the wall face to eliminate slack before backfilling.~~

~~**2. Wall Forming** - Use a temporary form system at the wall face during construction. A typical temporary form system and a sequence of wall construction required will be~~

~~shown. Use pegs, pins, or the manufacturer's recommended method as approved, in combination with the forming system, to hold the geotextile in place until the cover material is placed.~~

~~**(d) Backfill Placement** - Closely follow erection of each course of facing components with placement of MSE granular backfill material. Construct adjacent general embankment layers at the same time the MSE layers are constructed.~~

~~Do not operate tracked or rubber tired construction equipment directly upon geosynthetic reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over geosynthetic reinforcement. Avoid sudden braking and sharp turning movements.~~

~~At the end of each day, if rain is anticipated, slope the MSE granular backfill away from the MSE retaining wall face to direct surface runoff away from the wall. Do not allow surface runoff from adjacent areas to enter the MSE retaining wall construction site.~~

~~**(e) Construction Tolerances** - During construction of walls and placement of facing components, maintain the following tolerances:~~

~~**(1) Precast Concrete Facing Panels:**~~

- ~~Vertical tolerances and tangent horizontal alignment tolerances along the wall line shall not exceed 3/4 inch when measured with a 10 foot straightedge.~~
- ~~Maximum allowable offset in any facing component joint shall be 3/4 inch.~~
- ~~Horizontal, vertical and sloped joint openings between components shall be uniform, no larger than 1 1/4 inch, and no smaller than 5/8 inch.~~

~~**(2) Wire Facing Components:**~~

- ~~Vertical tolerances and tangent horizontal alignment tolerances along the wall line shall not exceed 2 inches when measured with a 10 foot straightedge.~~

~~**(3) Cast-in-Place Concrete Facades:**~~

- ~~Vertical tolerances and tangent horizontal alignment tolerances along the wall line shall not exceed 3/4 inch when measured with a 10 foot straightedge.~~

~~**(4) Segmental Retaining Wall Units:**~~

- ~~Vertical tolerance and tangent horizontal alignment tolerance shall not exceed 1 1/4 inch when measured with a 10 foot straightedge.~~

~~Check the plumbness and tolerances of each course of facing components before erecting the next course.~~

~~Measurement~~

~~**00596.80 Measurement** - The quantities of retaining walls will be measured on the area basis, and will be the area shown, in a vertical plane, for each retaining wall. Field measurement of each retaining wall area will not be made. The quantity will be the theoretical area of each retaining wall unless changes are ordered in writing by the Engineer. If changes are ordered, an adjustment will be made only for the quantity difference involved in the ordered plan changes.~~

~~The estimated quantities of excavation, shoring, footings, leveling pads, and specified backfill will be listed in the Special Provisions.~~

~~The quantities of type "F" coping will be measured on the length basis, from end to end of coping.~~

~~The quantities of sidewalk coping will be measured on the area basis, from end to end and from top of curb to exterior edge of coping.~~

~~Excavation below elevations shown will be measured according to 00510.80(b).~~

~~Payment~~

~~**00596.90 Payment** - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:~~

~~Pay Item~~	~~Unit of Measurement~~
~~(a) Retaining Wall, Cast-In-Place Concrete~~	~~Square Foot~~
~~(b) Retaining Wall, Gabion~~	~~Square Foot~~
~~(c) Retaining Wall, Prefabricated Modular~~	~~Square Foot~~
~~(d) Retaining Wall, Conventional Segmental~~	~~Square Foot~~
~~(e) Retaining Wall, MSE~~	~~Square Foot~~
~~(f) Retaining Wall, Contractor's Option~~	~~Square Foot~~
~~(g) Type "F" Coping~~	~~Foot~~
~~(h) Sidewalk Coping~~	~~Square Foot~~

~~Item (f) consists of two or more wall type options that would generally be paid for as individual walls under items (a) through (e). These options will be listed in the Special Provisions.~~

~~Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.~~

~~Excavation below elevations shown and backfill will be paid for according to 00510.90(c).~~

~~No separate or additional payment will be made for reinforcing steel and concrete in type "F" coping and sidewalk coping.~~

~~No separate or additional payment will be made for technical representatives, excavation, shoring, footings, leveling pads, specified backfill, or for wall drainage and filter systems, including perforated pipe, drain material, geotextile, and drain pipe, cast-in-place or precast standard coping, including coping reinforcing steel and concrete, and other appurtenances.~~

Section 00597 - Sound Walls

Description

00597.00 Scope - This work consists of furnishing and constructing sound walls at the locations shown or as directed.

Use one of the following sound wall types:

- Concrete block walls
- Precast concrete panel walls
- Concrete panel fence walls

00597.01 Variables - The amount and kind of work required to construct a sound wall varies according to the type of wall selected. Be responsible for determining the work required for each wall type and for the variables in quantities, including shoring, excavation, backfilling, excess material, staging work and other details of the work.

Materials

00597.10 Materials - Obtain all manufactured materials for the selected sound wall type from the same company. Only one type of wall will be allowed on the Project unless otherwise specified.

Store concrete masonry units and cementitious materials at the jobsite in a manner which will protect the materials from contact with soil and weather. Store mortar and grout materials in original unbroken packages.

00597.11 Concrete Block Sound Walls:

(a) Concrete Blocks - Furnish concrete blocks meeting the following requirements:

- Hollow, load-bearing blocks, graded N-1, f'm = 1,300 psi with 2,000 psi 28-day strength on net cross sectional area, according to ASTM C 90
- Kiln dried to 33~~%~~ percent total absorption
- Split ribbed (York) pattern on exposed areas
- Standard block on unexposed areas
- Nominal 8 inch x 8 inch x 16 inch size

Do not tint concrete blocks. Use uniform colored blocks along the length of individual walls.

(b) Concrete Caps - Construct concrete caps meeting the following requirements:

- Nominal 4 inch x 8 inch x 16 inch size
- Same color as concrete blocks

(c) Reinforcement - Furnish reinforcement meeting the requirements of Section 00530.

(d) Concrete - For pile footings, furnish concrete according to Section 00440. For all other components, including spread footings, furnish concrete according to Section 00540.

(e) Mortar and Grout - Furnish mortar meeting the requirements of ASTM C 270 that attains an ultimate compressive strength of at least 2,500 psi at 28 days. Furnish coarse grout meeting the

requirements of ASTM C 476 with a suitable consistency for pouring without segregation of materials.

(f) Preformed Expansion Joint Filler - Furnish expansion joint filler meeting the requirements of 02440.10.

(g) Fillers, Sealers and Damp-proofing - Furnish fillers, sealers, and damp-proofing materials from the QPL.

00597.12 Precast Concrete Panel Sound Walls:

(a) Reinforcement - Furnish reinforcement meeting the requirements of Section 00530.

(b) Concrete - For footings, furnish commercial grade concrete meeting the requirements of Section 00440. For all other components, furnish concrete meeting the requirements of Section 00540.

00597.13 Concrete Panel Lock Fence Sound Walls:

(a) General - Furnish concrete panel lock fence material and necessary components. Provide the manufacturer's test results and certificate of compliance according to 00165.35.

(b) Reinforcement - Furnish reinforcement meeting the requirements of Section 00530.

(c) Concrete - For footings, furnish commercial grade concrete meeting the requirements of Section 00440. For all other components, furnish concrete meeting the requirements of Section 00540.

Construction

00597.40 General - Perform structure excavation according to Section 00510 to the limits and stages shown. All sound walls, regardless of type, shall conform to the top of wall profile shown. Provide footings as shown or approved.

00597.41 Concrete Block Sound Walls:

(a) General - Construct all masonry walls plumb, level and true. Build walls in running bond pattern. Place masonry according to accepted standards of good practice and work in masonry construction and as shown.

If work is discontinued, protect the top of the wall with a well-secured waterproof cover.

Do not perform masonry work when the surrounding temperature is less than 35 °F unless provisions are made for heating and drying materials and for protecting the work.

Do not backfill walls until at least 24 hours after damp-proofing is applied.

Use clean, dry, ice-free, and frost-free masonry units. Do not dampen units before or during laying unless approved.

Place the first course of masonry on the footing in a full mortar bed. Mortar joints between units shall be 3/8 inch thick with full mortar coverage on vertical and horizontal face shells only. Vertical joints shall be shoved tight.

Discard mortar when:

- Not used within ~~two~~2 hours of initial mixing
- Stiffened due to hydration past initial set
- Stiffened due to evaporation
- Allowed to stand ~~one~~1 hour without mixing

Grout all cells containing reinforcing bars. Walls and crosswebs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Grout may stop in cells containing bars where, and if, the reinforcement stops. Position vertical steel in the center of the cell and securely tie in place at intervals of not more than 5 feet. Use grout that is sufficiently fluid to flow into all grout spaces, leaving no voids. Perform grouting according to either "low-lift grouting" or "high-lift grouting" as follows:

(1) Low-Lift Grouting - When the wall is grouted as the wall is laid up, do the following:

- Do not exceed 4 feet high wall construction before placing grout.
- Construct vertical cores or cells of a clear, unobstructed size measuring not less than 2 inches by 3 inches.
- Rod or vibrate grout when placed.
- Position reinforcing steel and tie in place.
- Do not proceed with constructing the wall above a bond beam course until the vertical cells below the bond beam course and the bond beam course itself have been filled with grout.
- When the time interval between lifts will exceed ~~one~~1 hour, stop the lifts 1 1/2 inches below the top of the course.

(2) High-Lift Grouting - When the wall is to be grouted full height or if the height to be grouted will exceed 4 feet, do the following:

- Leave cleanouts, with a minimum opening of 3 inches by 4 inches as shown, in the bottom course of the placement at each vertical cell. Keep cleanouts open until all mortar droppings have been removed and vertical reinforcing steel has been placed and inspected.
- Remove excess mortar from vertical cores and expose an unobstructed vertical hole with a dimension of at least 2 inches and a cross-sectional area of at least 10 square inches.
- Do not start grout work until 24 hours after the portion of the wall to be grouted has been constructed.
- Do not place grout in lifts greater than 4 feet in height. Rod or vibrate grout not later than 10 minutes after placing and before the preceding lift takes its permanent set. Extend rodding or vibrating 12 inches to 18 inches into the preceding lift.
- Do not begin grouting successive lifts until at least 30 minutes have elapsed after rodding or vibrating the preceding lift.
- If the time interval between lifts will exceed ~~one~~1 hour, stop the lifts 1 1/2 inch below the top of the course.
- Place wire screen, small mesh, expanded metal lath or other approved material in mortar joints under each bond beam course to prevent filling vertical cells not intended to be filled.

(b) Waterproofing - Treat all masonry wall cap surfaces with a waterproofing application of a high-build filler and rubber sealer. Treat at least 14 calendar days after the wall is completed. Apply filler by spraying or rolling according to the manufacturer's recommendations. Apply two coats of sealer to a minimum thickness of 10 mils. The finished product shall be the color "Summer Gray".

(c) Damp-Proofing - After the cap is waterproofed, damp-proof the vertical surfaces of the masonry walls. Apply damp-proofing at least 14 calendar days after the walls are completed and according to the manufacturer's recommendations.

00597.42 Precast Concrete Panel Sound Walls - Construct precast concrete panel sound walls plumb, level and true. Panels shall be free of major cracks. Cracks in panels will be measured after the panel is placed and walls have been backfilled. Cracks greater than 0.02 inch may require repairs or panel replacement, at the discretion of the Engineer.

00597.43 Concrete Panel Lock Fence Sound Walls - Construct concrete panel lock fence walls according to the manufacturer's recommendations.

Measurement

00597.80 Measurement - The quantities of sound walls will be measured on the area basis, ~~to the nearest square foot,~~ of the wall face area projected onto a vertical plane along one side of the wall.

Payment

00597.90 Payment - The accepted quantities of sound walls will be paid for at the Contract unit price, per square foot, for the item "Sound Walls".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavation, backfill, footings, concrete, reinforcement, waterproofing, and damp-proofing.

Section 00599 - Concrete Slope Paving

Description

00599.00 Scope - This work consists of constructing concrete slope paving on bridge end slopes as shown, specified, or directed.

Materials

00599.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete.....00440
Grout 02080.40
Reinforcement.....00530

Construction

00599.40 Slope Preparation - Grade the slopes for slope and berm paving, and curbs to the lines and grades established. Finish the area to a smooth, firm, compacted condition.

Dispose of excess materials according to 00330.41(a-4).

If slopes constructed under a separate contract require additional materials to prepare slopes to the established lines and grades, furnish such materials ~~as Extra Work~~ according to ~~Section 00196~~00140.30.

00599.42 Slope Paving - Pave slopes with pre-cast or cast-in-place blocks as the Contractor elects. Give the tops of blocks a wood float and brush finish parallel with the long dimension of the block.

(a) Pre-cast Blocks - Manufacture pre-cast blocks according to the plans and Section 00440.

(b) Cast-in-place Blocks - Place concrete for cast-in-place blocks according to Section 00440.

00599.43 Berm Paving - Construct berm paving according to the plans and Section 00440, except finish the berm paving to a neat, smooth surface.

00599.44 Slope Paving Curbs - Construct slope paving curbs according to the plans and to Section 00440 and Section 00530.

Measurement

00599.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Slope Paving - Concrete slope paving will be measured on the area basis, ~~to the nearest square foot,~~ on the slope paving surface for each bridge end slope.

(b) Berm Paving - Berm paving will be measured on the area basis, ~~to the nearest square foot,~~ on the berm paving surface for each berm.

(c) Slope Paving Curbs - Slope paving curbs will be measured on the length basis~~, to the nearest foot~~.

Payment

00599.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Concrete Slope Paving	Square Foot
(b)	Berm Paving	Square Foot
(c)	Slope Paving Curbs	Foot

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for furnishing additional embankment materials required for slope preparation constructed under a separate contract will be made ~~as Extra Work.~~according to 00195.20.

PART 00600 - BASES

Section 00610 - Reconditioning Existing Roadway

Description

00610.00 Scope - This work consists of reconditioning and preparing existing subgrades, bases, surfacings and pavements on which an additional layer or course of material is to be placed, under the Contract. The work includes existing shoulders, cut ditches, road connections, approach roads, ramps, bridge decks if not provided for elsewhere, and other roadbed areas on which construction work under the Contract is to be performed.

Materials

00610.10 Materials - Materials required for reconditioning and preparation work may consist of selected soil, sand and gravel, aggregate subbase or base material, water, asphalt, asphalt and portland cement concrete surfacing, and other material as directed. Furnish the materials meeting the requirements of the Specifications of the applicable Sections.

00610.15 Quality Control - Provide quality control according to Section 00165.

Labor

00610.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT, CAgT, and CDT technical certifications.

- ~~CEBT~~
- ~~CAgT~~
- ~~CDT~~

Construction

00610.40 Removal and Replacement of Unsuitable Materials - Remove unstable or unsuitable materials in the subgrade, subbase, base, surfacing or pavement areas as directed and dispose of according to 00330.41(a-3). Perform the removal and disposal according to 00140.30. Replace the removed materials with successive courses of materials furnished for other purposes under the Contract. Furnish, place and finish these materials as specified or as directed. If no materials are available for replacement, perform the replacement work ~~as Extra Work~~according to 00140.30.

00610.41 Ditches and Subgrades - Clean, trim and restore existing cut ditches to designated cross section and condition. Reshape, water, process and prepare the existing subgrade to the lines, grades, slopes and cross sections established. Compact according to 00330.43.

00610.42 Aggregate Subbase, Base, and Surfacing - Reshape, water, process and prepare the upper layer of existing subbases, bases and surfacings to lines, grades and cross sections established. Compact to densities required for similar new work.

00610.43 Surfacings - Clean existing surfacings of all loose material, dirt and dust by brooming, flushing with water or other approved methods.

Measurement

00610.80 Measurement - No measurement of quantities will be made for reconditioning and preparation work.

Materials used in the replacement of unsuitable materials according to 00610.40 will be measured in the manner applicable to the pay item under which the materials are furnished.

Payment

00610.90 Payment - Payment for reconditioning and preparation work will be made at the Contract lump sum amount for the item "Reconditioning Existing Roadway".

Payment will be payment in full for furnishing all material, equipment, labor, and incidentals necessary to complete the work as specified.

Removal and disposal of unsuitable materials will be paid for according to 00140.30.

Materials used for replacement of unsuitable materials according to 00610.40 will be paid for at the Contract unit price for the material involved. If the Contract Schedule of Items does not identify pay items for the material, payment will be made according to 00140.30.

Water furnished and used in the watering work and in the flushing of surfaces and pavements will be paid for according to Section 00340. If the Contract Schedule of Items does not identify a watering pay item, no separate or additional payment will be made for water furnished and used in the watering work and in the flushing of surfaces and pavements.

When the Contract Schedule of Items does not indicate payment for the work under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00620 - Cold Plane Pavement Removal

Description

00620.00 Scope - This work consists of removing existing pavement to prepare a foundation for placing new surfacing.

Equipment

00620.20 Equipment - Provide self-propelled planing machines or grinders:

- Capable of loosening pavement material.
- Capable of accurately establishing profile grades within a tolerance of 0.02 foot by reference from either the existing pavement or from independent grade control.
- With a positive means for controlling cross-slope elevations.
- With a totally enclosed cutting drum with replaceable cutting teeth.
- With an effective means of removing loosened material from the surface and preventing dust from escaping into the air.
- Capable of providing a true cross-slope grade that will allow placement of overlay pavement to a uniform thickness.

Construction

00620.40 Pavement Removal:

(a) General - Remove the existing pavement to the depth, width, grade and cross section shown or as directed. The use of a heating device to soften the pavement is not allowed. When removing pavement from bridge end panels. Limit the machine forward speed to 2.5 feet per minute.

(b) Depth 1 inch to 2 inches - If the depth of the existing pavement to be removed is 2 inches or less, but more than 1 inch and the section will be under traffic, schedule the work so the full width and length of travel lanes pavement can be removed during the same shift. Remove the shoulder area within 24 hours.

(c) Depth over 2 inches - If the depth of the existing pavement to be removed is over 2 inches and the section will be under traffic, schedule the work so the full width and length of the travel lanes and shoulders can be removed, leaving no longitudinal or transverse drop-offs, during the same shift.

(d) Pavement Removal Alternative - If unable to complete the pavement removal according to 00620.40(b) and (c), then within the same day construct a wedge of asphalt concrete, at a slope of 1V:10H or flatter along each exposed longitudinal drop-off, and 1V:50H or flatter along each exposed transverse drop-off. Place wedges completely across the milled area at intersections, points of beginning and ending of the milling operation, and around manholes, valve boxes and other structures. Longitudinal drop-offs of 1 inch or less do not require a wedge. Maintain wedges as long as the area remains under traffic or until pavement is replaced. Remove and dispose of wedges before placing new pavement.

(e) Warning Signs - Provide warning signs as required where abrupt or sloped drop-offs occur at the edge of the existing or new surface according to Section 00225.

00620.41 Surface Tolerance - Test with a 12 foot straightedge furnished and operated by the Contractor, as directed. The variation of the top of the ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed 1/4 inch.

00620.42 Disposal of Materials - ~~Materials removed under this Section that are not used on the Project become the property of the Contractor at the point of origin.~~ Dispose of ~~the material~~all materials according to 00290.20~~ unless special sites are specified in the Special Provisions~~.

00620.43 Maintenance Under Traffic - If the cold planed pavement surface will be exposed to traffic, sweep and clean prior to allowing traffic to use the roadway.

Measurement

00620.80 Measurement - The quantities of cold plane pavement removal will be measured on the area basis, in place.

When the depth of pavement to be removed is variable, the depth as shown is an estimate and is approximate only. No guarantee is made that the actual depth will be the same as the estimated depth.

Payment

00620.90 Payment - The accepted quantities of work performed under this Section will be made at the Contract unit price, per square yard, for the item "Cold Plane Pavement Removal, _____ Deep".

The depth will be inserted in the blank. If the depth is variable, the depth range will be inserted in the blank.

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for temporary wedges constructed, maintained, and removed under 00620.40(d), or for replacement of cutting teeth.

Section 00622 - Grinding Concrete Pavement

Description

00622.00 Scope - This work consists of grinding existing portland cement concrete pavement.

Equipment

00622.20 Grinding Equipment - Provide self-propelled grinding equipment that:

- Has diamond embedded grinding blades that will produce a smooth textured surface.
- Is able to grind a strip at least 4 feet wide.
- Can remove slurry and residue during the grinding operation.

00622.21 Smoothness Testing Equipment:

(a) Straightedge - Provide one 12-foot straightedge.

(b) Profilograph - Provide a California-type profilograph that:

- Can determine the profile index of the pavement according to ODOT TM 770.
- Is either computerized or not computerized.
- Is equipped with a recording device.
- Is calibrated, in good working condition, and ready for operation before concrete pavement grinding begins.

(c) Profilometer - Provide a profilometer that:

- Is capable of generating the equivalent California-type profilograph plot and values according to ODOT TM 770.
- Employs an accelerometer established inertial profiling reference and a laser height sensing instrument to produce a true profile of the pavement surface.
- Is capable of reporting elevations with a resolution of 0.004 inch or finer at an interval of 6 inches or less.
- Is able to generate the locations and heights of all bumps and dips.
- Is calibrated, in good working condition, and ready for operation before performing smoothness measurements.

Before beginning smoothness measurements, have the profilograph or profilometer operators meet with the Engineer at a mutually agreed upon time to discuss all aspects of smoothness measurements on the Project.

Labor

00622.30 Smoothness Testing Operators - Provide operators for the profilograph and the profilometer that are experienced in the operation of the equipment.

Construction

00622.40 Preparation - Complete full depth concrete repairs, spall repairs, and joint repairs according to Section 00758 in the area to be ground before beginning grinding operations.

00622.41 Grinding - Taper grind to match the elevation of bridge decks, bridge approach slabs, and at the ends of the grind area.

Provide positive lateral drainage by maintaining a constant cross slope between grinding extremities in each lane. Grind transition, auxiliary or ramp lane from the mainline edge as shown.

Schedule and proceed with the grinding operation that will produce a uniform finished surface. Grind the pavement in a longitudinal direction beginning and ending at lines normal to the pavement centerline.

Do not grind roadway shoulders unless shown. Do not encroach on traffic movement outside the work area. Do not damage underlying surfaces, cause fractures, or spall joints.

Perform grinding within one of the following aggregate hardness tolerances:

	Aggregate Hardness Tolerance	
	Moderately Hard Aggregate	**Hard Aggregate**
Abrasion (AASHTO T96)	> 20.0	≤ 20.0
Blade segment thickness	0.100" to 0.125"	0.100" to 0.125"
Land area between grooves*	0.100" to 0.135"	0.080" to 0.110"
Texture depth**	Target of 1/16" with averages between 1/32" to 3/32"	

* Based on an average of a minimum of 10 measurements across the ground width for one pass.

** Based on an average of a minimum of 6 measurements across the ground width for one pass.

The Project's aggregate hardness tolerance will be listed in the Special Provisions.

00622.42 Removal and Disposal of Material - Remove all grinding materials as the grinding operation is performed. Dispose of all materials according to 00290.20.

00622.43 Surface Finish - Provide a pavement surface that:

- Meets the aggregate hardness tolerances of 00622.41.
- Is true to grade.
- Has a longitudinal line-type texture with corrugations parallel to the outside pavement edge which present a narrow ridge corduroy type appearance.
- Has at least 95 percent of the pavement surface textured. When approved, depressed pavement areas and other localized depressed areas will not require texturing.

Extra depth grinding is not required where minor depressions are detected in the existing pavement.

Provide at least a 2.0 inch longitudinal overlap when producing multiple passes but keep overlaps over 2.0 inches to a minimum.

Maintenance

00622.60 Correction of Defects - Correct the following deficiencies at no additional cost to the Agency:

- Pavement corrugation due to "out-of-round" wheels on grinding equipment.

- Improper cutting head operations that cause the head to ride in and out of the pavement when encountering light and heavy cuts.
- Depressions created from improper starting and stopping during the cutting operation.
- Unground ridges left in the pavement from defective blades in the grinding head.

Regrind the entire lane width in areas that require corrective work.

Finishing and Cleaning Up

00622.70 Pavement Smoothness - Perform smoothness testing under the observation of the Engineer. If the Contractor performs smoothness measurements on a day other than the day pavement grinding is performed, all additional traffic control required for the smoothness testing, but not required for other work, will be at no additional cost to the Agency.

(a) Straightedge Testing and Tolerance - Test the surface with a 12 foot straightedge perpendicular to the centerline. The pavement surface shall not vary by more than 1/4 inch. Straightedge testing is not required across longitudinal joints or outside the ground area.

(b) Graphic Profile Testing and Tolerance:

(1) General - Test the longitudinal surface of textured surfaces for smoothness by the graphic profile testing (GPT) method according to ODOT TM 770. Before beginning grinding on the Project, demonstrate the profilograph and profilometer operation by conducting a calibration test according to ODOT TM 770, and running the machine twice over a 0.1 mile section of pavement with repeating results.

The pavement shall have a profile index of 7.0 inches per mile or less for each wheel path in each 0.1 mile segment or partial segment, and shall have no individual deviation of 0.3 inch or more.

(2) Surface Test - Provide a complete graphic profile by running the profilograph or profilometer over the full length of the lanes ground and 50 feet beyond the ends. Provide a profile in each vehicle wheel path by running profiles on the pavement surface along lines parallel to and approximately 3 feet from each edge of the pavement and 3 feet from each side of longitudinal joints.

(3) Determining Profile Index:

a. General - Determine the profile index of pavement in 0.1 mile segments and partial segments. A segment will end and will be considered a partial segment and a new segment will begin when the segment sequence is interrupted by stage construction or by profiled areas excluded from the GPT smoothness requirements.

The following profiled areas of pavement are excluded from the GPT smoothness requirements:

- Profiles extending beyond the Project ends
- Bridge decks and bridge panels
- First and last 13 feet at the Project ends and bridge end panels
- Pavement on horizontal curves with radii less than 1,000 feet

Include and analyze separately those areas in the profile charts that are not subject to the GPT smoothness profile index requirements.

b. Method of Analysis - Determine the profile index and individual deviations of 0.3 inch or more by analyzing the profile charts according to ODOT TM 770. Provide the profile charts and results to the Engineer.

(c) Failure To Meet Graphic Profile Requirements - Correct all segments or partial segments that exceed the requirements of 00622.70(b) in either wheel path by regrinding to the specified limits except correct deviations of 0.3 inch or more at least to the edge of the blanking band. The Engineer will determine and mark the areas to be profiled.

Retest all segments requiring corrective work for the entire length according to 00622.70(b) under the observation of the Engineer. All corrective work and graphic profiling, including traffic control, will be at no additional cost to the Agency.

Measurement

00622.80 Measurement - The quantities of concrete pavement grinding will be measured on the area basis.

Payment

00622.90 Payment - The accepted quantities of concrete pavement grinding will be paid for at the Contract unit price per square yard for the item "Grind Concrete Pavement".

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00635 - Grid-Rolled Aggregate Subbase

Description

00635.00 Scope - This work consists of furnishing, placing, and compacting with a perforated or grid-type roller, one or more layers of aggregate mixed with water, on a prepared surface to the lines, grades, thicknesses and cross sections shown or established.

Materials

00635.10 Materials - Furnish grid rolled aggregate subbase rock material having a maximum size of 6 inches and meeting the following requirements:

- **Abrasion** - The source materials for aggregate subbase shall not exceed 45 percent wear when tested according to AASHTO T 96.

- **Sand Equivalent** - Aggregate subbase material shall have a sand equivalent of not less than 25 when tested according to AASHTO T 176.

Equipment

00635.20 Compacting Equipment - Provide perforated or grid-type metal twin-drum rollers meeting the following requirements:

- Drums with an outside diameter of at least 5 feet.
- Maximum drum width of 32 inches.
- Capable of a 15 ton loading. The specific loaded weight will be as directed.

Use self-propelled or tractor pulled type rollers of sufficient size to propel it at 15 miles per hour.

Construction

00635.40 Preparation of Foundation - Provide a firm surface on which aggregate subbase is to be placed according to Section 00320, 00330, or 00610 as applicable.

00635.42 Thickness and Number of Layers - If the required compacted depth of the subbase exceeds 8 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 8 inches.

00635.43 Shaping and Compacting - Compact each layer of the subbase by as many passes of the roller as necessary to attain the desired fracture and compaction of the material. Operate the roller at the highest speed possible without bounce and without unevenness of compaction.

Perform blading and watering as necessary to provide uniformity of crown, cross section, and compaction.

Apply water according to Section 00340 and as directed.

Maintenance

00635.60 Care of the Work - After constructing each layer and completing the subbase, maintain the layer to specified conditions, and prevent or repair segregation, raveling, or rutting until it is covered with a following layer or until all Contract work is completed.

Measurement

00635.80 Measurement - The quantities of grid-rolled aggregate subbase will be measured on the area basis, constructed to the full thickness. The thickness will be identified on the plans. The surface area will be determined by horizontal measurements. In areas where directed to grid-roll to thicknesses other than identified on the plans, the areas will be adjusted by converting to an equivalent number of square yards on a proportionate volume basis.

Payment

00635.90 Payment - The accepted quantities of grid-rolled aggregate subbase will paid for at the Contract unit price, per square yard, for the item "Grid-Rolled Aggregate Subbase, ____ inches Thick".

The thickness of the subbase will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for water used to bring the mixture to optimum moisture content or for water used in the care of the work.

Section 00640 - Aggregate Base and Shoulders

Description

00640.00 Scope - This work consists of furnishing and placing one or more courses of aggregate base and/or shoulders on a prepared surface to the lines, grades, thicknesses and cross sections shown or established.

Materials

00640.10 Materials - Furnish aggregates of either 1" - 0 or 3/4" - 0 as the Contractor elects. Use clean, hard, durable aggregates, reasonably well-graded from the maximum size to dust.

00640.16 Acceptance of Aggregates - Acceptance will be visual by the Engineer.

Construction

00640.40 Preparation of Foundation - Provide a firm surface on which aggregates are to be placed according to 00641.40.

00640.41 Hauling and Placing - Transport the aggregate to the job site, add water to obtain proper moisture content, and place on the prepared surface or material by means acceptable to the Engineer.

Do not place shoulder aggregates on the top lift of newly constructed EAC or open-graded pavement.

00640.42 Thickness and Number of Layers:

(a) Base - If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.

(b) Shoulders - Place shoulder aggregates in a single layer, or two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches.

00640.43 Shaping and Compacting - Compact each layer of material placed in shoulder and base areas by rollers conforming in general to 00641.24 or as directed.

Shape and maintain the surface of each layer during the compaction operations to meet the requirements of 00640.44. Produce a uniform texture and firmly key the aggregates.

Apply water over the materials for proper compaction according to Section 00340, and as directed.

Continue the compactive effort until there is no reaction or yielding observed under the compactor.

00640.44 Surface Tolerance - The finished surface and the surface of each underlying layer of the aggregate shall parallel the established grade and cross section for the finished surface within 1/2 inch.

The finished surface of the compacted aggregate base, when tested with a 12 foot straightedge, shall not vary from the testing edge by more than 1/2 inch at any point. Furnish and operate the straightedge as directed.

Maintenance

00640.60 Care of the Work - After construction of each layer and completion of base, maintain the layer to specified conditions and prevent or repair segregation, raveling, or rutting, until it is covered with a following layer or until all work is completed.

Measurement

00640.80 Measurement - The quantities of aggregate will be measured on the weight basis, in the hauling vehicle.

Payment

00640.90 Payment - The accepted quantities of aggregates will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Aggregate Base	Ton
(b) Aggregate Shoulders	Ton

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for water used to obtain proper compaction and in the care of the work.

Section 00641 - Aggregate Subbase, Base, and Shoulders

Description

00641.00 Scope - This work consists of furnishing and placing one or more layers of aggregates, mixed with water, on a prepared surface to the lines, grades, thicknesses and cross sections shown or established.

Materials

00641.10 Materials:

(a) Base and Shoulder Aggregate - Aggregate for bases and shoulders shall be sized as specified. Base aggregate shall be dense-graded unless otherwise specified. Shoulder aggregates shall be either 1" - 0 or 3/4" - 0 size as the Contractor elects.

Furnish base and shoulder aggregates meeting the following requirements:

Dense-Graded Base Aggregate 02630.10
Open-Graded Aggregate.....02630.11
Shoulder Aggregate 02640

(b) Subbase Aggregate - Aggregate for subbases shall be crushed or uncrushed, including sands, reasonably well graded from coarse to fine.

Maximum size aggregate shall not exceed 75~~%~~ percent of the compacted thickness of the layer in which it is incorporated. Aggregates passing the 1/4 inch sieve shall not be less than 10~~%~~ percent nor more than 50~~%~~ percent of the whole, by weight. No more than 10~~%~~ percent of the aggregate shall pass the No. 100 sieve. Within these limits, the subbase aggregate gradation shall be adequate to produce a dense, firm base when placed and compacted.

(1) Grading - All of the grading requirements are given as percentages by weight. The gradation will be determined by sieve analysis according to AASHTO T 27.

(2) Abrasion - The source materials for aggregate subbase shall not exceed 45~~%~~ percent wear when tested according to AASHTO T 96 unless otherwise approved.

(3) Sand Equivalent - Aggregate subbase will be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 25.

00641.11 Stockpiling - If the produced aggregates are to be stockpiled, prepare the stockpile site and pile the materials according to 00680.40 and 00680.41.

00641.12 Limits of Mixture - Provide a mixture of aggregate and water having a uniform moisture content sufficient to obtain the required compaction. ~~Water may be introduced in a mixing plant, or on the grade. Determine the proportion of aggregate and water according to AASHTO T 99 and AASHTO T 224.~~ Proportions will be in percentages by weight and will be known as the ~~"~~Mix Design~~"~~. Determine the proportion of aggregate and water according to the MFTP. The amount of water ~~required in~~for the ~~mix design~~Mix Design will ~~normally~~ be ~~within a range of 5% to 10% of the mixture,~~ based on the dry weight of the ~~aggregates. The mixture furnished shall conform to the mix design with a tolerance in optimum water content of plus or minus 2%. Any mixture having water content in excess of 2% over the Mix Design may be accepted for use, according to 00641.80(d), if approved~~aggregate.

When introducing water at the mixing plant, furnish the mixture with a tolerance of ± 2 percent of the optimum water content at the time of mixing. If approved, excess percentage of water may be allowed. The Agency will treat excess percentage of water according to 00641.80(d).

00641.15 Quality Control:

(a) Aggregate Production Quality Control - ~~A~~Have a CAgT ~~shall~~ perform sampling and testing of aggregates according to Section 00165 and the MFTP. Statistically evaluate the aggregates according to Section 00165.

(b) Preproduced Aggregate - Compliance of aggregates produced and stockpiled before issuance of Notice to Proceed will be determined according to (1) or (2) below.

(1) Continuing production records meeting the requirements of Section 00165 and the MFTP.

(2) Sampling and testing the entire stockpile according to Section 00165 and the MFTP.

In addition, the material shall meet the requirements of 00641.10.

00641.16 Acceptance of Aggregates - Acceptance will be according to Section 00165.

(a) Stockpiled Aggregate for Aggregate Base and Shoulders - Acceptance will be based on the Contractor's quality control testing, if verified, as required in Section 00165.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the Quality Level (QL) for each sieve size, calculated according to 00165.40, is equal to or greater than the QL indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the QL indicated in Table 00165-2 yields a PF of less than 1.00 for any sieve size, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates having non-specification aggregate gradation will be rejected unless the non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material has been removed so that the QL for each sieve size is equal to or greater than the QL in Table 00165-2 for a 1.00 PF.

No payment will be made for non-specification materials.

(b) Aggregate Base and Shoulder Mixture - Acceptance testing will be performed on random samples obtained immediately following mixing with water according to the MFTP. For non-specification mixture the Engineer will determine the appropriate price reduction or order its removal from the work according to 00150.25.

(c) Aggregate Subbase - Aggregate subbase will be accepted based on the Engineer's visual inspection. Samples will be obtained and tested for compliance with 00641.10 by the Engineer if it is suspected that the material does not meet Specifications.

Equipment

00641.20 Mixing Plant - Mix aggregate and water by one of the following methods:

(a) Mixing Plant - Mix with a pug mill, rotary mixer, or other equipment at a mixing plant that:

- Has adjustable weighing or calibrated feeders, and other equipment that produces uniform, non-segregated, specified mixtures.
- Discharges water into the mixer by weighing or metering. The device shall be adjustable and shall assure uniform water content in the mixture.
- Has mixing blades or paddles of proper size, adjustment and clearance to provide uniform mixture.

(b) Road Mix - Motor grader or other suitable equipment.

00641.21 Hauling Equipment - Provide mixture hauling vehicles capable of hauling and depositing the mixture with a minimum of mix segregation.

00641.22 Spreading Equipment - Provide equipment capable of spreading the material and striking it off to designated line, grade, and transverse slope without segregation, dragging, or fracture of aggregate.

00641.24 Compacting Equipment - Provide self-propelled rollers and compactors capable of reversing without backlash. Rollers and compactors shall have a gross static weight of at least 8 tons, and shall be capable of compacting to specified density while the mix is still moist.

Labor

00641.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CEBT, CAgT, and CDT technical certifications.

~~• CEBT~~
~~• CAgT~~
~~• CDT~~

Construction

00641.40 Preparation of Foundation - Provide a firm surface or material, on which aggregates are to be placed, according to Sections 00320, 00330, or 00610 as applicable.

00641.41 Mixing, Hauling, and Placing - Add water to the aggregate while mixing to provide a moisture content according to 00641.12.

Thoroughly mix the combined aggregate and water for as long as necessary to produce a homogenous mixture with all aggregate particles uniformly coated with water. Mix, haul and place the material by one of the following methods:

(a) Stationary Mixing Plant - Combine materials in a pug mill or rotary mixer.

Deliver and deposit the mixture without delay. Deliver the mixture to the spreading equipment by direct deposit into its receiving device, or by placing in uniform windrows in front of the equipment.

(b) Road Mix - Place materials for each layer, add water and mix with motor grader until homogeneous mixture is achieved.

Do not place aggregate shoulder material on the top lift of newly constructed EAC or open-graded pavement.

00641.42 Placing Aggregate Base or Subbase on Geotextile - When subgrade or drainage geotextile is required between the subgrade and base, place the first lift of material directly on the fabric, without road mixing.

00641.43 Thickness and Number of Layers:

(a) Aggregate Base Courses - If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches unless approved.

Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.

(b) Aggregate Subbase Courses - The maximum compacted thickness of any one layer shall not exceed 9 inches unless approved.

(c) Shoulder Courses - Place aggregates in shoulder areas, other than as part of the base course, in one layer, or in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches.

00641.44 Shaping and Compacting:

(a) Aggregate Base Courses:

(1) Dense-graded Aggregates - Begin compaction of each layer of dense-graded aggregates immediately after the material is spread and continue until a density of not less than ~~100%~~95 percent of the maximum density has been achieved when tested according to the MFTP.

(2) Open-graded Aggregates - Compact the surface of each layer of open-graded aggregates using rollers conforming to 00641.24. Roll until there is no appreciable reaction or yielding under the compactor.

Shape and maintain the surface of each aggregate layer during the compaction operations to produce a finished surface meeting the requirements of 00641.45.

Apply additional water over the materials for proper compaction, according to Section 00340 and as directed.

(b) Aggregate Subbase and Shoulder Courses - Compact each layer of aggregate subbase and shoulder material until no reaction or yielding is observed under the compactor.

00641.45 Surface Tolerance - The finished surface of the aggregate and the surface of each underlying layer shall parallel the established grade and cross section for the finished surface within 1/2 inch.

The finished surface of the compacted aggregate, when tested with a 12 foot straightedge, shall not vary from the testing edge by more than 1/2 inch at any point. Furnish and operate the straightedge as directed.

Maintenance

00641.60 Care of the Work - After construction of each layer and completion of base, maintain the layer to specified conditions and prevent or repair segregation, raveling, or rutting until it is covered with a following layer or until all work is completed.

Measurement

00641.80 Measurement - The quantities of aggregate mixture will be measured on the weight basis, on the volume basis, or on the area basis according to the following:

(a) Weight Basis - When measurement is by weight, quantities will be measured in the hauling vehicle, after mixing.

(b) Volume Basis - When measurement is by volume, quantities will be measured in the hauling vehicle.

(c) Area Basis - When measurement is by area, the quantity will be the number of square yards of aggregate base constructed to the full thickness. The surface area will be determined by horizontal measurements. Each area constructed with varying thicknesses, as directed or shown, will be adjusted by converting it to an equivalent area at the pay item thickness on a proportionate volume basis.

(d) Adjustment of Water in Mixture - If the water in the aggregate mixture placed according to 00641.41(a) exceeds the percentage established in the mix design by more than 2~~%,~~ percent, the excess percentage of water will be deducted from the measurement of the mixture. Determination of excess water will be made by the same procedure used in setting the water content of the Mix Design under 00641.12 or converted to the equivalent volume.

If aggregates are stationary plant mixed, no separate measurement will be made for water added at the plant to bring the material to optimum moisture content.

If aggregates are road mixed, water used to bring the mixture to optimum moisture content will be measured according to 00340.80.

Payment

00641.90 Payment - The accepted quantities of aggregates will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Aggregate Subbase	Ton or Cubic Yard
(b)	Aggregate Base	Ton or Cubic Yard
(c)	_____ Aggregate Base	Ton or Cubic Yard
(d)	Plant Mix Aggregate Base	Ton or Cubic Yard
(e)	Plant Mix _____ Aggregate Base	Ton or Cubic Yard
(f)	Aggregate Shoulders	Ton or Cubic Yard
(g)	Aggregate Base, _____ Inches Thick	Square Yard

Items (b) and (d) will apply when the Contractor has the option of furnishing one or another of two or more designated sizes of aggregates.

In items (c) and (e), the designated size of aggregate to be used will be inserted in the blank.

In item (g), the depth of aggregate base will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for water used in the mixture, mixed and placed according to 00641.41(a), subject to the limitations of 00641.80(d).

No separate or additional payment will be made for water used in the care of the work according to 00641.60.

00641.91 Material on Hand - Payment for stockpiled materials on hand may be allowed according to 00195.60, subject to the requirements of 00641.10, 00641.15, 00641.16(a), and subject to QA verification.

Section 00680 - Stockpiled Aggregates

Description

00680.00 Scope - This work consists of furnishing crushed rock or other aggregates in stockpiles at the places and in the manner specified.

Materials

00680.10 Sources of Material - Obtain the material to be furnished in stockpiles from sources according to 00160.60.

00680.11 Aggregates - Furnish aggregates meeting the following requirements:

(a) Aggregate Base and Shoulder Aggregate - Furnish aggregates in stockpiles of the sizes specified and conforming to the requirements of 00641.10.

(b) Emulsified AC Aggregate - Furnish aggregates in stockpiles of the following sizes or as specified:

1" - 1/2"
3/4" - 1/2"
1/2" - 1/4"
3/8" - 1/4"
3/8" - No. 4
3/8" - No. 8

Aggregates in stockpiles shall conform to the following requirements:

(1) Quality - Provide aggregates meeting the requirements of 00715.10(a), (c), (d), (e) and (f).

(2) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide grading for the designated size aggregate according to the following:

	Designated Sizes					
	1" - 1/2"	**3/4" - 1/2"**	**1/2" - 1/4"**	**3/8" - 1/4"**	**3/8" - No. 4**	**3/8" - No. 8**
Sieve Size	**Percent Passing (by weight)**					
1"	100	100				
3/4"	95 - 100	90 - 100	100			
1/2"	60 - 90	0 - 10	85 - 100	100	100	
3/8"	–	–	–	85 - 100	80 - 100	100
1/4"	15 - 30	0 - 2	0 - 15	0 - 15	10 - 40	–
No. 4	–	–	–	–	–	45 - 65
No. 8	0 - 7	–	0 - 4	–	0 - 6	0 - 10
No. 30	–	–	–	0 -2	0 - 2	–
No. 200	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
No. 200 *	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1

* In gravels

00680.15 Aggregate Production Quality Control - Provide quality control during production of aggregate according to Section 00165. Sampling and testing shall be performed by a CAgT at the minimum frequency schedule indicated in the MFTP for Section 00641, or according to Section 00715, as applicable. Aggregates will be evaluated for compliance according to the following:

(a) Gradation - Analyze gradation statistically according to Section 00165. A stockpile contains specification aggregate when the Pay Factor (PF) for each sieve size calculated according to 00165.40 is equal to or greater than 1.00. Each required sample represents a sublot.

When the results from Table 00165-2 yield a Pay Factor of less than 1.00 for any sieve size, the material is non-specification. The Engineer will reject any stockpile of aggregate containing non-specification material unless the non-specification material is removed from the stockpile. Do not add additional material to such a stockpile until enough non-specification material is removed so that the PF for each sieve size is equal to or greater than 1.00.

(b) Other Tests - Stop production, make appropriate operational adjustments, and remove all failing material from the stockpile whenever a quality control test result, other than sieve analysis, does not meet Specifications. Document operational adjustments made and notify the Engineer prior to resuming production.

00680.16 Acceptance of Aggregate - The Contractor's quality control tests will be used for acceptance of aggregates if verified by the Agency's quality assurance program. The Agency will perform aggregate production quality assurance according to the following:

(a) ODOT-Administered Projects - Quality assurance testing on projects administered by ODOT will be performed according to Section 00165, the MFTP and the ODOT Quality Assurance ~~Manual~~Program.

(b) Projects Administered by Other Agencies - The quantity of quality assurance testing on projects administered by Agencies other than ODOT will be at the discretion of the Agency or as specified.

Equipment

00680.20 Rock Crusher - Comply with the following:

(a) Permits - Before crushing rock for the Project, provide the Agency with copies of permits according to 00160.70.

(b) Crusher - Furnish rock ~~crusher(s)~~crushers capable of producing rock meeting these Specifications. Use an impact crusher of sufficient size and capable of producing aggregate in cubical form, free from sharp points or slivers.

00680.21 Conveyor - Provide ~~conveyor(s)~~conveyors capable of reaching a minimum distance of 70 feet, to stockpile sanding materials in sand sheds without segregation during stockpiling.

00680.22 Hauling Equipment - Provide vehicles for hauling crushed aggregates capable of discharging the materials without segregation.

Labor

00680.30 Quality Control Personnel - Provide a ~~certified~~ technician ~~in the following field:~~having a CAgT technical certification.

~~• CAgT~~

Construction

00680.40 Preparation of Sites:

(a) Source Sites - Prepare and develop the source site according to the terms of the source permit and source development plan in the Special Provisions.

(b) Stockpile Sites - Clear, level, and prepare stockpile sites as directed.

00680.41 Piling of Materials - Place each separate designated size of material to be stockpiled at a given site in a separate stockpile. Locate each stockpile to occupy as small an area as practical, and separate each pile so that working room will be adequate for removing the materials later. Height of the piles shall not be less than 8 feet, nor side slopes flatter than 1V:1.5H, unless directed. Except in sand sheds, stockpile sanding materials to a height of 15 feet, or as directed.

Place the material in stockpiles with a minimum of segregation. Unless otherwise allowed, place the material in stockpiles in horizontal layers not more than 4 feet in thickness.

00680.42 Places of Delivery - Places of delivery and the tentative plans of distribution of the materials will be shown or specified.

00680.43 Agency's Right to Materials - If the Engineer finds it necessary, the Agency may take materials from stockpiles before the stockpiles have been completed and measured, or may take a part of the materials intended for placement in stockpiles, in trucks or other vehicles at the plant.

Finishing and Cleaning Up

00680.70 Cleaning Up Source Sites - Clean up the source sites according to the terms of the source permit and source development plan in the ~~special provisions~~Special Provisions.

Measurement

00680.80 Measurement - The quantities of each designated size of material will be measured according to the following:

- **Weight Basis** - When measurement is by weight, the quantities of each designated size of material will be measured on the weight basis, in the hauling vehicle.

- **Volume Basis** - When measurement is by volume, the quantities of each designated size of material will be measured on the volume basis, by cross-section measurement of the completed stockpiles, with no allowance for settlement or shrinkage.

00680.81 Materials Taken from Stockpiles Prior to Completion - Materials taken by the Agency according to 00680.43 will be measured in the Agency's hauling vehicles. If measurement is on the volume basis, the vehicle measurement will be converted to equivalent stockpile measurement at the ratio of 1.00 cubic yard, vehicle measurement to 0.95 cubic yard, stockpile measurement. If measurement is on the weight basis, the weight will be determined in the same manner and by the same means as used in determining the weight of materials stockpiled and paid for under the Contract.

Payment

00680.90 Payment - The accepted quantities of each size of specified material will be paid for at the Contract unit price, per ton or cubic yard, for the item "_____ Material In Stockpile".

The respective sizes of stockpiled aggregates will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials in stockpiles and sand sheds, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for source development and clean-up, preparation of stockpile sites, hauling of stockpile materials, or placing materials in sand sheds.

PART 00700 - WEARING SURFACES

Section 00705 - Emulsified Asphalt Prime Coat and Emulsified Asphalt Fog Coat

Description

00705.00 Scope - This work consists of applying asphalt, with or without aggregate cover materials, to a prepared surface. The prime coat referred to in these Specifications is a penetration treatment to aggregate surfaces to coat and bind the material into a hard surface. The fog coat referred to in these Specifications is a treatment applied to existing asphalt concrete pavement surfaces to renew and seal the pavement surface.

Materials

00705.10 Aggregate Cover Material - When required by the Special Provisions, furnish aggregate cover material consisting of crushed or uncrushed rock free of clay, loam or other harmful substances and meeting the following gradation. Sieve analysis will be determined according to AASHTO T 27. Sieve analysis may be waived and the aggregate cover material accepted visually if allowed by the Engineer.

Fine Cover		Coarse Cover	
Sieve Size	**Percent Passing (by Weight)**	**Sieve Size**	**Percent Passing (by Weight)**
3/8"	100	1"	100
1/4"	90 - 100	3/4"	90 - 100
No. 8	30 - 66	3/8"	55 - 75
No. 30	8 - 28	1/4"	40 - 60
No. 100	0 - 5	No. 8	*

***** Of the fraction passing the 1/4 inch sieve, 40 to 60~~%~~ percent shall pass the No. 8 sieve.

00705.11 Emulsified Asphalt - Furnish asphalt meeting the following requirements:

(a) General - Provide emulsified asphalt conforming to the requirement of ODOT's publication, "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the Project is advertised. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

Obtain samples of emulsified asphalt according to AASHTO T 40, prior to dilution with water, at the frequency indicated in the MFTP. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency, within 30 calendar days from the day the sample was taken.

(b) Prime Coat - Provide CSS-1, CSS-1h, or CMS-2S emulsified asphalt for the prime coat.

(c) Fog Coat - Provide CSS-1, CSS-1h, or HFRS-P1 emulsified asphalt for the fog coat.

For every part emulsified asphalt, add not more than one part water. Add water at point of supply or point of application as directed, and mix with emulsified asphalt. The exact proportion of added water will be determined in a manner acceptable to the Engineer.

Equipment

00705.20 Equipment - Provide a pressure distributor, hauling vehicles, and other necessary equipment to ensure efficient operation and construction to meet specified results. Provide equipment in such number and capacities as will provide coordinated and uniform progress of the work.

00705.21 Asphalt Distributor - Provide an asphalt distributor designed, equipped, maintained, and operated so the emulsified asphalt material is applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

00705.22 Aggregate Spreaders - When aggregate cover material is required, provide a mechanical spreading device that will spread the aggregate cover material in a manner acceptable to the Engineer.

00705.23 Power Brooms - When aggregate cover material is required, provide pickup or non-pickup type power brooms equipped with a positive means to control vertical pressure.

Construction

00705.40 Season and Weather Limitations - Do not place the prime coat or fog coat when the air temperature is below 60 °F, or when the Engineer determines that weather or surface conditions are detrimental to proper construction.

00705.41 Preparation of Foundation for Prime Coat - Bring aggregate bases and other bases or foundations, when constructed under the Contract, to the completed and finished condition according to the applicable Specifications.

Bring old bases and foundations, constructed by others, to the applicable condition according to Section 00610, and within 1/2 inch of established grade and cross section if other than a bituminous surface.

00705.42 Sequence of Operations - Construct the prime coat or fog coat with a single spread of asphalt followed immediately with a single spread of aggregate cover material, if required.

00705.43 Application of Asphalt - Apply asphalt according to the following:

(a) Prime Coats - Apply asphalt at a uniform rate, normally within a range of 0.20 to 0.75 gallons per square yard of surface. The exact rate of application will be determined by the Engineer.

(b) Fog Coats - Apply the diluted emulsified asphalt within the range of 0.10 to 0.15 gallons per square yard. The exact rate of application will be determined by the Engineer.

Discontinue application of the emulsified asphalt fog coat sufficiently early in the day to permit the termination of traffic control prior to sunset. Apply emulsified asphalt to only one designated traffic lane at a time.

00705.44 Spreading Aggregate Cover Material - When aggregate cover material is required, spread the aggregate cover material within the range of 0.004 to 0.013 cubic yards per square yard as directed.

Maintenance

00705.60 Curing, Maintaining and Opening Prime Coats to Traffic - Cure the prime coat for a minimum of ~~three~~3 calendar days after construction, as directed, before a succeeding course is placed upon it. If directed, traffic may be allowed to travel over the prime coat at any time after its construction. During the curing period, when in use by traffic and until it is covered by a succeeding course, maintain the prime coat to the specified shape and condition, as directed.

00705.61 Power Brooming Fog Coats - Following the applications of all aggregate cover material, carefully broom the entire surface unless brooming damages the fog coat, to remove loose aggregate that could damage vehicles. Use a minimum of two power brooms.

Subsequent brooming the following ~~two~~2 days may be directed by the Engineer to ensure that the surface is free of loose aggregate that could cause vehicle damage.

In curbed areas, use a pickup type power broom. On bridges, sidewalks and other areas off the roadway, remove all extraneous aggregates to the satisfaction of the Engineer.

Measurement

00705.80 Measurement - The quantities of emulsified asphalt will be measured on the weight basis.

The quantities of aggregate cover material will be measured on the weight basis or on the volume basis in the hauling vehicle.

Payment

00705.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Emulsified Asphalt in Prime Coat	Ton
(b) Emulsified Asphalt in Fog Coat	Ton
(c) Aggregate Cover Material	Ton or Cubic Yard

Item (b) includes water required to dilute the emulsified asphalt, according to 00705.11(c).

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for materials used during the maintenance period.

Section 00706 - Emulsified Asphalt Slurry Seal Surfacing

Description

00706.00 Scope - This work consists of applying one or more layers of slurry seal consisting of emulsified asphalt, water, aggregate, and additives on a prepared surface as shown or directed.

00706.02 Abbreviations:

ISSA - International Slurry Surfacing Association

Materials

00706.10 Emulsified Asphalt - Furnish CQS-1h emulsified asphalt meeting the following requirements when tested according to AASHTO T 59:

Saybolt Viscosity, seconds at 77 °F ..... 15 - 50
Residue from Distillation, Weight % ..... 57% minimum
Sieve Test, % Retained on No. 20 Sieve..... 0.1 maximum
Particle Charge, Electroplate..... (informational)
Settlement (Storage Stability), 24 hour..... 1% maximum
Cement Mixing Test ..... (informational)

The residue shall pass the following specifications:

Penetration at 77 °F, 3.5 ounces, 5 sec ..... 40 - 90 minimum
Solubility in CS_2 or TCE..... 97.5 minimum
Ductility at 77 °F, inch..... 15.7 minimum

00706.11 Polymer Modified Emulsion - Furnish CQS-1h polymer modified emulsion. The polymer modifier shall be either a solid synthetic rubber or latex material. Combine the polymer modifier with the base asphalt or asphalt emulsion, prior to loading at the manufacturing plant, at the minimum rate of 2.5~~%~~ to 3~~%~~ percent polymer solids by weight of asphalt. The polymer modified emulsion shall be compatible with the mix design developed for the conventional slurry seal. Each shipment of emulsified asphalt shall be accompanied by a certificate of analysis or certificate of compliance from the manufacturer.

00706.12 Aggregate - The aggregate used shall be clean, angular, durable, well graded and uniform. The aggregate shall consist of broken stone, crushed gravel, slag or a combination of them. To assure the material is totally crushed, 100~~%~~ percent of the parent aggregate shall be larger than the largest stone in the gradation to be used.

Aggregate gradation shall meet one of the following types:

	TYPE I - Parking Areas, Urban and Residential Streets, Airport Runways	**TYPE II - Urban and Residential Streets, Airport Runways**	**TYPE III - Primary and Interstate Routes**	
Sieve Size	**Percent Passing**	**Percent Passing**	**Percent Passing**	**Stockpile Tolerance**
3/8"	100	100	100	0
No. 4	100	90 - 100	70 - 90	± 5%

No. 8	90 - 100	65 - 90	45 - 70	± 5%
No. 16	65 - 90	45 - 70	28 - 50	± 5%
No. 30	40 - 65	30 - 50	19 - 34	± 5%
No. 50	25 - 42	18 - 30	12 - 25	± 4%
No. 100	15 - 30	10 - 21	7 - 18	± 3%
No. 200	10.0 - 20.0	5.0 - 15.0	5.0 - 15.0	± 2.0%

The job mix gradation shall be within the gradation band for the desired type. After the target gradation has been submitted then the percent passing each sieve shall not vary by more than the stockpile tolerance and still remain within the gradation band.

00706.13 Additives and Mineral Filler - Liquid retardant and mineral fillers may only be used when their quantity can be metered. The use of additives in the slurry mix, (or individual materials), shall comply initially with the quantities predetermined by the mix design, or with field adjustments if required, after approval by the engineer.

Portland cement, hydrated lime, limestone dust, fly ash or other approved filler required by the mix design shall meet the requirements of ASTM D 242, and shall be considered as part of the dry aggregate.

00706.14 Water - Water shall be potable, free of harmful salts and contaminants, and compatible with the slurry mix. Water used in mixing or curing shall be reasonably clean and free of oil, sugar, organic matter or other substance injurious to the finished product.

00706.15 Job Mix Formula ~~(JMF)~~ - Prior to the pre-construction conference, submit a signed slurry seal mix design for the specific materials to be used on the Project. Show the percentages of each individual material required on the mix design report. The complete mix design shall be made with the same aggregate gradation that will be used on the Project. After the mix design has been approved no substitution will be allowed unless approved. Water, not exceeding 11~~%~~ percent by weight to asphalt emulsion, shall be used to develop a good mix.

(a) Laboratory Evaluation - Have the mix design prepared and tested by a laboratory which has experience in designing emulsified asphalt slurry seal surfacing. Determine the proportions of component materials and perform the tests described in 00706.15(b). The final mix design shall meet the limits described in 00706.15(b) and 00706.15(c).

(b) Mix Design Tests:

Test	Description	Specification
ISSA TB-106	Slurry Seal Consistency	
ISSA TB-139 (For quick-traffic systems)	Wet Cohesion, 30 minutes set 60 minutes set	0.10 lb.-in. min. 0.17 lb.-in. min.
ISSA TB-109 (For heavy traffic areas only)	Excess Asphalt by LWT and Sand Adhesion	1 lb./sq. yd. max.
ISSA TB-114	Wet Stripping	Pass (90% minimum)
ISSA TB-100	Wet Track Abrasion Loss One hour soak	1.5 lb./sq. yd. max.
ISSA TB-113	Mix Time *	Controllable to 180 sec. minimum

* The mixing test and set time test should be done at the highest temperatures expected during construction.

The wet track abrasion test is used to determine the minimum asphalt content.

The mixing test is used to predict how long the material can be mixed in the machine before it begins to break.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report shall clearly show the proportions of aggregate, the minimum and maximum proportions of mineral filler and water, additive usage, and asphalt emulsion based on the dry weight of the aggregate.

All the component materials used in the mix design shall be representative of the materials proposed for use on the Project.

Show the percentages of each individual material required in the laboratory report. Adjustments may be required during the construction, based on the field conditions. The Engineer will give final approval for all such adjustments.

(c) Component Materials - The Engineer will approve the mix design, all slurry seal materials and methods prior to use. The component materials shall be within the following limits:

- **Residual Asphalt:**
  - Type I - 10% - 16%
  - Type II - 7.5% - 13.5%
  - Type III - 6.5% - 12%
  - Based on dry weight of aggregate
- **Mineral Filler:**
  - 0.5% - 2.0%
  - Based on dry weight of aggregate
- **Additives** - As needed.
- **Water** - As needed to achieve proper mix consistency. Total mix liquids shall not exceed the loose aggregate voids. Use ISSA T106 to check optimum liquids.

00706.16 Tolerances and Limits - Tolerances for individual materials as well as the slurry seal mixture during production are as follows:

- After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be allowed.
- The percentage of aggregate passing each sieve shall be within the stockpile tolerance range as stated in 00706.12.
- The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two successive sieves.
- The slurry consistency shall not vary more than plus or minus 2 inches from the job mix formula after field adjustments.
- The rate of application, once determined by the Engineer, shall not vary more than plus or minus 2 pound per square yard while remaining within the design application rate.

00706.17 Quality Control - Be responsible for quality control as required by Section 00165. Perform quality control sampling and testing as follows:

(a) QC/QA Slurry Seal Program - Test gradation, mixture, moisture, and asphalt according to the MFTP.

(b) Slurry Seal Production (Gradation):

- **Stockpile** - Every 60,000 square yards.
- **Tanker** - Every 60,000 square yards.
- **Mixture** - To be taken directly out of ~~pugmill~~pug mill every 60,000 square yards.

(c) Verification Testing - If comparisons of test results are outside the allowable differences, the Contractor and Engineer will investigate the reason. The Engineer may stop production while the investigation is in progress if the potential for pavement failure is present. The investigation may include review of calculation, testing of the remaining samples, review and observation of Contractor testing procedures and equipment, and a comparison of sample test results.

Equipment

00706.20 Equipment - Provide suitable surface preparation equipment, traffic control equipment, hand tools and any other support equipment required as necessary to perform the work.

00706.21 Mixing Equipment - The ~~machine(s)~~machines shall be specifically designed and manufactured to lay slurry seal. Mix slurry seal in continuous pug mill mixers; a self-propelled machine specifically designed and manufactured to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive and water to a revolving blade mixer that discharges the thoroughly mixed product on a continuous flow basis. Concrete transit mixer trucks shall not be used. Minimum slurry seal machine size shall be 7 cubic yards. In the case of equipment failure have a minimum of two machines on-site with another off site for immediate backup. The machine shall be capable of mixing materials at pre-set proportions regardless of the speed of the machine and without changing machine settings.

The mixing machine shall be equipped with an approved fine feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed. Use the fine feeder whenever added mineral filler is a part of the aggregate blend.

The mixing machine shall be equipped with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding spreading equipment.

(a) Proportioning Devices - Provide and properly mark individual volume or weight controls, such as revolution counters or similar devices, for proportioning each material to be added to the mix (for example; aggregate, mineral filler, additive, emulsified asphalt and water). Instruct the Engineer how to calculate the application rate per square yard utilizing the Contractor's proportioning devices.

(b) Calibration - Calibrate, in the presence of the Engineer, each slurry mixing unit to be used on the Project prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machines metering devices. No machine will be allowed to work on the Project until the calibration has been completed and/or accepted.

00706.22 Spreading Equipment - Spreader Box - Attach to the mixer machine a mechanical type squeegee distributor equipped with flexible material that is in contact with the pavement surface to prevent the loss of slurry from the distributor. Adjust the distributor to prevent the loss of slurry on varying grades and crown and to assure uniform spread. There shall be a steering device and a flexible strike-off. The spreader box shall have an adjustable width. Keep the spreader box reasonably clean, and do not allow buildups of asphalt and aggregate. Only one tail rubber will be allowed. Any type of drag used shall be subject to approval by the Engineer and kept in a completely flexible condition at all times.

00706.23 Rollers - If required by Special Provision, rollers shall be self-propelled, steel-wheeled or pneumatic-tired type and be equipped with a water spray system. Steel-wheeled rollers shall be capable of providing a weight of not less than 2,400 pounds per foot width of the compression roll or rolls. Pneumatic-tired rollers shall be capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area.

Labor

00706.30 Quality Control Personnel - Provide a ~~certified~~ technician ~~in the following field:~~having a CAT-I technical certification.

~~• CAT-I~~

Construction

00706.40 Weather Limitations - Do not apply the slurry seal if either the pavement or air temperature is below 50 °F and falling. The slurry seal may be applied when both the pavement and air temperature are above 45 °F and rising. Do not apply if there is a danger that the finished product will freeze before 24 hours. Do not apply when weather conditions prolong opening to traffic beyond a reasonable time. Do not apply in the rain. Replace slurry damaged by rain after application according to the Specifications, and as determined by Engineer, at no additional cost to the Agency. Clean the street of all remaining slurry mix materials prior to re-application.

Adjust the rate of application of the fog spray during the day to suit temperatures, surface texture, humidity and dryness of pavement surface. Do not spray additional water into the spreader box.

00706.41 Preparation of Surface - Submit details of the proposed street cleaning for approval by the Engineer prior to the preconstruction conference.

Remove any organic materials in cracks or joints not removed during crack sealing as part of the pavement preparation.

Pavement preparation shall consist of removal of all oil spills, flushing and sweeping. Complete flushing, as needed, prior to sweeping. Finish sweeping with a vacuum sweeper no more than 24 hours prior to application of the slurry seal. If there is a delay of more than 48 hours between sweeping and slurry sealing caused by weather conditions or other unforeseen circumstances, re~~-~~sweep as determined by the Engineer, at no additional cost to the Agency.

Prepare the pavement on which the slurry seal is to be placed as follows, as directed.

(a) Base Repairs - Where determined by the Engineer, excavate and replace surfacing materials according to Section 00748.

(b) Surface Repairs - Where the pavement is severely cracked, rutted, deformed or otherwise distressed, place a leveling course or patch using 3/4~~-inch~~" or 1/2~~-inch dense graded asphalt~~

~~concrete.~~" ACP. The class of mix to be used shall conform to ~~Section~~Sections 00744 and 00745~~.~~, as applicable. Place the mixture according to ~~Section~~Sections 00744 and 00745, as applicable.

(c) Crack Sealing - Clean and fill cracks 1/8 inch and larger inside the proposed slurry seal area.

(d) Tack Coat - On old, dry bituminous pavements and on rigid pavements, the Engineer may direct that tack coats be applied prior to placing the slurry seal. The tack coat shall be a diluted asphalt emulsion of the same type and grade specified for the slurry mix. The ratio of asphalt emulsion to water shall be 1:3. Apply the diluted material uniformly with a pressure distributor at a rate between 0.05 to 0.10 gallon per square yard, as determined by the Engineer. The tack coat shall be cured thoroughly prior to the application of the slurry seal.

(e) Street Equipment and Procedure - Immediately prior to applying the slurry seal, clear the surface of all loose material, silt spots, vegetation, oil spots and other objectionable material. Any standard cleaning method will be acceptable. If water is used, allow cracks to dry thoroughly before slurry sealing. The Engineer will approve the surface preparation prior to sealing.

(f) Utility Covers - Protect manholes, valve boxes, drop inlets and other service entrances from the slurry seal by a suitable method. Clean these covers as quickly as possible after the application of the slurry seal and definitely prior to the final set. If necessary, clean slurry residual from the interior of the utilities.

(g) Pavement Markings - Cover, or remove, all reflector buttons before slurry seal is to be applied to any area, as determined by the Engineer. Cover all thermo-tape markings and do not slurry seal over, or remove and replace as directed. Remove all paint pavement markings to prevent bleeding through the slurry seal and to allow proper adhesion.

00706.42 General - The surface may be wetted by fogging ahead of the slurry box, if required by local conditions. Apply water used in wetting the surface at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry box. The slurry mixture shall be of the desired consistency upon leaving the mixer. Do not add additional elements. Carry a sufficient amount of slurry in all parts of the spreader at all times so that complete coverage is obtained. Do not allow lumping, balling or unmixed aggregate in the spreader box. Do not allow segregation of the emulsion and aggregate fines from the coarse aggregates. If the coarse aggregate settles to the bottom of the mix, remove the slurry from the pavement. Do not allow excessive breaking of the emulsion in the spreader box. Do not leave streaks, such as caused by oversized aggregate, in the finished pavement. Maximum mixing time in the ~~pugmill~~pug mill shall be ~~four~~4 minutes.

00706.43 Application Rate - The minimum rate of application of dry aggregate per square yard will be determined by the Engineer. The depth of the slurry seal shall be sufficient to correct surface conditions, fill surface voids, and provide sealing and a minimum wearing surface. The maximum allowable vehicle speed for the rate of application shall be 180 feet per minute. Failure to demonstrate the proper rate of application will result in suspension of the work until the Contractor can demonstrate otherwise, at no additional cost to the Agency.

ISSA TB112 gives a method to determine expected application rates.

The slurry seal mixture shall be of proper consistency at all times to provide the application rate required by the surface condition. The average application rate, as measured by the Engineer, shall be according to the following table:

	Recommended Use	Application Rate
TYPE I	Parking Areas, Urban and Residential Streets, Airport Runways	6.7 - 10.0 lbs./sq. yd.

TYPE II	Urban and Residential Streets, Airport Runways	10.0 - 16.7 lbs./sq. yd.
TYPE III	Primary and Interstate Routes	15.0 - 25.0 lbs./sq. yd.

00706.44 Applying Slurry Seal Sample Strip - The strip shall consist of two panels approximately 50 feet long, placed side by side to form a typical seam between them. The width of the panels shall be the same as the Contractor plans to use on the streets. Place the strip at least 24 hours prior to the beginning of the actual work. Use the strip to calculate and monitor the rate of application in relation to weight of material per area, and to define the speed of the equipment related to the rate of application. If it is determined by the Engineer on the basis of this test strip that there are deficiencies in the mix design, method of application and rate of application, the Engineer may require the Contractor to revise the mix design, or repair or modify the equipment or application. After all changes are made, lay a new sample strip.

00706.45 Joints - Construct a uniform line along the edge and a good seal at curb lines. Construct the flow line at curbs to allow storm drainage flow to catch basins without bonding along the curb line. In the case of a concrete gutter, cover the gutter line joint with the slurry seal, but do not overlap onto the gutter. Remove any overlap, as determined by the Engineer, at no additional cost to the Agency. Streets that have been recently slurry sealed that cross this Project shall not be slurry sealed again.

The slurry joints and panels shall be straight, neat and uniform and follow the contour of the existing curb or concrete gutter. The width of the panels shall be the same as demonstrated in the sample strip. Floating (adding additional water other than what is required for the approved mix design) of the emulsion or slurry mixture in the ~~pugmill~~pug mill and/or spreader box to cover or overlap missed areas will be prohibited. Keep lines straight at intersections to provide a good appearance.

00706.46 Handwork - Use approved squeegees to spread slurry in areas not accessible to the slurry mixer.

Limit handwork at the beginning and end of the panels to prevent segregation of the rock from the emulsion and to minimize cosmetic drag mop marks and/or defects in the finished product.

The same type finish as applied by the spreader box shall be required. Complete handwork prior to setting of the slurry.

00706.47 Curing - The rate of curing of the slurry seal shall be such that a street may be opened to traffic after application without tracking or damage to the surface. Protect the area for the full curing period with suitable barricades or markers.

The Agency will not be responsible for any damage to the slurry seal prior to opening the area. Repair all damage to the slurry, to the satisfaction of the Engineer, at no additional cost to the Agency.

00706.48 Rolling - If required by Special Provision, apply a minimum of two full coverage passes to the surfaced areas by the roller, or as directed.

00706.49 Cleanup - Remove all debris associated with the performance of the work on a daily basis.

Temporary

00706.51 Provision for Traffic - Be responsible for notifying all abutting property owners along the streets according to the approved schedule, or an approved revision of the schedule, 48 hours prior to the specific work.

Remove all traffic control promptly when it is determined that the street may be open to traffic. Do not seal any street that requires closing overnight without the approval of the Engineer.

If the slurry seal does not cure in a timely manner and remains trackable overnight, apply a covering of 1/4 inch minus material to prevent tracking and related property damage prior to permitting traffic on the street at no additional cost to the Agency.

Be responsible for all damage to the uncured slurry or to private or public property due to tracking of the uncured material.

Measurement

00706.80 Measurement - Crack sealing will be measured on the length basis, of material in place.

Slurry seal will be measured on the area basis ~~and calculated to the nearest square yard~~.

Asphalt concrete pavement repair will be measured according to 00748.80.

Payment

00706.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Slurry Seal Crack Sealing	Foot
(b)	Slurry Seal	Square Yard

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Asphalt concrete pavement repair will be paid for according to 00748.90.

When the Contract Schedule of Items does not indicate payment for work under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00710 - Single Application Emulsified Asphalt Surface Treatment

Description

00710.00 Scope - This work consists of applying emulsified asphalt and graded aggregates as shown or directed.

The surface treatment design will be designated on the plans or in the Special Provisions.

Materials

00710.10 Aggregates - Furnish aggregates meeting the following requirements:

(a) Size Designation - Provide the size of aggregate for the single application emulsified asphalt surface treatment design designated in the plans or Special Provisions according to the following:

Chip Seal Design	Size of Screenings
Fine	3/8" - No. 8
Single Size Medium	3/8" - 1/4"
Graded Medium	3/8" - No. 4
Coarse	1/2" - 1/4"

(b) Fractured Faces - Provide aggregates consisting of broken stone, crushed gravel or a combination of both. Crush aggregate such that at least 90~~%~~ percent by weight of the total aggregate retained on the No. 8 and larger sieves is fractured on two faces, as determined according to AASHTO ~~TP 61~~T 335.

(c) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide grading for the designated single application emulsified asphalt surface treatment design according to the following:

Sieve Size	Coarse 1/2" - 1/4"	Single Size Medium 3/8" - 1/4"	Graded Medium 3/8" - No. 4	Fine 3/8" - No. 8
		Percent Passing (by Weight)		
3/4"	100			
1/2"	85 - 100	100	100	
3/8"	–	85 - 100	80 - 100	100
1/4"	0 - 15	0 - 15	10 - 40	–
No. 4	–	–	–	45 - 65
No. 8	0 - 4	–	0 - 6	0 - 10
No. 30	–	0 - 2	0 - 2	–
No. 200 (wet)	0.0 - 2.0	0.0 - 2.0	0.0 - 2.0	0.0 - 2.0
No. 200 (wet) *	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0

* in gravels

(d) Unit Weight of Aggregate - Provide aggregate with a minimum unit weight of 90 pounds per cubic foot according to AASHTO T 19.

(e) Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12~~%~~ percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(f) Durability - Provide aggregates meeting the following durability requirements:

Test	Test Method ODOT	Test Method AASHTO	Maximum Values
Abrasion		T 96	30.0%
Degradation (coarse aggregate)			
Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(g) Harmful Substances - Provide aggregates meeting the following harmful substances requirements:

Test	Test Method ODOT	Test Method AASHTO	Limits
Lightweight Pieces		T 113	1.0% maximum
Wood Particles	TM 225		0.1% maximum
Elongated Pieces (coarse aggregate at a ratio of 5:1)	TM 229		10.0% maximum
Cleanness Value	TM 227		75 minimum

(h) Taking Aggregates from Agency Stockpiles - When it is specified that aggregates are to be taken from Agency-controlled stockpiles, take the material in an orderly manner. Do not contaminate the materials. Salvage all material possible from the area which the material is taken. Shape unused portions of a stockpile to neat lines. The Contractor will be charged for materials wasted through negligence or used without authority.

(i) Stockpiling Contractor Furnished Aggregates on Agency Property - Aggregates may be temporarily stockpiled at approved sites on Agency property provided the areas used are as small as practicable. Restore the site to its original condition after the materials have been removed. Any contamination during storage or from reloading operations will be cause for rejection.

00710.11 Emulsified Asphalt - Furnish polymer-modified emulsified asphalt or non-polymer-modified emulsified asphalt as specified for the single application emulsified asphalt surface treatment design designated in the plans or Special Provisions. When non-polymer-modified emulsified asphalt is designated, the Contractor may elect to substitute a polymer-modified emulsified asphalt, however, selection of the polymer-modified emulsified asphalt will not be cause for additional compensation.

(a) Non-Polymer-Modified Emulsified Asphalt - When non-polymer-modified emulsified asphalt is specified, use CRS-2 or HFRS-2 emulsified asphalt as the Contractor elects.

(b) Polymer-Modified Emulsified Asphalt - When polymer-modified emulsified asphalt is specified, use CRS-2P or HFRS-P1 as the Contractor elects.

(c) Acceptance of Emulsified Asphalt - Provide emulsified asphalt conforming to the requirements of ODOT's publication, "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable Specifications are those contained in the current publication on the date the Project is advertised. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

Excessive delay in the use of the emulsified asphalt or excessive pumping of the emulsified asphalt may significantly reduce the viscosity and may make the material unsuitable for surface

treatment use. For this reason limit pumping between the bulk storage tank, hauling transportation, field storage tanks and distributor to an absolute minimum to maintain proper viscosity. Final acceptance of emulsified asphalt will be at the point of application.

Obtain samples of emulsified asphalt according to AASHTO T 40 at the frequency indicated in the MFTP. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency. Non-polymer-modified emulsified asphalt will be tested within 30 calendar days from the date it is sampled. Polymer-modified emulsified asphalt will be tested within 14 calendar days from the date it is sampled.

00710.15 Aggregate Production Quality Control - Provide quality control during production of aggregate according to Section 00165. Sampling and Testing shall be performed by a CAgT at the minimum frequency schedule indicated in the MFTP.

(a) Quality Control Compliance - Evaluate aggregates for compliance according to the following:

(1) Gradation - Analyze gradation statistically according to Section 00165. A stockpile contains specification aggregate when the Pay Factor (PF) for each sieve size calculated according to 00165.40 is equal to or greater than 1.00. Each required sample represents a sublot.

When the results from Table 00165-2 yield a Pay Factor of less than 1.00 for any sieve size, the material is non-specification. The Engineer will reject any stockpile of aggregate containing non-specification material unless the non-specification material is removed from the stockpile. Do not add additional material to such a stockpile until enough non-specification material is removed so that the PF for each sieve size is equal to or greater than 1.00.

(2) Other Tests - Stop production, make appropriate operational adjustments, and remove all failing material from the stockpile whenever a quality control test result, other than sieve analysis, does not meet Specifications. Document operational adjustments made and notify the Engineer prior to resuming production.

(3) Preproduced Aggregate - Compliance of aggregates produced and stockpiled before the award of this Contract will be determined by either of the following:

- Continuing production records meeting the requirements of 00710.10 and 00710.15.
- Sampling according to AASHTO T 2 and testing the entire stockpile at the minimum frequency schedule indicated in the MFTP. The material shall meet the requirements of 00710.10 and 00710.15.

(b) Materials on Hand - Payment for stockpiled materials on hand may be allowed as described in 00195.60 subject to meeting the requirements of 00710.10 and 00710.15.

00710.16 Acceptance of Aggregate - The Contractors quality control tests will be used for acceptance of aggregates if verified by the Agency's quality assurance program. The Agency will perform aggregate production quality assurance according to the following:

(a) ODOT Administered Projects - Quality assurance testing on ODOT administered projects will be performed according to Section 00165, the MFTP and the ODOT Quality Assurance ~~Manual~~Program.

(b) Projects Administered by Other Agencies - The quantity of quality assurance testing on projects administered by other Agencies will be at the discretion of the Agency or as designated in the Special Provisions.

Equipment

00710.20 Equipment - Provide a pressure distributor, hauling vehicles, chip spreader, compactors, power brooms and other necessary equipment to ensure efficient operation and construction to meet specified results. Provide equipment in sufficient number and capacities that will provide coordinated and uniform progress of the work.

Provide two-way radio communication between the asphalt distributor and chip spreader.

00710.21 Asphalt Distributor - Provide an asphalt distributor designed, equipped, maintained and operated so the emulsified asphalt material may be applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 - 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

00710.22 Chip Spreaders - Provide self-propelled chip spreaders equipped with a mechanical device that will spread the aggregate at a uniform rate across the full width of the chip spreaders. Provide chip spreaders equipped with an aggregate segregator assembly. Chip spreaders without an aggregate segregator assembly may be allowed if approved by the Engineer. Provide chip spreaders of adequate width to provide full coverage of the specified panel and without placing joints in the travel lanes.

00710.23 Compactors - Provide self-propelled pneumatic-tired or steel-wheeled rollers in good condition and capable of operating at speeds compatible with the surface treatment operation. A minimum of two pneumatic-tired rollers and one steel-wheeled roller is required.

(a) Pneumatic-tired Rollers - Provide self-propelled, tandem or multiple axle, multiple wheel type pneumatic-tired rollers with smooth-tread pneumatic tires of equal size. The tires shall be staggered on the axles at such spacings and overlaps that will provide uniform compacting pressure for the full compacting width of the roller. The minimum load per tire shall be 2,800 pounds, with tire inflation pressures of 45 psi to 90 psi.

(b) Steel-wheeled Rollers - Provide steel-wheeled rollers with a gross static weight of at least 8 tons.

00710.24 Power Brooms - Provide pickup or non-pickup type power brooms equipped with a positive means to control vertical pressure.

Labor

00710.30 Quality Control Personnel - Provide a ~~certified~~ technician ~~in the following field:~~having a CAgT technical certification.

~~• CAgT~~

Construction

00710.40 Season and Weather Limitations - Do not apply emulsified asphalt when the pavement temperature is below 70 °F, or if the humidity is higher than 75~~%.~~ percent. Complete the application of the emulsified asphalt and the aggregate ~~three~~3 hours before sunset. Remove by milling, or

other methods approved by the Engineer, and replace all surface treatments damaged by weather during the first 24 hours after application at no additional cost to the Agency. The placing of single application emulsified asphalt surface treatments will not be allowed before July 1 or after August 31.

00710.41 Rate of Progress and Scheduling - Do not apply more surface treatment in any ~~one~~ 1 day than can be broomed the following morning, unless approved by the Engineer. Provide a traffic control plan for approval by the Engineer if operations exceed 3 centerline miles or 6 lane miles per day.

00710.42 Preparation of Underlying Surfaces - Immediately before applying the emulsified asphalt, clean and dry the surface to be treated in a manner approved by the Engineer.

00710.43 Sequence of Operations - Construct the single application emulsified asphalt surface treatment with a single spread of emulsified asphalt followed immediately with a single spread of aggregate and initial rolling, unless otherwise directed by the Engineer. Surface treatment is not required for guardrail flares, driveways, or other irregular areas as directed.

00710.44 Application Rates - Apply the emulsified asphalt and spread the aggregate within the following ranges of rates for the specified surface treatment design. The exact application and spread rate will be determined by the Engineer.

Chip Seal Design	Emulsified Asphalt Application Rate (gal./sq. yd.)	Aggregate Spread Rate (cu. yd./sq. yd.)
Fine	0.25 - 0.40	0.004 - 0.009
Single Size Medium	0.40 - 0.65	0.005 - 0.015
Graded Medium	0.40 - 0.65	0.005 - 0.015
Coarse	0.33 - 0.70	0.009 - 0.018

00710.45 Applying Emulsified Asphalt - Apply emulsified asphalt at the rates specified in 00710.44 and according to the following:

- Apply the emulsified asphalt working toward the aggregate stockpile at all times, unless otherwise approved by the Engineer.
- Leave a minimum of 200 gallons of emulsified asphalt in the distributor tank at all times.
- Do not apply emulsified asphalt to more than one-half the width of the travel way at one time with the remaining width remaining open to traffic. Do not close the open lane until traffic controlled by pilot car is operating on the new surface treatment. Apply the surface treatment, weather permitting, to both sides of the travel way so that the end of the work is squared up ~~three~~ 3 hours before sunset.
- Do not apply emulsified asphalt a greater distance than can be immediately covered by aggregates before the emulsion breaks.
- Place building paper over the treated surface at the beginning of each spread to ensure that the nozzles are operating properly before the uncovered surface is reached. Remove and dispose of building paper in a manner satisfactory to the Engineer.
- If requested by the Engineer, demonstrate that the distribution of the emulsified asphalt does not vary between the individual nozzles by more than 15~~%~~ percent transversely from the average, and no more than 10~~%~~ percent longitudinally from the specified rate of application.
- Apply the emulsified asphalt at a temperature between 140 °F and 185 °F as recommended by the manufacturer.

00710.46 Hauling and Spreading Aggregates - Spread aggregates at the rates specified in 00710.44.

Do not operate hauling and spreading equipment on uncovered emulsified asphalt. During the first hour after application of the emulsified asphalt and aggregate, operate at speeds no more than 10 mph and after the first hour, not more than 15 mph until otherwise allowed by the Engineer. Carefully operate hauling equipment at all times, at moderate speeds that will not damage the new surface treatment or create a hazard to the traveling public. Route hauling equipment and pilot lines as uniformly as possible over the full width of the new surface in place.

Calibrate the gate opening, gear selection and engine RPM of the chip spreaders for the various sizes of aggregate to be used. Following calibration, verify the rate of application by a method acceptable to the Engineer.

Immediately cover the emulsified asphalt surface with aggregate unless otherwise authorized by the Engineer. Maintain the rate of spread of this aggregate within 10~~%~~ percent of specified rate. Using approved methods, remove or repair emulsified asphalt that has set or "broke" before being covered with aggregate, at no additional cost to the Agency.

Aggregates shall be surface damp at the time of application. Excess free water (water not adhering to the aggregate surface) on the aggregate will not be allowed.

Do not operate the chip spreader at speeds which cause the chips to roll over after striking the emulsion covered surface.

Provide coverage without gaps or overlapping adjacent coverages. Do not construct longitudinal joints within the travel lanes.

Construct neat transverse cut off of aggregates and remove any excess aggregates from the surface prior to resuming operations.

00710.47 Shaping and Compacting - After the aggregates have been placed on the emulsified asphalt, spread or remove all piles, ridges, or uneven distribution to ensure against rough spots in the final surface.

Compact the surface with a minimum of two coverages with a pneumatic-tired roller and one coverage with a steel-wheeled roller. Continue compacting until the material is interlocked, firm and partially bound with the underlying emulsified asphalt. The sequence of roller coverages may be adjusted at the discretion of the Engineer.

Operate rollers at speeds such that the rollers do not pick up aggregates from the surface. Do not exceed rolling speeds of 5 mph.

In the event aggregates begin to pick up under traffic or from the rolling operation, immediately cover and roll the area with additional quantities of aggregate.

Maintenance

00710.60 Power Brooming - Following the application of the surface treatment, carefully broom the entire surface to remove loose aggregate. Discontinue the operation if brooming damages the surface treatment. Use a minimum of two power brooms.

Subsequent brooming the following ~~two~~2 days may be directed by the Engineer to ensure that the surface is free of loose aggregate that could cause vehicle damage.

In curbed areas, use a pick-up type power broom. On bridges, sidewalks and other areas off the roadway, remove all loose aggregates to the satisfaction of the Engineer.

Measurement

00710.80 Measurement - The quantities of aggregate will be measured on the weight basis or on the volume basis in the hauling vehicle.

The quantities of emulsified asphalt will be measured on the weight basis.

The quantities of asphalt surface treatment of approaches will be measured on the unit basis for each street connection and road approach.

Payment

00710.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Aggregate in Emulsified Asphalt Surface Treatment	Ton or Cubic Yard
(b) Asphalt in Emulsified Asphalt Surface Treatment	Ton
(c) Extra for Emulsified Asphalt Surface Treatment Approaches	Each

Item (c) applies to the extra costs of placing the aggregates and asphalt in single application emulsified asphalt surface treatments only on street connections and road approaches. Payment will be in addition to payment made for the materials used in the work.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for preparing the road surface, placing materials in final position, or brooming.

Section 00711 - Pre-Coated Aggregate Asphalt Surface Treatment

Description

00711.00 Scope - This work consists of applying a surface treatment using a modified hot asphalt binder and precoated graded aggregate as shown.

Materials

00711.10 Aggregates - Furnish aggregate meeting the following requirements:

(a) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide aggregate meeting the following gradation:

	3/8" - No. 4
Sieve Size	Percent Passing (by Weight)
1/2"	100
3/8"	85 - 100
No. 4	0 - 15
No. 8	0 - 5
No. 200 Wet	0 - 1.5

(b) Fractured Faces - Provide aggregate consisting of broken stone, crushed gravel, or a combination of both. Crush aggregate such that at least 90 percent by weight of the total aggregate retained on the No. 8 and larger sieves is fractured on two faces, as determined according to AASHTO T 335.

(c) Unit Weight of Aggregate - Provide aggregate with a minimum unit weight of 90 pounds per cubic foot according to AASHTO T 19.

(d) Soundness - Provide aggregate with a weighted loss not exceeding 12 percent when subjected to five cycles of the soundness test using sodium sulfate according to AASHTO T 104.

(e) Durability - Provide aggregate meeting the following durability requirements:

	Test Method		Maximum
Test	ODOT	AASHTO	Values
Abrasion		T 96	30.0%
Degrade (Plus No. 4) Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(f) Harmful Substances - Provide aggregate meeting the following harmful substances requirements:

	Test Method		
Test	ODOT	AASHTO	Limit
Lightweight Pieces		T 113	1.0% maximum
Wood Particles	TM 225		0.1% maximum
Elongated Pieces (5:1 ratio)	TM 229		10.0% maximum
Cleanness Value	TM 227		75 minimum

00711.11 Asphalt Binder - Furnish AC15-5TR or AC-15P asphalt for the binder meeting the following requirements:

		AC15-5TR		AC-15P	
Test	**Test Method**	**Min.**	**Max.**	**Min.**	**Max.**
Absolute Viscosity at 140F, poise	ODOT TM 430	1500		1500	
Kinematic Viscosity at 275F, cSt	AASHTO T 201		2000		2000
Penetration at 25C, 100g, 5 sec, dmm	AASHTO T 49	90	140	100	150
Elastic Recovery, %	ODOT TM 429	55		55	
Cleveland Open Cup Flash Point, C	AASHTO T 48	260		260	

Obtain asphalt binder samples according to AASHTO T 40 at a frequency of one sample for each 50 tons of asphalt binder used. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency.

00711.12 Asphalt and Additives for Pre-Coated Aggregate - Furnish PG64-22 grade asphalt to pre coat the aggregate meeting the requirement of ODOT's publication, "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable Specifications are those contained in the current publication on the date the Project is advertised.

Obtain samples of asphalt according to AASHTO T 40 when requested by the Engineer. Samples may be tested at the discretion of the Engineer at the Agency's expense.

00711.15 Aggregate Production Quality Control - Provide quality control during production of aggregates according to Section 00165. Have a CAgT sample and test according to the MFTP section 4(D), for section 00710 materials. Statistically evaluate the aggregates according to Section 00165.

00711.16 Acceptance of Aggregate - The Contractors quality control tests will be used for acceptance of aggregates if verified by the Agency's quality assurance program. The Agency will perform aggregate production quality assurance according to Section 00165, the MFTP, and section 00710.16 of the ODOT Quality Assurance Program.

Obtain asphalt binder samples according to AASHTO T 40 at a frequency of one sample for each 50 tons of asphalt binder used. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency.

00711.17 Pre-Coated Aggregate Mixture - Pre-coat, cure, store, and maintain the pre-coated aggregate mixture according to the following:

- Waste all bag house dust during production of the pre-coated aggregate mixture.
- Use an asphalt hot plant to coat the aggregate with asphalt.
- Achieve at least a 90 percent coating on all the material retained on the No. 4 sieve by applying between 0.7 and 1.0 percent liquid asphalt of the total weight of the material. Establish the target value and obtain the Engineer's approval before beginning the coating process. The acceptable liquid asphalt tolerance is ± 0.2 percent. Test according to ODOT TM 321 at a frequency of one test for every 500 tons of mixture. Coated aggregate that is not within the acceptable tolerance will be rejected.
- Maintain the plant dryer temperature between 190 °F and 230 °F. Maintain the liquid asphalt temperature at the liquid asphalt supplier's recommended temperature.

- The maximum moisture content of the pre-coated aggregate mixture is limited to 1.3 percent. Test according to AASHTO T 329 at a frequency of one test for every 500 tons of mixture.
- After pre-coating, stockpile, cool, and cure the aggregate mixture for at least 7 calendar days before using it.
- Use multiple stockpiles to store the pre-coated aggregate mixture. Do not place additional pre-coated aggregate mixture into an existing stockpile until the temperature of the additional pre-coated aggregate mixture is no more than 140 °F.
- Turn the pre-coated aggregate mixture with a loader or other means to accelerate cooling, to increase uniformity of the coating on the aggregates, to avoid heat buildup, and to prevent burning of the asphalt coating. Excessive clumping may require re screening of the mixture before acceptance. If excessive dust is encountered when placing the pre-coated aggregate mixture, re-screen it at the stockpile site.
- Final acceptance of the pre-coated aggregate mixture will be completed at the stockpile staging site.

Equipment

00711.20 Equipment - Provide pressure distributors, hauling vehicles, chip spreader, compactors, power brooms and other necessary equipment to insure efficient operation and construction to meet specified results. Provide equipment in sufficient number and capacities that will provide coordinated and uniform progress of the work.

Provide two-way radio communication between the asphalt distributor and chip spreader.

00711.21 Asphalt Distributors - Provide asphalt distributors that are:

- Designed, equipped, maintained, and operated so the asphalt material may be applied uniformly at even heat, and in a continuous operation.
- Capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 - 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard.
- Equipped with a tachometer, pressure gages, accurate volume measuring devices, and a thermometer for measuring temperature of tank contents.
- Equipped with a Computer Rate Control device.
- Equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically.

Set the bar height for triple lap coverage.

Demonstrate to the Engineer that the asphalt distributors are properly calibrated before beginning work.

00711.22 Chip Spreaders - Provide chip spreaders that are:

- Self-propelled, computerized chip spreaders, and with a screenings hopper in the rear and a belt conveyor to carry the screenings to the front of the spreader hopper. Rear screens may be removed at the direction of the engineer if excess build-up occurs.
- Capable of providing a uniform spread rate over the entire width of the traffic lane in one application.
- Equipped with an aggregate segregator assembly unless otherwise allowed by the Engineer.

- Of adequate width to provide full coverage of the specified panel without placing joints in the travel lanes.
- Equipped with a surface temperature thermometer which reads the surface temperature in advance of rock placement, and be visible to the chip spreader operator.

Provide verification to the Engineer that the chip spreaders are properly calibrated before beginning work.

00711.23 Compactors - Provide at least three rollers for multiple pass operations and at least five rollers for continuous operations meeting the following requirements:

- Be self-propelled pneumatic-tired in good condition and capable of operating at speeds compatible with the surface treatment operation.
- Be tandem or multiple axle, multiple wheel type pneumatic-tired rollers with smooth-tread pneumatic tires of equal size.
- Have staggered tires on the axles at spacing and overlaps that will provide uniform compaction pressure for the full compacting width of the roller.
- Have minimum load per tire of 2,800 pounds, with tire inflation pressures of 45 to 100 psi.
- Maintained air pressure to not vary more than ± 5 psi in each tire per machine.

00711.24 Power Brooms - Provide at least four pickup or non-pickup type power brooms equipped with a positive means to control vertical pressure.

00711.25 Asphalt Storage Tank - Provide a heated asphalt storage tank in close proximity to Project.

Labor

00711.30 Quality Control Personnel - Provide a technician having a CAgT technical certification.

00711.31 Technical Representative - Provide a qualified technical representative from the asphalt binder supplier, on site, during all surface treatment operations. The technical representative duties are to assist the Engineer in establishing the asphalt binder and pre-coated aggregate mixture application rates and to provide input on the temperatures for the application of the asphalt binder coat.

Construction

00711.40 Season, Weather and Temperature Limitations - Construct the surface treatment in warm dry weather. Apply the hot asphalt binder only when the ambient temperature is 70 °F or higher and the pavement surface temperature, in the sun and shade is 75 °F or higher. Do not apply if the road surface is wet or if rain is predicted. If unexpected rain does occur during application, shut off the asphalt distributor but continue with pre-coated aggregate mixture placement until all newly sprayed asphalt binder has been covered. Do not resume the surface treatment operation for at least 2 days and when allowed by the Engineer.

00711.41 Rate of Progress and Scheduling - Do not apply more surface treatment in any one day than can be broomed the same day.

00711.42 Preparation of Underlying Surfaces - At the beginning of the shift, clean the surface to be treated of all loose material by brooming.

00711.43 Sequence of Operations - Construct the surface treatment as follows:

- Apply the binder.
- Distribute the pre-coated aggregate mixture.
- Compact it with pneumatic tired rollers.

When applying the asphalt binder at intersections, turn pockets, gore points, and other irregular areas do not apply the asphalt binder in excess of what can be covered with the pre-coated aggregate mixture within the appropriate temperature range of the asphalt binder.

00711.44 Application Rates - Apply the asphalt binder and spread the pre-coated aggregate mixture within the following ranges of rates. The exact application and spread rate will be determined by the Engineer.

Asphalt binder application rate.....0.35 to 0.45 gallon per square yard

Pre coated aggregate mixture spread rate.....10 to 20 pounds per square yard

00711.45 Applying Asphalt Binder Coat - Place asphalt binder to the road surface with a pressure distributor at the rates specified and according to the following:

- Apply to no more than one-half the width of the travel way at one time.
- Apply so the longitudinal joint between adjacent applications of asphalt binder and pre-coated aggregate mixture coincides with the line between designated traffic lanes.
- Apply asphalt binder at a distance that allows the pre-coated aggregate mixture to be applied at the binder surface temperature listed in 00711.46. Do not operate hauling and spreading equipment on uncovered asphalt binder.
- Apply at a temperature between 330 °F and 370 °F or as recommended by the asphalt binder supplier. Do not elevate the asphalt binder above 330 °F for more than a 4 hour period or a temperature or time period recommended by the asphalt binder supplier.
- Clean all joints of excess loose material before applying the asphalt binder.
- Construct joints without ridges and depressions and have uniform appearance consistent with the adjacent sealed surface. Correct all defects at no cost to the Agency.
- Place building paper over the treated surface at the beginning of each spread for each distributor to insure that the nozzles are operating properly before the uncoated surface is reached. Remove and dispose of building paper according to Section 00290.

00711.46 Hauling and Spreading Aggregates - Haul and spread the pre-coated aggregate mixture at the rates specified and the following:

- Periodically verify the gate opening to be sure a consistent spread rate is maintained. Maintain the pre-coated aggregate mixture spread rate within ± 5% of the established rate.
- Operate hauling equipment at speeds that will not damage the new surface treatment. Route hauling equipment and pilot car traffic as uniformly as possible over the full width of the new surface.
- Cover the asphalt binder surface with pre-coated aggregate mixture when the asphalt binder surface temperature is between 130 °F and 180 °F.
- Uniformly spread pre-coated aggregate mixture to provide coverage without gaps or overlapping adjacent coverages. Do not construct longitudinal joints within the travel lanes.

Construct neat transverse cut off of pre-coated aggregate mixture and remove all excess aggregate from the surface before resuming operations.

00711.47 Shaping and Compacting - After the pre-coated aggregate mixture has been spread on the asphalt binder surface, remove all piles, ridges, and uneven surfaces.

Make the initial compaction pass behind the spreader as soon as the pre-coated aggregate mixture is spread. Hauling equipment may be used to assist in compaction immediately behind the spreader. Use sufficient pneumatic rollers to cover the width of the pre-coated aggregate mixture spread in one pass. Roll in a staggered pattern. Operate rollers to maintain close proximity to the spreader but do not exceed 5 mph. Complete at least three roller passes within 30 minutes of spreading pre-coated aggregate mixture. If rollers are unable to keep up with the spreader, stop application of asphalt binder and pre coated aggregate mixture until to rollers catch up or furnish additional rollers. If pre coated aggregate mixture spreading is stopped for more than 2 minutes, move the spreader ahead of or off the surface so that cover material may be immediately rolled.

Maintenance

00711.60 Power Brooming - After rolling the pre-coated aggregate mixture, remove loose aggregate by brooming the entire surface. Delay brooming if the brooms damage the surface. Broom one pass in the opposite direction in which the pre-coated aggregate mixture was placed. Do not allow uncontrolled traffic on the surface until all brooming of excess aggregate is completed.

Subsequent brooming may be required for up to 2 days after placement as directed.

Seven calendar days after completion of a section of surface treatment, remove all loose aggregate from the shoulder area by brooming.

On bridges, barrier areas, minimum width median areas, and curbed areas, use a pick-up type power broom. On bridges, sidewalks, and other areas off the roadway, remove all loose aggregates to the satisfaction of the Engineer. Dispose of loose aggregate at least 150 feet from the nearest waterway in areas identified for this purpose.

Measurement

00711.80 Measurement - The quantities of work performed under this Section will be measured on the weight basis.

Payment

00711.90 Payment - The accepted quantities for work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Pre-coated Aggregate in Asphalt Surface Treatment	Ton
(b) Asphalt Binder Coat in Asphalt Surface Treatment	Ton
(c) PG64-22 in Pre-coated Aggregate	Ton

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00715 - Multiple Application Emulsified Asphalt Surface Treatment

Description

00715.00 Scope - This work consists of applying multiple layers of emulsified asphalt and graded aggregates, applied in successive spreads, to form a firm, finished surface as shown or directed.

The surface treatment design will be designated on the plans or in the Special Provisions.

Materials

00715.10 Aggregates - Furnish aggregates meeting the following requirements:

(a) Fractured Faces - Provide aggregates consisting of broken stone, crushed gravel, or a combination of both. Crush aggregate such that at least 90~~%~~ percent by weight of the total aggregate retained on the No. 8 and larger sieves is fractured on two faces, as determined according to AASHTO ~~TP 61~~T 335.

(b) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide designated gradings for the specified multiple application emulsified asphalt surface treatment design according to the following:

	Designated Size			
Sieve Size	**1" - 1/2"**	**3/4" - 1/2"**	**1/2" - 1/4"**	**3/8" - No. 8**
		Percent Passing (by Weight)		
1"	100	100		
3/4"	95 - 100	90 - 100	100	
1/2"	60 - 90	0 - 10	85 - 100	
3/8"	–	–	–	100
1/4"	15 - 30	0 - 2	0 - 15	–
No. 4	–	–	–	45 - 65
No. 8	0 - 7	–	0 - 4	0 - 10
No. 200 (wet)	0.0 - 2.0	0.0 - 2.0	0.0 - 2.0	0.0 - 2.0
No. 200 (wet) *	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0

* in gravels

(c) Unit Weight of Aggregate - Provide aggregate with a minimum unit weight of 90 pounds per cubic foot according to AASHTO T 19.

(d) Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12~~%~~ percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(e) Durability - Provide aggregates meeting the following durability requirements:

	Test Method		Maximum
Test	**ODOT**	**AASHTO**	**Values**
Abrasion		T 96	30.0%
Degradation (coarse aggregate)			
Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(f) Harmful Substances - Provide aggregates meeting the following harmful substances requirements:

Test	Test Method ODOT	Test Method AASHTO	Limits
Lightweight Pieces		T 113	1.0% maximum
Wood Particles	TM 225		0.1% maximum
Elongated Pieces (coarse aggregate at a ratio of 5:1)	TM 229		10.0% maximum
Cleanness Value	TM 227		75 minimum

(g) Taking Aggregates from Agency Stockpiles - When it is specified that aggregates are to be taken from Agency-controlled stockpiles, take the material in an orderly manner. Do not contaminate the materials. Salvage all material possible from the area which the material is taken. Shape unused portions of a stockpile to neat lines. The Contractor will be charged for materials wasted through negligence or used without authority.

(h) Stockpiling Contractor Furnished Aggregates on Agency Property - Aggregates may be temporarily stockpiled at approved sites on Agency property provided the areas used are as small as practicable. Restore the site to its original condition after the materials have been removed. Any contamination during storage or from reloading operations will be cause for rejection.

00715.11 Emulsified Asphalt - Furnish polymer-modified emulsified asphalt or non-polymer-modified emulsified asphalt as specified for the multiple application emulsified asphalt surface treatment design designated in the plans or Special Provisions. When non-polymer-modified emulsified asphalt is designated, the Contractor may elect to substitute a polymer-modified emulsified asphalt, however, selection of the polymer-modified emulsified asphalt will not be cause for additional compensation.

(a) Non-Polymer-Modified Emulsified Asphalt - When non-polymer-modified emulsified asphalt is specified, use CRS-2 or HFRS-2 emulsified asphalt as the Contractor elects.

(b) Polymer-Modified Emulsified Asphalt - When polymer-modified emulsified asphalt is specified, use CRS-2P or HFRS P1 as the Contractor elects.

(c) Acceptance of Emulsified Asphalt - Provide emulsified asphalt conforming to the requirement of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the Project is advertised. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

Excessive delay in the use of the emulsified asphalt or excessive pumping of the emulsified asphalt may significantly reduce the viscosity and may make the material unsuitable for surface treatment use. For this reason limit pumping between the bulk storage tank, hauling transportation, field storage tanks and distributor to an absolute minimum to maintain proper viscosity. Final acceptance of emulsified asphalt will be at the point of application.

Obtain emulsified asphalt samples according to AASHTO T 40 at the frequency indicated in the MFTP. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency. Non-polymer-modified emulsified asphalt will be tested within 30 calendar days from the date it is sampled. Polymer-modified emulsified asphalt will be tested within 14 calendar days from the date it is sampled.

00715.15 Aggregate Production Quality Control - Provide quality control during production of aggregate according to Section 00165. Sampling and Testing shall be performed by a CAgT at the minimum frequency schedule indicated in the MFTP.

(a) Quality Control Compliance - Evaluate aggregates for compliance according to the following:

(1) Gradation - Analyze gradation statistically according to Section 00165. A stockpile contains specification aggregate when the Pay Factor (PF) for each sieve size calculated according to 00165.40 is equal to or greater than 1.00. Each required sample represents a sublot.

When the results from Table 00165-2 yield a Pay Factor of less than 1.00 for any sieve size, the material is non-specification. The Engineer will reject any stockpile of aggregate containing non-specification material unless the non-specification material is removed from the stockpile. Do not add additional material to such a stockpile until enough non-specification material is removed so that the PF for each sieve size is equal to or greater than 1.00.

(2) Other Tests - Stop production, make appropriate operational adjustments, and remove all failing material from the stockpile whenever a quality control test result, other than sieve analysis, does not meet Specifications. Document operational adjustments made and notify the Engineer prior to resuming production.

(3) Preproduced Aggregate - Compliance of aggregates produced and stockpiled before the award of this Contract will be determined by either one of the following:

- Continuing production records meeting the requirements of 00715.10 and 00715.15.
- Sampling according to AASHTO T 2 and testing the entire stockpile at the minimum frequency schedule indicated in the MFTP. The material shall meet the requirements of 00715.10 and 00715.15.

(b) Materials on Hand - Payment for stockpiled materials on hand may be allowed as described in 00195.60 subject to meeting the requirements of 00715.10 and 00715.15.

00715.16 Acceptance of Aggregate - The Contractors quality control tests will be used for acceptance of aggregates if verified by the Agency's quality assurance program. The Agency will perform aggregate production quality assurance according to the following:

(a) ODOT Administered Projects - Quality assurance testing on ODOT administered projects will be performed according to Section 00165, the MFTP and the ODOT Quality Assurance ~~Manual~~Program.

(b) Projects Administered by Other Agencies - The quantity of quality assurance testing on projects administered by other Agencies will be at the discretion of the Agency or as designated in the Special Provisions.

Equipment

00715.20 Equipment - Provide a pressure distributor, hauling vehicles, chip spreader, compactors, power brooms, and other necessary equipment to ensure efficient operation and construction to meet specified results. Provide equipment in sufficient number and capacities that will provide coordinated and uniform progress of the work.

Provide two way radio communication between the asphalt distributor and chip spreader.

00715.21 Asphalt Distributor - Provide an asphalt distributor designed, equipped, maintained and operated so the emulsified asphalt material is applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 - 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

00715.22 Chip Spreaders - Provide self-propelled chip spreaders equipped with a mechanical device that will spread the aggregate at a uniform rate across the full width of the chip spreaders. Provide chip spreaders equipped with an aggregate segregator assembly. Chip spreaders without an aggregate segregator assembly may be allowed if approved by the Engineer. Provide chip spreaders of adequate width to provide full coverage of the specified panel and without placing joints in the travel lanes.

00715.23 Compactors - Provide self-propelled, pneumatic-tired or steel-wheeled rollers in good condition and capable of operating at speeds compatible with the multiple application emulsified asphalt surface treatment operation. A minimum of two pneumatic-tired rollers and one steel-wheeled roller is required.

(a) Pneumatic-tired Rollers - Provide self-propelled, tandem or multiple axle, multiple wheel type pneumatic-tired rollers with smooth-tread pneumatic tires of equal size. The tires shall be staggered on the axles at such spacings and overlaps that will provide uniform compacting pressure for the full compacting width of the roller. The minimum load per tire shall be 2,800 pounds, with tire inflation pressures of 45 psi to 90 psi.

(b) Steel-wheeled Rollers - Provide steel-wheeled rollers with a gross static weight of at least 8 tons.

00715.24 Power Brooms - Provide pickup or nonpickupnon-pickup type power brooms equipped with a positive means to control vertical pressure.

Labor

00715.30 Quality Control Personnel - Provide a certified technician in the following field:having a CAgT technical certification.

- CAgT

Construction

00715.40 Season and Weather Limitations - Do not apply emulsified asphalt when the pavement temperature is below 70 °F, or if the humidity is higher than 75%. percent. Complete the application of the emulsified asphalt and the aggregate three3 hours before sunset. Remove by milling, or other methods approved by the Engineer, and replace all surface treatments damaged by weather during the first 24 hours after application at no additional cost to the Agency. The placing of multiple application emulsified asphalt surface treatments will not be allowed before July 1 or after August 31.

00715.41 Preparation of Underlying Surfaces - Prepare underlying surfaces according to the following:

(a) Asphalt Surfaces - Immediately before applying the emulsified asphalt, clean and dry the surface to be sealed and trim the shoulders in a manner approved by the Engineer.

(b) Aggregate Surfaces - Bring aggregate bases and other bases or foundations, when constructed under the Contract, to the completed and finished condition according to the applicable Specifications.

Bring old bases and foundations, constructed by others, to the applicable condition according to Section 00610, and within 1/2 inch of established grade and cross section.

00715.42 Sequence of Operations and Application Rates - Construct the number of spreads, the size of aggregates, and the application rates for both emulsified asphalt and aggregates for the multiple application emulsified asphalt surface treatment design specified according to Table 00715-1. Vary the rates of spread as directed during the progress of the work to produce the best results. Surface treatment is not required for guardrail flares, driveways, or other irregular areas as directed.

Table 00715-1
Multiple Surface Treatment Design

Spreading Order and Rates of Spread*	Fine Double Chip Seal	Medium Double Chip Seal	Type E-9 Oil Mat	Type E-11 Oil Mat
First Course				
Emulsified Asphalt	0.20	0.25	0.30	0.30
1" - 1/2" Aggregate	–	–	–	0.015
3/4" - 1/2" Aggregate	–	–	0.014	–
1/2" - 1/4" Aggregate	–	0.010	–	–
3/8" - No. 8 Aggregate	0.008	–	–	–
Second Course				
Emulsified Asphalt	0.30	0.30	0.35	0.35
1" - 1/2" Aggregate	–	–	–	0.015
1/2" - 1/4" Aggregate	–	–	0.010	–
3/8" - No.8 Aggregate	0.006	0.007	0.002	0.002
Third Course				
Emulsified Asphalt	–	–	0.30	0.35
1/2" - 1/4" Aggregate	–	–	–	0.010
3/8" - No. 8 Aggregate	–	–	0.007	0.003
Fourth Course				
Emulsified Asphalt	–	–	–	0.30
3/8" - No. 8 Aggregate	–	–	–	0.007
Total Quantities				
Emulsified Asphalt	0.50	0.55	0.95	1.30
Aggregates	0.014	0.017	0.033	0.052

* The rates of spread are in the following units:
Emulsified Asphalt - gallons per square yard
Aggregates - cubic yards per square yard

(a) Type E-9 and E-11 Oil Mats - Use one of the following procedures as mutually agreed to by the Engineer and Contractor for Type E-9 and E-11 oil mats:

- Complete first and second course (and third course for Type E-11) of the oil mat throughout the entire section (including the dry key) to which the oil mat is to be applied. Square up these courses ~~three~~3 hours prior to sunset each day.

  Prior to applying third course (fourth course for Type E-11), lightly broom any loose aggregates from surface. Apply third or fourth course (seal coat) throughout entire section. Square up the courses ~~three~~3 hours prior to sunset each day.
- Square up first and second course (and third course for Type E-11) of the oil mat ~~three~~3 hours prior to sunset.
- The following day, prior to applying third course (fourth course for Type E-11), lightly broom any loose aggregates from surface. Place the third or fourth course (seal coat) of the oil mat and square up ~~three~~3 hours prior to sunset.
- Complete all courses the same day. Square up all courses ~~three~~3 hours prior to sunset.

(b) Taper at Project Ends - Stop succeeding courses of each surface treatment 16 feet beyond the preceding course, or as directed by the Engineer, at Project ends to provide a smooth transition to the existing pavement.

00715.43 Applying Emulsified Asphalt - Apply emulsified asphalt at the rates specified in 00715.42 and according to the following:

- Apply emulsified asphalt, working toward the aggregate stockpile at all times, unless otherwise approved by the Engineer.
- Leave a minimum of 200 gallons of emulsified asphalt in the distributor tank at all times.
- Do not apply emulsified asphalt to more than one-half the width of the travel way at one time with the remaining width remaining open to traffic. Do not close the open lane until traffic controlled by pilot car is operating on the new surface treatment. Apply the surface treatment, weather permitting, to both sides of the travel way so that the end of the work is squared up ~~three~~ 3 hours before sunset.
- Do not apply emulsified asphalt a greater distance than can be immediately covered by aggregates before the emulsion breaks.
- Place building paper over the treated surface at the beginning of each spread to ensure that the nozzles are operating properly before the uncovered surface is reached. Remove and dispose of building paper in a manner satisfactory to the Engineer.
- If requested by the Engineer, demonstrate that the distribution of the emulsified asphalt does not vary between the individual nozzles by more than 15~~%~~ percent transversely from the average, and no more than 10~~%~~ percent longitudinally from the specified rate of application.
- Apply the emulsified asphalt at a temperature between 140 °F and 185 °F as recommended by the manufacturer.

00715.44 Hauling and Spreading Aggregates - Spread aggregates at the rates specified in 00715.42.

Do not operate hauling and spreading equipment on uncovered emulsified asphalt. During the first hour after application of the emulsified asphalt and aggregate, operate at speeds no more than 10 mph and after the first hour, not more than 15 mph until otherwise allowed by the Engineer. Carefully operate hauling equipment at all times, at moderate speeds that will not damage the new surface treatment or create a hazard to the traveling public. Route hauling equipment and pilot lines as uniformly as possible over the full width of the new surface in place.

Calibrate the gate opening, gear selection and engine RPM of the chip spreaders for the various sizes of aggregate to be used. Following calibration, verify the rate of application by a method acceptable to the Engineer.

Immediately cover the emulsified asphalt surface with aggregate unless otherwise authorized by the Engineer. Maintain the rate of spread of this aggregate within 10~~%~~ percent of specified rate. Using approved methods, remove or repair emulsified asphalt that has set or "broke" before being covered with aggregate, at no additional cost to the Agency.

Aggregates shall be surface damp at the time of application. Excess free water (water not adhering to the aggregate surface) on the aggregate will not be allowed.

Do not operate the chip spreader at speeds which cause the chips to roll over after striking the emulsion covered surface.

Provide coverage without gaps or overlapping adjacent coverages. Do not construct longitudinal joints within the travel lanes.

Construct neat transverse cut off of aggregates and remove any excess aggregates from the surface prior to resuming operations. Stagger cut-offs of successive courses a minimum of 16 feet prior to the end of a proceeding course.

00715.45 Shaping and Compacting - After the aggregates have been placed on the emulsified asphalt and spread, remove all piles, ridges or uneven distribution to ensure against rough spots in the final surface.

Compact the surface with a minimum of four complete coverages immediately behind the chip spreader. Perform additional coverages as directed by the Engineer until the material is interlocked, firm, and partially bound with the underlying emulsified asphalt. The sequence of rollers will be as directed by the Engineer.

Operate rollers at speeds that do not damage the surface. Do not exceed rolling speeds of 5 mph. In the event aggregates begin to pick up under traffic or from the rolling operation, immediately cover and roll the area with additional quantities of aggregate.

Begin rolling at the low side of the cross section and progress with passes parallel to the roadway centerline. Overlap each preceding pass by at least one half the width of the roller.

Along curbs, walls and at all other places not accessible to specified rollers, thoroughly compact the aggregate with mechanical tampers or hand tampers. Provide hand tampers with a weight of not less than 50 pounds and a tamping face of not more than 0.7 square foot.

Correct irregularities in emulsified asphalt distribution, surface smoothness, non-uniformity of texture, segregation of materials, dirt pockets, spots of excess asphalt and other deficiencies and defects. Accomplish this by the removal, replacement, addition of material, repetition of construction operations or other suitable means, as directed or approved by the Engineer.

Maintenance

00715.60 Establishment - During periods when partial construction is open to traffic and for ~~one~~ 1 calendar week following original completion of the final course throughout the entire length of the Project, perform the following operations:

- Maintain the surface to correct bleeding of asphalt, keep the surface free of ravel, traffic grooves, holes and other deformations, and eliminate other defects that may appear.
- Roll and compact the surface to maintain or restore firmness and stability to the materials.
- Broom the surface to ensure that the surface is free of loose aggregate. Discontinue brooming if the operation damages the surface. In curbed areas, use a pick up type power broom. On bridges, sidewalks and other areas off the roadway, remove all loose aggregates to the satisfaction of the Engineer.

Perform the above operations under traffic and at frequencies which the Engineer determines as being necessary to develop and establish the course to uniform firmness and stability throughout.

Finishing and Cleaning Up

00715.70 Surface Tolerance - Provide a finished surface, after brooming, that does not vary by more than 1/2 inch either transverse or perpendicular to centerline when tested with a 12 foot straightedge. Furnish and operate the straightedge under the observation of the Engineer.

00715.71 Correction of Surface Deficiencies - Correct all deficiencies in surface tolerance in a manner acceptable to the Engineer. Perform all corrective work within 14 calendar days following notification at no additional cost to the Agency.

Measurement

00715.80 Measurement - The quantities of aggregate will be measured on the weight basis or on the volume basis in the hauling vehicle.

The quantities of emulsified asphalt will be measured on the weight basis.

The quantities of asphalt surface treatment of approaches will be measured on the unit basis for each street connection and road approach.

Payment

00715.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Aggregate in Multiple Application Emulsified Asphalt Surface Treatment	Cubic Yard or Ton
(b)	Asphalt in Multiple Application Emulsified Asphalt Surface Treatment	Ton
(c)	Extra for Multiple Application Emulsified Asphalt Surface Treatment Approaches	Each

Item (c) applies to the extra costs of placing the aggregates and asphalt in emulsified asphalt surface treatment only on street connections and road approaches. Payment will be in addition to payment made for the materials used in the work.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for preparing the road surface, placing material in final position, or blading and brooming.

Section 00730 - Emulsified Asphalt Tack Coat

Description

00730.00 Scope - This work consists of furnishing and placing emulsified asphalt on a prepared asphalt concrete, portland cement concrete, or other paved surface to ensure bond between lifts as specified.

Materials

00730.11 Emulsified Asphalt - Furnish CSS-1, CSS-1h, CMS-2, CMS-2S, CMS-2h, CRS-1, CRS-2, HFRS-2, or HFMS-2 as selected by the Contractor.

Furnish emulsified asphalt meeting the requirements of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the Project is advertised. The materials may be conditionally accepted at the source or point of loading for transport to the Project.

Excessive delay in the use of the emulsified asphalt or excessive pumping of the emulsified asphalt may significantly reduce the viscosity and may make the material unsuitable for tack coat use. For this reason limit pumping between the bulk storage tank, hauling transportation, field storage tanks and distributor to an absolute minimum to maintain proper viscosity. Final acceptance of emulsified asphalt will be at the point of application.

Dilution of the tack coat material may be allowed to a maximum 1:1 ratio. Determine the proportion of water to be added to the emulsified asphalt. Do not dilute the emulsified asphalt until the Engineer approves the dilution ratio. Add the water to the emulsified asphalt and mix according to the asphalt supplier.

Obtain samples according to AASHTO T 40 prior to dilution with water, if allowed, at the frequency indicated in the MFTP. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency. Emulsified asphalt will be tested within 30 calendar days from the date it is sampled.

Equipment

00730.22 Asphalt Distributor - Provide an asphalt distributor designed, equipped, maintained and operated so the emulsified asphalt material may be applied uniformly at even heat. The distributor shall be capable of applying the asphalt on variable surface widths up to 16 feet, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, and with uniform pressure. The variation allowed from any specified rate shall not exceed 0.02 gallons per square yard. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Provide distributors equipped with a positive power unit for the asphalt pump, and full circulation spray bars adjustable both laterally and vertically. Set the bar height for triple lap coverage.

Construction

00730.40 Temperature Limitations - Apply tack coat only when the surface temperature in the shade is not less than the appropriate minimum surface temperature according to 00735.40, 00744.40, ~~or~~and 00745.40, as applicable.

00730.41 Traffic Control - Do not apply the tack to more than one-half the width of the travel way at one time. The remaining width shall remain open to traffic. Do not close the open lane until traffic controlled by pilot car is operating on the new surface.

00730.42 Preparation of Underlying Surfaces - Immediately before applying the tack coat, the surface to be tacked shall be clean and dry. Clean all loose material by brooming, flushing with water or other approved methods.

00730.44 Applying Tack Coat - Apply the emulsified asphalt with a pressure distributor conforming to 00730.22, unless otherwise allowed. Apply the emulsified asphalt to the prepared surface at a rate between 0.05 and 0.20 gallons per square yard as directed and with the emulsified asphalt temperature between 140 °F and 185 °F as recommended by the manufacturer. Application rates for tack coat diluted according to 00730.11 will be increased as necessary to provide the same amount of residual asphalt as the application rates specified above.

Do not place hot mixed asphalt concrete pavement or emulsified asphalt concrete pavement on the tack coat until the emulsified asphalt separates from the water (breaks), but before it loses its tackiness.

Measurement

00730.80 Measurement - The quantities of emulsified asphalt cement used as tack will be measured on the weight basis.

Payment

00730.90 Payment - The accepted quantities of emulsified asphalt cement used as tack coat will be paid for at the Contract unit price, per ton, for the item "Emulsified Asphalt for Tack Coat".

Payment will be payment in full for furnishing, mixing with water, and placing the materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for water added to dilute the emulsified asphalt used as tack coat.

Section 00735 - Emulsified Asphalt Concrete Pavement

Description

00735.00 Scope - This work consists of constructing an emulsified asphalt concrete (EAC) pavement composed of aggregate and emulsified asphalt, plant mixed into a uniformly coated mixture, spread on a prepared base, covered with choke aggregate, and compacted to the lines, grades, thicknesses, and cross sections shown or established.

00735.05 Precrushing and Prepaving Conferences:

(a) Precrushing Conference - Supervisory personnel of the Contractor and any subcontractors who are to be involved in aggregate crushing of EAC aggregates shall meet with the Engineer at a mutually agreed time, to discuss methods of accomplishing all phases of the crushing work. The Crusher Supervisor and the Contractor's CAgT shall attend the meeting.

(b) Prepaving Conference - Supervisory personnel of the Contractor, including the CAT-I and any subcontractors who are to be involved in the paving work, shall meet with the Engineer at a mutually agreed time to discuss methods of accomplishing all phases of the paving work.

Materials

00735.10 Aggregates - Furnish aggregates for EAC meeting the following requirements:

(a) General - Scalp the rock material used to produce aggregates on a 3/4 inch sieve covering the entire screen deck (after it has passed through the primary crusher if quarry rock is used). The material remaining may be accepted for use by visual inspection. The Engineer may perform verification testing of the gradation. The material shall meet the following:

Sieve Size	Percent Passing (by Weight)
4"	95 - 100
3/4"	5 Max.

(b) Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12~~%~~ percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(c) Durability - Provide EAC aggregates meeting the following durability requirements:

Test	Test Method ODOT	Test Method AASHTO	Maximum Values
Abrasion		T 96	30.0%
Degradation (coarse aggregate)			
Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(d) Fractured Faces - Determine fracture of aggregates according to AASHTO ~~TP 61~~T 335. Crush aggregate to provide at least two fractured faces on 90~~%~~ percent of the material retained on a 1/4 inch sieve, and one fractured face on 75~~%~~ percent of the material retained on a No. 8 sieve.

(e) Harmful Substances - Provide EAC aggregates meeting the following harmful substances requirements:

Test	Test Method ODOT	Test Method AASHTO	Limits
Lightweight Pieces		T 113	1.0% maximum
Wood Particles	TM 225		0.1% maximum
Elongated Pieces (coarse aggregate at a ratio of 5:1)	TM 229		10.0% maximum
Cleanness Value	TM 227		75 minimum

(f) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide grading of EAC aggregate conforming to the following:

Sieve Size	Percent Passing (by Weight)	Leveling or Patching Percent Passing (by Weight)
1"	100	
3/4"	95 - 100	100
1/2"	60 - 90	95 - 100
1/4"	15 - 30	15 - 40
No. 8	0 - 7	0 - 10
No. 200	0.0 - 2.0	0.0 - 2.0
No. 200 *	0.0 - 1.0	0.0 - 1.0

* in gravels

If the aggregates are produced in two or more separate sizes, the gradation of the blended sizes shall conform to the above grading requirements.

(g) Stockpiling - Prepare the ground for the stockpile site to prevent contamination. Prevent segregation, as much as possible, when stockpiling and removing the aggregate.

00735.11 Emulsified Asphalt - Furnish CM-2, CMS-2S, or HFMS-2 emulsified asphalt meeting the requirements of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from the ODOT Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the Project is advertised. The materials may be conditionally accepted at the source or point of loading for transport to the Project. Acceptance of the selected emulsified asphalt is subject to the production of a suitable JMF.

Excessive delay in the use of the emulsified asphalt or excessive pumping of the emulsified asphalt may significantly reduce the viscosity and may make the material unsuitable for EAC use. Limit pumping between the bulk storage tank, hauling transportation, field storage tanks, and plant to an absolute minimum to maintain viscosity.

Obtain emulsified asphalt samples according to AASHTO T 40 at the frequency indicated in the MFTP. Samples will be tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency, within 30 calendar days from the day the sample was taken.

00735.13 Job Mix Formula~~ (JMF)~~ - Provide a mixture comprised of aggregate and emulsified asphalt in the proportions established in the job mix formula (JMF~~.~~). The emulsified asphalt content shall be between 5.0~~%~~ and 8.0~~%,~~ percent, by weight, of the total aggregate. Vary the proportions of materials as directed.

The CMDT shall prepare, sign and submit a JMF and samples to the Engineer for each mixture required at least 10 calendar days prior to anticipated use in EAC, and according to the latest copy of the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

Furnish representative samples of material to be used in the mixture as follows:

Material	Amount
New Coarse Aggregate	55 pounds
Emulsified Asphalt Cement	4 quarts in 1 quart plastic containers

Provide a JMF meeting the following mixture requirements:

EAC Mixture

Air Voids, %	15 - 30 according to AASHTO T 269*
IRS	Report according to ODOT TM 313*
Percent Coating	90% minimum

* AASHTO T 269 and ODOT TM 313 procedures available from ODOT Materials Laboratory.

00735.14 Choke Aggregate - Furnish choke aggregate meeting the gradation below. Perform sieve analysis according to AASHTO T 27. Use crushed or uncrushed rock free of clay, loam or other harmful substances.

Sieve Size	Percent Passing (by Weight)
3/8"	100
1/4"	90 - 100
No. 8	30 - 66
No. 30	8 - 28
No. 100	0 - 5

00735.15 Aggregate Production Quality Control - Provide quality control during production of EAC aggregate according to Section 00165. Sampling and testing shall be performed by a CAgT at the minimum frequency indicated in the MFTP.

(a) Quality Control Compliance - Evaluate EAC aggregates for conformance according to the following:

(1) Gradation - Analyze gradation statistically according to Section 00165. A stockpile contains specification aggregate when the Pay Factor (PF) for each sieve size calculated according to 00165.40 is equal to or greater than 1.00. Each required sample represents a sublot.

When the results from Table 00165-2 yield a Pay Factor of less than 1.00 for any sieve size, the material is non-specification. The Engineer will reject any stockpile of aggregate containing non-specification material unless the non-specification material is removed from the stockpile. Do not add additional material to such a stockpile until enough non-specification material is removed so that the PF for each sieve size is equal to or greater than 1.00.

(2) Other Tests - Stop production, make appropriate operational adjustments, and remove all failing material from the stockpile whenever a quality control test result, other than sieve

analysis, does not meet Specifications. Document operational adjustments made and notify the Engineer prior to resuming production.

(3) Preproduced Aggregate - Compliance of aggregates produced and stockpiled before the award of this Contract will be determined by either of the following methods:

- Continuing production records meeting the requirements of 00735.10, 00735.14, and 00735.15.
- Sampling according to AASHTO T 2 and testing the entire stockpile at the minimum frequency schedule indicated in the MFTP. The material shall meet the requirements of 00735.10, 00735.14, and 00735.15.

00735.16 Acceptance of Aggregate - The Contractors quality control tests will be used for acceptance of EAC aggregates if verified by the Agency's quality assurance program. The Agency will perform aggregate production quality assurance according to the following.

(a) ODOT Administered Projects - Quality assurance testing on ODOT administered projects will be performed according to Section 00165, the MFTP and the ODOT Quality Assurance ~~Manual~~Program.

(b) Projects Administered by Other Agencies - The quantity of quality assurance testing on projects administered by other Agencies will be at the discretion of the Agency or as designated in the Special Provisions.

00735.17 EAC Mixture Production Quality Control - Provide quality control during production of EAC mixture according to Section 00165 and the following:

(a) Personnel Requirements - Maintain quality control by:

- Providing at least one CAT-I full-time at each plant site used to furnish mixture to the Project.
- Obtaining samples under the direct supervision of a CAT-I.
- Having all testing, data analysis and reporting of test results performed by a CAT-I.

(b) Laboratory Requirements - Furnish and maintain an ODOT certified laboratory at the plant site furnished with the necessary equipment and supplies for performing Contractor quality control testing.

The laboratory shall be on-site and operational prior to the beginning of EAC production. Provide laboratory equipment meeting the requirements of the test methods identified in these Specifications.

Calibrate all testing equipment according to the required test methods. The Engineer may inspect measuring and testing devices to confirm both calibration and condition.

(c) Plant Calibration - Calibrate the plant according to ODOT TM 322. The plant calibration shall be witnessed and documented by a CAT-I. Do not begin production until calibration tests indicate that the specified proportions can be obtained.

(d) Required Tests - Randomly sample and test the aggregate and emulsified asphalt during EAC mixture production according to Section 00165 and the MFTP.

(e) Quality Control Compliance - Evaluate EAC mixture for compliance according to Section 00165 and the MFTP.

00735.18 Acceptance of EAC Mixture - The Contractor's quality control tests will be used for acceptance of EAC mixture if verified by the Agency's quality assurance program. The Agency will perform EAC mixture production quality assurance according to the following:

(a) ODOT Administered Projects - Quality assurance testing on ODOT administered projects will be performed according to Section 00165, the MFTP and the ODOT Quality Assurance ~~Manual~~Program.

(b) Projects Administered by Other Agencies - The amount of quality assurance testing on projects administered by other Agencies will be at the discretion of the Agency or as designated in the Special Provisions.

Equipment

00735.20 EAC Mixing Plant - Mix the EAC at a plant capable of providing a mix of aggregate and emulsified asphalt of uniform proportions and consistency as designated.

Provide mixing plants with the following operating equipment:

- A positive control linking the aggregate and emulsified asphalt feed so that a constant ratio of emulsified asphalt to aggregate is maintained.
- Totalizers for the emulsified asphalt metering device and the aggregate scales.
- A metering device that can determine percent of emulsified asphalt in mixture at any time the plant is in operation.
- An adjustable emulsified asphalt spray bar.
- Provide and operate a mechanical sampling device that produces a representative sample of the quantity of material required for the appropriate tests, when sampling at or around crushing, screening, mixing plants, conveyors, or other similar mechanical equipment.

Proportion the aggregate by weight. Proportion the emulsified asphalt by either weight or metering. Provide equipment capable of feeding and maintaining a constant rate of aggregate within a tolerance of plus or minus 5~~%,~~ percent, by weight, of the designated amount, and feeding a constant rate of emulsified asphalt within ~~plus or minus~~± 0.5~~%,~~ percent, by weight, of the designated amount.

00735.21 Hauling Equipment - Provide hauling vehicles in good operating condition with tight, clean, metal beds and a cover. Equip beds of hauling vehicles with a positive system to prevent materials from leaking onto the surfaces over which the hauling vehicle travels. If leakage occurs, remove any spilled material and repair any damage according to 00170.85.

Coat the beds with a minimum amount of an approved material to keep the EAC from sticking to the beds. Do not use diesel oil. Drain excess coating material before loading by raising the truck bed, opening belly dump gates, or operating the conveyor belt, as appropriate.

Do not use vehicles that cause segregation or delay operations.

00735.22 EAC Pavers - Provide EAC pavers meeting the following requirements:

(a) Power and Support - Self-contained, self-propelled, supported on tracks or wheels, none of which contact the mixture being placed.

(b) Augers and Screed - Equipped with augers and a screed or strike-off assembly, heated if necessary, which:

- Can spread and finish EAC to a uniform texture, in the specified widths, thicknesses, lines, grades, and cross sections.
- Will not segregate, tear, shove, or gouge EAC.
- Produce a finished surface to specified evenness and texture.

(c) Control System - Equipped with a paver control system which:

- Controls EAC placement to specified slope and grade.
- Maintains the paver screed in proper position.
- Provides specified results through mechanical sensors and sensor-directed devices actuated from independent line and grade control references.

00735.23 Compactors - Provide self-propelled, steel-wheeled and pneumatic-tired rollers capable of reversing without backlash according to the following:

(a) Steel-Wheeled Rollers - Provide steel-wheeled rollers with:

- A gross static weight of at least 8 tons.
- A gross static weight of at least 6 tons for finish rolling.

(b) Pneumatic-tired Rollers - Provide pneumatic-tired rollers meeting the following:

- Be tandem, or multiple axle, multiple wheel type.
- Have smooth-tread, pneumatic tires of equal size.
- Have tires staggered on the axles, spaced and overlapped to provide uniform compacting pressure for the full compacting width.
- Have a minimum load of 2,800 pounds per tire with tire inflation pressures of 45 psi to 90 psi.

00735.24 Chip Spreaders - Provide self-propelled chip spreaders equipped with a mechanical device that will spread the aggregate at a uniform rate across the full width of the chip spreaders. Provide chip spreaders of adequate width to provide full coverage of the specified panel.

00735.25 Power Brooms - Provide pickup and/or ~~nonpickup~~non-pickup power brooms that have a positive means to control vertical pressure.

00735.26 Release Agents - Do not use diesel oil as a release agent to coat or clean equipment at the mixing plant, or on hauling equipment beds or compactors.

Labor

00735.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CAgT, CAT-I, and CMDT technical certifications.

~~• CAgT~~
~~• CAT-I~~
~~• CMDT~~

Construction

00735.40 Season and Weather Limitations - Place EAC from May 1 to August 31, inclusive, when the pavement temperature is 60 °F or above. Seasonal limitations for EAC will not supersede seasonal limitations for emulsified asphalt surface treatments on the Project.

Do not place EAC:

- When the underlying layer is frozen.
- During rain or other adverse weather conditions.

Correct mixtures damaged by weather by milling and replacement or other approved methods at no additional cost to the Agency.

00735.41 Rate of Progress and Scheduling - Do not begin work until there is enough mixing, hauling, spreading and compacting equipment on the Project to assure that the paving machine can place the EAC without stopping, as nearly as possible.

00735.42 Preparation of Underlying Surfaces - Clean all deleterious material, dirt and dust from existing and new bases, surfacings, and pavements in a manner acceptable to the Engineer.

Bring the existing surface to uniformity by patching irregular or depressed surfaces and potholes with EAC thoroughly compacted until it conforms with the surrounding surface. Prepare individual potholes for patching by cutting the edges vertically to the depth of the deepest portion of the hole.

When designated in the plans or Special Provisions, place leveling courses of EAC on existing pavements before constructing the final paving course. Perform the leveling work to the lines and grades established. Place leveling material with either a paving machine or motor grader as directed.

Apply a tack coat to the existing surface according to Section 00730 prior to placing EAC.

00735.43 Mixing:

(a) General - Mix the aggregate and emulsified asphalt until a uniform consistency is obtained. Use the temperature of the emulsified asphalt cement recommended by the supplier.

(b) Moisture - At the time it is mixed with the emulsified asphalt, provide aggregate with a moisture content adequate to allow distribution of the emulsion, but not so great that moisture or emulsion runs from the mixture. Provide special processing necessary to attain an acceptable moisture content at no additional cost to the Agency.

(1) No Moisture Problem - A visual moisture content determination by the Engineer will suffice when there are no apparent moisture problems.

(2) Moisture Problems - If there are unresolved moisture problems, the maximum allowable moisture shall be the saturated surface dry (SSD) moisture content for the aggregate submitted for the JMF, as determined by AASHTO T 84 and AASHTO T 85.

00735.44 Control of Grade - Use a floating beam device of adequate length and sensitivity on either or both sides of the paver to provide adequate reference to control the grade of the paver.

Where this method is impractical, manual control of grade for the paver will be allowed when approved.

00735.45 Hauling, Depositing, and Placing:

(a) Hauling - Deliver the mixture to the paving machine at a rate that provides continuous operation of the paving machine, except for unavoidable delay or breakdown. If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the Contractor matches the delivery rate of mixture with the capacity of the paving machine.

If rain or cold weather conditions are encountered any time between loading and placement:

- Suspend mixing operations.
- Cover the mixture in transit.
- Do not place mixture that is in transit until conditions improve, unless placed at Contractor's risk according to 00735.40.
- Take action to prevent emulsion run-off from entering drainage channels or facilities.

The EAC will be rejected before placing if it is found to be:

- Segregating or separating.
- Solidifying or crusting.

Work with the Engineer to make appropriate adjustments if an excessive amount of emulsified asphalt is leaking from trucks.

No more EAC will be accepted until corrective action has been taken.

Dispose of rejected loads at no additional cost to the Agency.

(b) Depositing - Deposit the EAC material in windrows from the hauling vehicles so segregation is prevented. Alternate methods of depositing may be used if specified in the Special Provisions or allowed by the Engineer.

Provide pick-up equipment that can:

- Pick up substantially all of the material deposited on the roadway.
- Be self-supporting, not exert any vertical load on the paving machine, or cause vibrations or other motions which could have a detrimental effect on the riding quality of the completed pavement.

(c) Placing - Place the EAC on dry, prepared surfaces with pavers meeting the requirements of 00735.22. Spread and finish to established widths, thickness, line, grade and cross section.

When approved, the EAC may be spread with other equipment and means where irregularities or obstacles make the use of specified equipment impractical.

00735.46 Compaction - Compact the EAC as follows:

(a) General - After the EAC has been spread, struck off, and surface irregularities or other defects remedied roll it uniformly until compacted as specified.

(b) Rolling - Compact the EAC with rollers conforming to 00735.23. Provide sufficient rollers of type and weight to compact the mixture while it is in a workable condition. Operate rollers at a uniform speed not more than 3 mph, with the drive roll or wheels nearest the paver.

Begin rolling at the sides and proceed longitudinally, parallel to the road centerline, and gradually progressing towards the center, unless otherwise directed. On superelevated curves, begin rolling at the low side and progress to the high side. When paving in echelon, or when abutting a previously paved lane, roll the longitudinal joint first, followed by the regular rolling pattern.

Do not make sharp turns or park rollers on the EAC. Stop each pass at least 5 feet longitudinally from preceding stops. Do not displace the line and grade of edges. Prevent the EAC from sticking to the wheels and spotting or defacing the EAC by wetting them with a minimum of water or other approved material.

(1) Breakdown Rolling - Use ~~nonvibratory~~non-vibratory, three-wheel steel, or tandem-wheeled-steel rollers. Make at least three complete roller coverages.

(2) Intermediate Rolling - Use a self-propelled, pneumatic-tired roller following the placement of choke aggregate according to 00735.47. Make at least two complete roller coverages with the pneumatic-tired roller immediately following application of choke aggregate.

(3) Finish Rolling - Use ~~nonvibratory~~non-vibratory, tandem-wheeled steel rollers, and continue until roller marks are eliminated.

Compact areas inaccessible to rollers with mechanical tampers as directed.

00735.47 Choke Aggregate - Provide at least two choke aggregate trucks. After breakdown compaction and before intermediate compaction, place choke aggregate with a chip spreader capable of obtaining a rate between 0.003 to 0.006 cubic yard per square yard.

If aggregate ravels or picks from the fresh EAC pavement during rolling operations or after opening to traffic, cover immediately with additional choke aggregate and roll with a tandem-wheeled steel roller, unless otherwise directed.

Be prepared to place additional choke aggregate for a period of 48 hours after the fresh EAC pavement is open to traffic. Spread excess aggregate uniformly across the fresh EAC pavement by brooming or other suitable means.

00735.48 Longitudinal Joints - Bond, compact and finish the new EAC at longitudinal joints equal to the EAC against which it is placed.

(a) Location - Place EAC in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.

(1) Base Course - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

(2) Wearing Course - Do not construct longitudinal joints in the wearing course within the area or width of a traffic lane. On median lanes and on shoulder areas, construct joints only at lane lines or at points of change in the transverse slopes, as shown or as directed.

(b) Drop-offs:

- Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.
- Protect edges from being broken down.

- If unable to complete the pavement without drop-offs according to 00735.48(c):
  - Construct and maintain a wedge of EAC at a slope of 1V:10H or flatter along the exposed longitudinal joint.
  - Remove and dispose of the wedge before continuing paving operations.
  - Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. EAC for the temporary wedge will be paid for at the pay item price.

(c) Placing EAC Under Traffic - When placing EAC pavement under traffic, schedule work for the nominal thickness being laid as follows or as required by the Special Provisions:

(1) More Than 2 inches - Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.

(2) More Than 1 inch But Not More Than 2 inches - Schedule work so at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each workweek complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.

00735.49 Transverse Joints - Construct transverse joints according to the following:

(a) Travel Lanes - Construct transverse joints on the travel lane portion of all specified pavement courses, except leveling courses, as follows:

(1) Project Ends - Construct transverse joints at Project ends as shown or as directed.

(2) Temporary End Panel - Maintain pavement depth, line and grade at least 5 feet beyond the selected transverse joint location, and from that point wedge down on the appropriate slope until it meets the surface beneath the EAC, assuming a pavement course thickness of 2 inches, as follows:

- For wedges that will be under traffic for less than 24 hours, the wedge length shall be 8 feet (1V:50H taper rate).
- For wedges that will be under traffic for 24 hours or longer, the wedge length shall be 25 feet (1V:160H taper rate).

When the pavement course thickness is different than the above 2 inch example, use the appropriate taper rate to compute the length of the wedge. The wedge length plus the 5 feet or longer panel form the "temporary end panel".

(3) Vertical Face - After the mixture has reached the required density:

- Provide a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting or other approved methods.
- Remove EAC material from the joint to the end of the panel. If removed before resuming paving beyond the joint, reconstruct the temporary end panel immediately by placing a bond-breaker of paper, dust or other suitable material against the vertical face and on the surface to be occupied by the temporary end panel. Construct a full-depth panel at least 5 feet long, beginning at the sawed or cut joint, and taper it according to 00735.49(a-2) to zero thickness.

(4) Excess EAC - After completing a temporary end panel as specified, dispose of the unused remainder of EAC as directed. Payment will be made for the entire load of EAC, but will be limited to one load only per joint per panel.

(5) Resume Paving - When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.

(6) Joint Requirements - Compact both sides of the joint to specified density. When tested with a straightedge placed across the joint, provide a joint surface meeting specified surface tolerances.

(b) Abutting Bridge Ends - Compact the EAC abutting bridge ends, and other rigid type structures, in the transverse and/or diagonal direction, as well as longitudinally, as directed.

Maintenance

00735.60 Correction of Defects - Correct all defects in material and work, as directed, at no additional cost to the Agency. Defects include segregation of materials, ~~nonuniform~~non-uniform texture and fouled surfaces preventing full bond between successive spreads of mixture. No adjustment in Contract time will be made for corrective work.

(a) Slicks - Remove and replace slicks immediately with suitable materials.

(b) Roller Damage Surface Repair - Correct all displacements of any course at once, with rakes and addition of fresh mixture when required, regardless of thickness.

(c) Other Defects - Remove, replace with fresh EAC, and compact to conform to the surrounding area all EAC that:

- Is loose, broken or mixed with dirt.
- Shows visually too much or too little asphalt.
- Is defective in any way.

If a seal coat is required by the Special Provisions, or if directed, remove and replace the EAC that contains defects, excesses, or deficiencies prior to placing the seal coat at no additional cost to the Agency.

00735.61 Brooming - Remove loose choke aggregate by carefully brooming the entire surface. Do this as directed by the Engineer, unless brooming damages the new EAC pavement.

Subsequent brooming the following ~~two~~2 days may be directed by the Engineer to ensure that the surface is free of loose aggregate that could cause vehicle damage.

In curbed areas, use a pick up type power broom. On bridges, sidewalks and other areas off the roadway, remove all loose aggregates to the satisfaction of the Engineer.

00735.62 Curing - After each lift of EAC has been placed, allow the EAC to cure a minimum of 72 hours after laydown or as directed, before placing the next lift of EAC.

Finishing and Cleaning Up

00735.70 Pavement Smoothness - Furnish a 12 foot straightedge and/or a 12 foot rolling straightedge and test as specified. Additional testing may be required. Mark areas not meeting the surface tolerance.

Perform pavement smoothness testing immediately after initial brooming of choke aggregate.

(a) Single Course Construction - Test with the 12 foot straightedge parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch.

(b) Multiple Course Construction - Test the surface of the course on which the wearing course is placed according to 00735.70(a).

Test the wearing course of EAC with the rolling straightedge in the designated wheel path of a 0.1 mile strip of each travel lane per mile, where directed, and on each transverse joint throughout the Project. Operate the rolling straightedge parallel to the centerline. The surface shall not vary more than 0.015 foot.

Also test the wearing course of EAC with a 12 foot straightedge placed perpendicular to the centerline at least once within the above-mentioned 0.1 mile strip. It shall not vary by more than 1/4 inch.

If the 0.1 mile testing strip meets the Specifications, no further testing of the mile represented by the testing strip will be required, except at the transverse joints. If any part of the testing strip does not meet the Specifications, both wheel paths of the entire mile shall be tested.

00735.71 Correction of Pavement Roughness - Correct equipment or paving operation immediately when tests show the pavement smoothness is not meeting the tolerance in 00735.70.

Correct the surface roughness to the required tolerances by a means acceptable to the Engineer.

Complete correction of all surface roughness within 14 calendar days following notification unless otherwise directed at no additional cost to the Agency.

00735.72 Fog Coat - After the EAC has cured at least 14 calendar days, apply a fog coat to the EAC surface according to Section 00705. Place the fog coat at least ~~one~~ 1 day prior to placing a single or multiple application surface treatment if a surface treatment is required by the Special Provisions.

00735.73 Emulsified Asphalt Surface Treatment - After the EAC has been placed and has cured at least 14 calendar days, apply a single or multiple application emulsified asphalt surface treatment according to Section 00710 or Section 00715 if required by the Special Provisions.

Measurement

00735.80 Measurement - The quantities of EAC will be measured on the weight basis. No deduction will be made for the weight of the emulsified asphalt used in the EAC.

The quantities of emulsified asphalt in the EAC will be measured on the weight basis.

The quantities of choke aggregate will be measured on the weight basis, or on the volume basis in the hauling vehicle.

Payment

00735.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Emulsified Asphalt Concrete Mixture	Ton
(b)	Emulsified Asphalt in Mixture	Ton
(c)	Choke Aggregate	Ton or Cubic Yard
(d)	Emulsified Asphalt Concrete in Leveling and/or Patching	Ton
(e)	Haul and Place Emulsified Asphalt Concrete Mixture	Ton
(f)	Haul and Place Choke Aggregate	Ton

Item (d) applies when EAC is used in leveling, patching, or leveling and patching.

Item (e) applies to EAC that is furnished by the Agency and hauled and placed by the Contractor.

Item (f) applies to choke aggregate that is furnished by the Agency and hauled and placed by the Contractor.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for water used in brooming operations.

Section ~~00744 - Minor Hot Mixed~~00740 - Commercial Asphalt Concrete ~~(MHMAC)~~ Pavement (CACP)

Description

~~00744~~00740.00 **Scope** - This work consists of ~~constructing minor hot mixed~~furnishing and placing commercial asphalt concrete ~~(MHMAC)~~ pavement (CACP) to the lines, grades, thicknesses, and cross sections shown or established~~.~~,

~~00744~~Materials

00740.10 Materials - Furnish CACP that is a well-graded, uniform, durable commercial mix. All new materials, or a combination of new materials and reclaimed materials, may be used. If requested, provide a copy of the JMF to the Engineer before paving.

00740.12 Asphalt Cement - Use PG 64-22 or PG 64-28 unless otherwise specified in the Contract Documents or approved. Provide asphalt cement conforming to the requirement of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from ODOT's website. The applicable specifications are those contained in the current publication on the date the Project is advertised.

00740.13 Tack Coat - Furnish tack meeting the requirements of Section 00730.

00740.14 Acceptance - All material will be accepted by visual inspection by the Engineer.

Construction

00740.44 Placing Asphalt Concrete - Place asphalt concrete structures of uniform width by either mechanical extrusion methods or between suitable forms, as the Contractor elects. Other structures may be constructed without the use of forms unless otherwise directed. The Engineer may allow small or special pavers, spreader boxes, or blade graders for placing asphalt concrete. The Engineer may allow mixture to be placed by hand methods.

00740.45 Compacting Asphalt Concrete - Compaction of the asphalt concrete to a specified density will not be required, regardless of thickness. Perform breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the rollers. Perform additional coverages, as directed, to obtain finish rolling of the CACP.

Along curbs and walls, on walks, irregular areas, and other areas not practically accessible to rollers, compact the mixture with small, self-propelled rollers, mechanical tampers, hot hand tampers, or hand rollers. On depressed areas a trench roller may be used, or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Measurement

00740.80 Measurement - The quantities of commercial asphalt concrete pavement will be measured on the weight basis.

Payment

00740.90 Payment - The accepted quantities of commercial asphalt concrete pavement will be paid for at the Contract unit price, per ton, for the item "Commercial Asphalt Concrete Pavement".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for reclaimed asphalt pavement, reclaimed asphalt shingles, and asphalt cement.

Section 00743 - Porous Asphalt Concrete (PAC)

Description

00743.00 Scope - This work consists of constructing one or more courses of porous asphalt concrete (PAC) pavement for drainage or storm water infiltration, plant mixed into a uniformly coated mixture, placed on a prepared foundation, compacted and finished to a specified smoothness to the lines, grades, thickness, and cross sections shown or established.

00743.01 Abbreviations:

PAC - Porous Asphalt Concrete

TSR - Tensile Strength Ratio

VFA - Voids Filled with Asphalt

VMA - Voids in Mineral Aggregate

00744.02 Definitions:

Minor Hot MixedPorous Asphalt Concrete (MHMAC) - A hot plant mixed, uniformly coated mixture of asphalt cement, open graded aggregate and additives as required.

Level 1 MHMAC - MHMAC for use in applications with very low traffic and only limited exposure to trucks.

Level 2 MHMAC - MHMAC for use in applications with low traffic volumes and low volume truck traffic.

Level 3 MHMAC - MHMAC for use in applications exposed to moderate truck traffic.

00744.03 Reclaimed Asphalt Pavement (RAP) Material - Reclaimed HMAC pavement (RAP) material used in the production of new MHMAC is optional. No more than 30% RAP material will be allowed in the new MHMAC pavement.
Asphalt Treated Permeable Base - A plant mixed, uniformly coated mixture of asphalt cement, open graded aggregate and additives as required. All references to PAC will also apply to ATPB unless otherwise specified.

Wearing Course - The top lift of PAC, regardless of thickness.

Materials

00744.10 Aggregate - Furnish coarse, fine, and RAPFurnish new aggregates for MHMAC meeting the following requirements:

Testing of aggregates for soundness, durability, and harmful substances will be at the discretion and expense of the Agency.

(a(a) New Coarse and Fine Aggregates - Produce and stockpile coarse and fine aggregate from crushed rock or other inert material of similar characteristics.

No natural or uncrushed blend sand will be allowed in PAC.

(1) Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12% percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(b2) Durability - Provide aggregate not exceeding the following maximum values:

Test	Test Method ODOT	Test Method AASHTO	Aggregates Coarse
Abrasion		T 96	30.0%
Degradation			
Passing No. 20 sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(c(3) Fractured Faces - Provide crushed aggregate with not less than the minimum number of fractured faces as determined by AASHTO TP 61T 355 as follows:

Percent of Fracture (by Weight)

Type of Mix	Material Retained 1 1/2", 1", 3/4", 1/2"", and No. 4 Sieve (two fractured faces)	Material Retained on No. 8 sieve (one fractured face)
All Dense Graded MHMAC	ATPB	75 75
(d PAC	90	75

(4) Harmful Substancessubstances - Do not exceed the following maximum values:

Test	Test Method ODOT	Test Method AASHTO	Aggregates Coarse	Aggregates Fine
Lightweight pieces		T 113	1.0%	
Wood Particles	TM 225		0.10%	
Elongated Pieces (at a ratio of 5:1)	TM 229		10.0%	
Plasticity Index		T 90		0 or NP
Sand Equivalent		T176T 176		45 min.

(e) (b) Reclaimed Asphalt Pavement - Reclaimed asphalt pavement (RAP) material used in the production of new PAC is optional. No more than 30 percent RAP material will be allowed in the new PAC pavement. Use RAP aggregates in the PAC that are no larger than the specified maximum allowable aggregate size before entering the cold feed. Blend the RAP material with new aggregate to provide a mixture conforming to the JMF within the tolerances specified.

00743.11 Asphalt Cement, Additives, and Aggregate Treatment - Furnish the following asphalt cement and additives:

(a) Asphalt Cement - Use the grade of asphalt that is specified in the Contract Documents. A polymer modified asphalt cement is required in the wearing course. Provide asphalt cement conforming to the requirement of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available on ODOT's website. The applicable specifications are those contained in the current publication on the date the project is advertised.

(b) Asphalt Cement Additives - Use standard recognized asphalt cement additive products that are of known value for the intended purpose and approved for use on the basis of laboratory tests and capable of being thoroughly mixed. Do not use asphalt cement additives that have deleterious effects on the asphalt material. Do not use silicones as an additive. Add the following asphalt cement additives when required by the JMF:

- Anti-stripping asphalt cement additives to prevent stripping or separation of asphalt coatings from aggregates to satisfy the TSR specified in 00743.13.
- Asphalt cement admixtures used to aid in the mixing.

00743.12 Mix Type and Broadband Limits - Furnish the mix type specified in the Contract Documents within the broadband limits according to the following:

(a) Mix Type - Furnish the types of PAC shown or as directed.

(b) Broadband Limits - Provide a JMF for the specified mix type within the control points listed below:

Sieve Size	3/8" PAC Control Points (% passing by Weight)		1/2" PAC Control Points (% passing by Weight)		3/4" ATPB Control Points (% passing by Weight)	
	Min.	Max.	Min.	Max.	Min.	Max.
1"					99	100
3/4"			99	100	85	95
1/2"	99	100	90	98	35	68
3/8"	90	100	–	–	–	–
No. 4	22	40	18	32	2	10
No. 8	5	15	3	15	0	5
No. 200	1.0	5.0	1.0	5.0	0.0	2.0
Asphalt Cement	*	*	*	*	2.5	3.5

* Per JMF

00743.13 Job Mix Formula Requirements - Do not begin production of PAC for use on the project until the JMF is reviewed by the Engineer and written consent is provided to proceed. The JMF proposed for use on the project will be evaluated based on the criteria identified in 00743.13(b) and the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete. For all mixes, complete TSR testing at least once per calendar year. A new JMF is required if the asphalt cement grade or source, any additives, or the source of the aggregate change during production.

(a) Contractor Provided Job Mix Formula - Have a CMDT prepare, sign, and submit a JMF to the Engineer for each mixture required at least 10 calendar days before the anticipated use in PAC, and according to the latest copy of the ODOT Contractor Mix Design Guidelines for Asphalt Concrete. If requested, submit material samples 10 calendar days before use.

(b) Job Mix Formula Requirements - Provide a JMF meeting the following mixture requirements:

	3/8" and 1/2" PAC	3/4" ATPB
Design Method	ODOT	ODOT

Air Voids, %	16.0 - 20.0	–
Draindown, %	70 - 80	–
TSR *, % minimum	80	–
Coating, % minimum	–	90
VFA, %	30 - 50	–

* Run the TSR for open graded mixtures on a surrogate dense graded mixture. If a dense graded JMF has been prepared for the same material sources in the last year, the results for the most recent TSR may be applied to the porous asphalt mixture. If not, prepare the TSR test samples for a dense graded mix using the equivalent top size stone and materials from the same sources, which will represent the porous asphalt mixture.

00743.14 Tolerances and Limits - Produce and place PAC within the following JMF tolerances and limits:

Gradation Constituent	PAC Type 1/2"	3/8"	ATPB
1"			99 - 100%
3/4"	99 - 100%		85 - 95%
1/2"	90 - 98%	99-100%	35 - 68%
3/8"	=	90-100%	=
No. 4	JMF ± 5%	JMF ± 5%	JMF ± 5%
No. 8	JMF ± 4%	JMF ± 4%	JMF ± 4%
No. 30	JMF ± 4%	JMF ± 4%	=
No. 200	JMF ± 2.0%	JMF ± 2.0%	JMF ± 2.0%

Constituent of Mixture	PAC All Types
Asphalt Cement - ODOT TM 321 (Cold Feed/Meter)	JMF ± 0.20%
Asphalt Cement - AASHTO T 308 (Ignition) and ODOT TM 323	JMF ± 0.50%
RAP Content - ODOT TM 321	JMF ± 2.0%
Moisture content at time of discharge from the mixing plant - AASHTO T 329*	1.10% max.

* Does not apply to 3/4" ATPB

When a JMF tolerance applies to a constituent, full tolerance will be given even if it exceeds the control points established in 00743.12(b).

00743.16 Sampling and Testing - For each 1,000 tons of placement, have a CAT-1 perform a minimum of one of each of the following test methods as modified in the MFTP:

- Asphalt Content:
  - Mixes with RAP - AASHTO T 308 with ODOT TM 323 determined Calibration Factor
  - Mixes without RAP - AASHTO T 308 with ODOT TM 323 determined Calibration Factor or ODOT TM 321
- Gradation:

- Mixes with RAP - AASHTO T 30
- Mixes without RAP - AASHTO T 30 or AASHTO T 27/11

- Mix Moisture - AASHTO T 329

When less than 1,000 tons of mix is placed in a day, perform a minimum of one series of tests per day. Provide test results to the Engineer by the middle of the following work shift.

If less than three samples are obtained on a project, the Contractor may supplement test results with the Engineer's approval by:

- Accelerating testing.
- Provide test results from other projects with the same JMF within the past 120 days of first date of JMF production.
- Test back up samples.

Provide a minimum of three test results. Provide samples or split samples to the Engineer when requested.

00743.17 Acceptance - If the average for each mix gradation constituent and asphalt content is within the specification limits, the material will be accepted. If the average asphalt content or one or more gradation constituents is not within the specification limits, the material will be accepted according to 00150.25.

Equipment

00743.20 Pavers - Provide pavers specifically designed to spread and finish asphalt concrete pavement to a uniform texture in the widths, thicknesses, lines, grades, and cross-sections specified. When approved, alternate equipment may be used for areas where the use of a paver is impractical.

00743.21 Compactors - Provide self-propelled steel-wheeled rollers specifically designed to compact asphalt concrete pavement and capable of reversing without backlash. Provide a sufficient number of appropriately weighted rollers to compact the mixture.

Labor

00743.30 Quality Control Personnel - Provide technicians having CAT-I, CMDT, and CAgT technical certifications.

Construction

00743.40 Season and Temperature Limitations - Place PAC when the temperature of the surface that is to be paved is not less than 50 °F.

00743.41 Prepaving Conference - Have a prepaving conference with all Contractor Supervisory personnel, all subcontractors who are to be involved in the paving work, and the Engineer. Meet at a mutually agreed time to discuss all methods of accomplishing all phases of the paving work.

00743.42 Preparation of Underlying Surfaces - All bases and foundations on which the pavement is to be constructed shall meet the applicable Specifications and be approved before beginning paving operations. Recondition existing bases and foundations according to Section 00610. Trim broken or ragged edges to firm material when directed.

The pavement surface shall be dry before the preparation work and paving.

00743.43 Mixing and Placement Temperatures - Establish the allowable mixing and placement temperature ranges by the JMF. Measure the mixture temperature at the discharge of the mixer. Measure the placement temperature behind the paver. The maximum mixture temperature of the PAC at the mixer is 350 °F. The minimum placement temperature of the PAC behind the paver is 205 °F

00743.44 Hauling, Depositing, and Placing - Haul, deposit, and place PAC according to the following:

(a) Hauling - Cover PAC if rain or cold air temperatures are encountered any time between loading and placement.

If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the mixture delivery rate matches the paving machine operation.

(b) Depositing - Deposit PAC from the hauling vehicles so segregation is prevented.

(c) Placing - Place the mixture in the number of lifts and courses, and to the compacted thickness for each lift and course, as shown. Place each course in one lift unless otherwise specified. Do not exceed a compacted thickness of 4 inches for any lift unless approved. Limit the minimum lift thickness to twice the maximum aggregate size in the mix.

Uncompacted mixture behind the paver with temperatures below the minimum specified in 00743.43 will be rejected unless otherwise allowed by the Engineer.

Do not place PAC during rain or other adverse weather conditions, unless allowed by the Engineer. PAC in transit at the time adverse conditions occur may be placed if:

- It has been covered during transit.
- The PAC temperature is satisfactory.
- It is placed on a foundation free from pools or flow of water.

00743.45 Longitudinal Joints - At longitudinal joints, bond, compact and finish the PAC equal to the Pavement against which it is placed.

(a) Location - Place the PAC in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.

(1) Base Course - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

(2) Wearing Course - Do not construct longitudinal joints within the width of a traffic lane. Construct longitudinal joints at either skip lines or fog lines unless approved. On median lanes and on shoulder areas construct longitudinal joints only at lane lines or at points of change in the transverse slopes, as shown or as directed.

(b) Drop-offs:

- Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.
- Protect edges from being broken down.

00743.49 Compaction - After the PAC has been spread, struck off, and surface irregularities and other defects remedied, roll it uniformly until compacted. Compaction of PAC to a specified density will not be required. Continue the breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the rollers. Perform additional coverages to complete finish rolling of the PAC.

Maintenance

00743.60 Correction of Defects - Correct all defects in material and work, as directed, at no additional cost to the Agency, according to the following:

(a) Fouled Surfaces - Repair and clean fouled surfaces that would prevent full bond between successive lifts of mixture.

(b) Boils, Slicks, and Oversized Material - Replace boils, slicks, and oversized material with fresh mixture. If problems with boils and slicks continue to occur, stop production until a plan for eliminating the boils and slicks is approved by the Engineer.

(c) Roller Damage to Surface - Correct surface damage from rollers with additional fresh mixture or by other means approved by the Engineer.

Finishing and Cleaning Up

00743.70 Pavement Smoothness - Furnish a 12 foot straightedge and test as specified. Additional testing may be required. Mark areas not meeting the surface tolerance.

(a) Travel Lanes - Test wearing course with the 12 foot straightedge in travel lanes parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch.

(b) Utility Appurtenances - If the Contractor constructs or adjusts utility appurtenances the tolerances of 00743.70(a) apply. If the utility appurtenances are adjusted by others, these tolerances do not apply.

(c) Shoulders, Paved Medians, Parking Lanes, and Parking Lots - Straightedge testing in shoulders, paved medians, parking lanes, and parking lots is not required.

00743.71 Correction of Pavement Roughness - Correct equipment or paving operation procedures when tests show the pavement smoothness does not comply with 00743.70. In addition, do the following:

(a) Methods - Correct wearing course surface roughness to the required tolerances, using one of the following methods as approved by the Engineer:

- Remove and replace the wearing surface lift.
- Profile to a maximum depth of 0.3 inch with abrasive grinders equipped with a cutting head comprised of multiple diamond blades.

(b) Time Limit - Complete correction of all surface roughness within 14 calendar days of completion of paving.

00743.72 Opening to Traffic - Allow PAC to cure at least 72 hours before opening to traffic, unless otherwise directed.

Measurement

00743.80 Measurement - The quantities of PAC will be measured on the weight basis.

No deductions will be made for asphalt cement, mineral filler, lime, anti-strip, or any other additive used in the mixture.

Payment

00743.90 Payment - The accepted quantities of PAC incorporated into the Project, whether or not recycled materials are used, will be paid for at the Contract unit price, per ton, for the item "_____ Mixture".

The types of PAC (1/2 inch PAC, 3/8 inch PAC, 3/4 inch ATPB) will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for leveling work, QC testing, asphalt cement, mineral filler, lime, and anti-stripping or other additives.

Section 00744 - Asphalt Concrete Pavement

Description

00744.00 Scope - This work consists of constructing asphalt concrete pavement (ACP) to the lines, grades, thicknesses, and cross sections shown or established.

00744.01 Abbreviations:

HMAC - Hot Mix Asphalt Concrete

MAMD - Moving Average Maximum Density

RAM - Recycled Asphalt Material

TSR - Tensile Strength Ratio

VFA - Voids Filled with Asphalt

VMA - Voids in Mineral Aggregate

WMAC - Warm Mix Asphalt Concrete

00744.02 Definitions:

Asphalt Concrete Pavement - Uniformly coated mixture of asphalt cement, graded aggregate, and additives as required. The use of ACP in this section refers to either hot mix or warm mix asphalt concrete.

Hot Mix Asphalt Concrete - A hot plant mixed ACP.

Level 1 ACP - ACP for use in applications with very low traffic and only limited exposure to trucks.

Level 2 ACP - ACP for use in applications with low traffic volumes and low volume truck traffic.

Level 3 ACP - ACP for use in applications exposed to moderate truck traffic.

Recycled Asphalt Material - The combination of reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS).

Warm Mix Asphalt Concrete - An asphalt concrete mix following all requirements of HMAC, except that through use of approved additives or processes, it is mixed, placed, and compacted at lower temperatures.

Materials

00744.10 Aggregate - Furnish new aggregate, RAP aggregate, and RAS aggregate meeting the following requirements:

(a) New Coarse ~~Aggregate~~and Fine Aggregates - Produce coarse ~~aggregate from crushed rock or other inert material of similar characteristics.~~

~~(f) Fine Aggregate~~ ~~- Produce~~and fine aggregate from crushed rock or other inert material of similar characteristics.

Blend sand is allowed for Levels 1, 2, and 3 mixes. Do not ~~blend~~use more than ~~10% by weight of~~6 percent natural or uncrushed blend sand~~ into~~, by weight, in the total ~~fine~~ aggregate~~ unless approved~~. Provide a means of verifying and documenting the amount of blend sand added to the aggregate.

~~(g) RAP Aggregate~~ - Testing of aggregates for soundness, durability, and harmful substances will be at the discretion and expense of the Agency.

(1) Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12 percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(2) Durability - Provide aggregate not exceeding the following maximum values:

Test	Test Method		Aggregates
	ODOT	AASHTO	Coarse
Abrasion		T 96	30.0%
Degradation			
Passing No. 20 sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

(3) Fractured Faces - Provide crushed aggregate with not less than the minimum number of fractured faces as determined by AASHTO T 335 as follows:

	Percent of Fracture (by Weight)	
Type of Mix	Material Retained on 1", 3/4", 1/2" and No. 4 Sieve (two fractured faces)	Material Retained on No. 8 sieve (one fractured face)
All ACP	75	75

(4) Harmful Substances - Do not exceed the following maximum values:

Test	Test Method		Aggregates	
	ODOT	AASHTO	Coarse	Fine
Lightweight pieces		T 113	1.0%	
Wood Particles	TM 225		0.10%	
Elongated Pieces (at a ratio of 5:1)	TM 229		10.0%	
Plasticity Index		T 90		0 or NP
Sand Equivalent		T 176		45 min.

(b) Reclaimed Asphalt Pavement - RAP material used in the production of new ACP is optional. No more than 30 percent RAP material will be allowed in the new ACP pavement. Use RAP aggregates in the ~~MHMAC, according to 00744.03,~~ACP that are no larger than the specified maximum allowable aggregate size before entering the cold feed. Blend the RAP material with new aggregate to provide a mixture conforming to the JMF within the tolerances specified.

(c) Recycled Asphalt Shingles - RAS used in the production of new ACP is optional. Either manufacturer waste (post-manufacturer) RAS or tear-off (post-consumer) RAS may be used. Manufacturer waste RAS is processed asphalt shingle material derived from manufacturer's shingle scrap. Tear-off RAS is processed asphalt shingle material derived from shingle scrap removed from structures. All percentages are based upon dry weights for calculations.

(1) Processing Shingles - Process the RAS by grinding at ambient temperature so that 100 percent of the shredded pieces are less than 1/2 inch in any dimension and that 90 percent are less than 3/8 inch in any dimension when sampled according to AASHTO T 2 and

tested according to AASHTO T 27. Sample and test the processed RAS for gradation at a frequency of one test for every 50 tons of RAS processed.

(2) Harmful Substances - Certify that the RAS does not contain asbestos fibers according to the policies and procedures established by the Department of Environmental Quality. Test deleterious materials according to ODOT TM 335 at a frequency of one test for every 50 tons of RAS material. Limit the percentage of deleterious materials to 1.0 percent. If fine aggregate is added as an anti-clumping agent, sample and test processed RAS for harmful substances before adding the fine aggregates.

(3) Anti-Clumping Additive - Fine aggregate meeting the requirements of 00744.10(a) may be added to the RAS in a quantity not to exceed 4 percent by weight of RAS to keep the material workable and to prevent conglomeration of the shingle particles in the stockpile. Include these added fine aggregates in the mix design. RAS may also be blended with RAP in controlled percentages to preclude clumping. Do not contaminate stockpiled RAS with dirt or other foreign materials.

(4) Allowable Percentages - No more than 5.0 percent RAS by total weight of aggregate is allowed in ACP mixtures. Restrict the maximum allowable percentage of asphalt binder replacement to 20.0 percent for base courses and 15.0 percent for wearing courses in ACP containing only RAS.

When RAS is used in conjunction with RAP, restrict the maximum allowable percentage of binder replacement to 30.0 percent for base courses and 25.0 percent for wearing courses.

(5) Establishing Mix Design Inputs - For ACP mixtures containing RAS or RAM, following any addition of fine aggregate as an anti-clumping agent, test the material according to ODOT TM 319 to establish the asphalt content, material specific gravities, and gradation. Develop mixture designs according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

Blend the RAS or RAM with new aggregate to provide a mixture conforming to the JMF within the tolerances specified.

00744.11 Asphalt Cement and Additives - Furnish the following asphalt cement and additives:

(a) Asphalt Cement - ~~Use PG 64-22 or PG 70-22 asphalt unless otherwise specified in the Contract documents.~~ Provide asphalt cement conforming to the requirement of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from ODOT's ~~Pavement Services Engineer.~~website. The applicable specifications are those contained in the current publication on the date the Project is advertised. Use the grade of asphalt that is specified in the Special Provisions.

~~Testing of the~~ **(b) Asphalt Cement Additives** - Use standard recognized asphalt cement ~~used on this Project will be at~~additive products that are of known value for the ~~discretion~~intended purpose and ~~expense of~~ approved for use on the ~~Agency.~~

~~Asphalt in RAP material, when blended with new asphalt shall provide properties similar to the above specified asphalt. When RAP material is used at a rate~~basis of ~~less than 15%, no adjustment to the new asphalt will be required. When utilizing RAP at a rate at or above 15%, the combined RAP~~laboratory tests and ~~new~~

~~asphalt shall provide blended properties equivalent to the specified grade. Determine the blended properties according to ASTM D 4887. Determine~~ capable of being thoroughly mixed. Do not use asphalt cement ~~properties for the RAP material from~~additives that have detrimental effects on the asphalt material. Do not use silicones as an additive. Add the following asphalt cement ~~recovered from the RAP according to AASHTO T 170.~~

~~**(b) Asphalt Cement Additives** - When~~ additives when required by the JMF~~, add antistripping additives meeting the requirements below and satisfying the Tensile Strength Ratio (TSR) specified in 00744.13.~~:

- ~~Additives~~Anti-stripping asphalt cement additives to prevent stripping or separation of asphalt coatings from aggregates~~, and~~ to satisfy the TSR specified in 00744.13.
- Asphalt cement admixtures used to aid in the mixing or use of asphalt mixes or for experimental purposes~~, shall be standard recognized products of known value for the intended purpose and approved for use on the basis of laboratory tests. They shall have no deleterious effect on the asphalt material~~.

When WMAC is used, select one of the WMAC technologies and process and additive types identified on ODOT's publication "Approved WMAC Technologies".

Submit the proposed WMAC technology to be used and a plan for its implementation at the pre-construction conference.

Comply with the manufacturer's recommendations for incorporating additives and ~~be completely miscible. Do not use silicones as an additive~~WMAC technologies into the mix. Comply with manufacturer's recommendations regarding receiving, storing, and delivering the additives.

00744.12 Mix Type and Broadband Limits - ~~Mix~~Furnish the mix type ~~and~~specified in the Contract Documents within the broadband limits ~~shall meet the~~according to following:

(a) Mix Type - Furnish the ~~type(s)~~types of ~~MHMAC~~ACP shown or as directed. ~~The broadband limits for each of the mix types are specified in (b) below.~~ When the plans allow an option of two types for a course of pavement, use only one type throughout the course.

(b) Broadband Limits - Provide a JMF for the specified mix type within the control points listed below:

Sieve Size	3/4" ~~Dense~~ACP Control Points (% passing by Weight)		1/2" ~~Dense~~ACP Control Points (% passing by Weight)		3/8" ~~Dense~~ACP Control Points (% passing by Weight)	
	Min.	Max.	Min.	Max.	Min.	Max.
1"	100					
3/4"	90	100	100			
1/2"	–	90	90	100	100	
3/8"	–	–	–	90	90	100
No. 4	–	–	–	–	–	90
No. 8	23	49	28	58	32	67
No. 200	2.0	8.0	2.0	10.0	2.0	10.0

00744.13 Job Mix Formula ~~(JMF)~~ Requirements - Provide a JMF for the Project meeting the following criteria and that was either developed or verified within ~~three~~3 years of the date the Contract was advertised:

	Level 1	**Level 2**	**Level 3**
Design Method	Superpave	Superpave	Superpave
Compaction Level	65 Gyrations	65 Gyrations	80 Gyrations
Air Voids, %	3.5	4.0	4.0
VMA, % minimum	1/2 inch - 14.0 3/8 inch - 15.0	3/4 inch - 13.0 1/2 inch - 14.0 3/8 inch - 15.0	3/4 inch - 13.0 1/2 inch - 14.0 3/8 inch - 15.0
VMA, % maximum	min + 2.0%	min + 2.0%	min + 2.0%
P No. 200 / Eff. AC ratio	0.8 to 1.6	0.8 to 1.6	0.8 to 1.6
TSR, % minimum	80	80	80
VFA, %	70 - 80 3/8 inch: 70 - 80	65 - 78 3/8 inch: 70 - 80	65 - 75 3/8 inch: 70 - 80

~~The~~
Develop the JMF ~~shall have been developed~~ according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete; or ~~verified~~verify according to the ODOT Mix Design Verification process. Submit the proposed JMF and supporting data to the Engineer for review at least 10 calendar days before anticipated use. If acceptable, written acceptance will be provided. Perform a new TSR if the source of the asphalt cement changes.

For Level 3 wearing course mixes, include the results of the performance testing as outlined in the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete in the mix design submittal.

Issue a separate JMF for WMAC. Do not use RAS in WMAC mixes with minimum compaction temperatures less than 260 °F.

When WMAC is used, provide the following information in addition to the requirements listed for ACP:

- WMAC technology and WMAC additives information.
- WMAC technology manufacturer's established recommendations of usage.
- WMAC technology manufacturer's established target rate for water and additives, the acceptable variation for production, and documentation showing the impact of excessive production variation.
- WMAC technology material safety data sheets if applicable.
- Temperature range for mixing.
- Temperature range for compacting.
- Except for foaming technology, asphalt binder performance grade test data of the asphalt binder and chemical additive at the manufacturer's recommended dosage rate.
- Except for foaming technology, WMAC mixture performance test results. Perform testing for foaming technology on the production mix on specimens compacted at WMAC compaction temperatures.

00744.14 Tolerances and Limits - Produce and place ~~MHMAC~~ACP within the following JMF tolerances and limits:

Gradation Constituent		**~~MHMAC~~ACP Type**		
		3/4"	**1/2"**	**3/8"**
	1"	JMF ± 5% *		
	~~1~~3/4"	~~JMF ± 5%~~	JMF ± 5% *	

3/41/2"	90 - 100JMF	JMF ± 5%	JMF ± 5% *
1/23/8"	JMF ± 5%	90 - 100%	JMF ± 5%
3/8"No. 4	JMF ± 5%	JMF ± 5%	90 -
No. 48	JMF ± 54%	JMF ± 54%	JMF ± 54%
No. 830	JMF ± 4%	JMF ± 4%	JMF ± 4%
No. 30200	JMF ± 42.0%	JMF	JMF
No. 200* Maximum not to exceed 100%	JMF ± 2.0%	JMF ± 2.0%	JMF ± 2.0%

* Maximum not to exceed 100%

Constituent of Mixture	MHMACACP All Types
	Asphalt Cement -
ODOT TM 321 (Cold Feed/Meter)	JMF ± 0.20%
Asphalt Cement - AASHTO T 308 (Ignition) and ODOT TM 323	JMF ± 0.50%
RAP Content - ODOT TM 321	JMF ± 2.0%
RAS Content - ODOT TM 321	JMF ± 1.0%
RAM Content - ODOT TM 321	JMF ± 2.0%
Moisture content at time of discharge from the mixing plant - WAQTC TM 6AASHTO T 329	0.80% max.

When a JMF tolerance applies to a constituent, full tolerance will be given even if it exceeds the Control Pointscontrol points established in 00744.12(b). Full tolerance will be given for RAP, RAS, or RAM content even if it exceeds the limits established in 00744.10.

00744.16 MHMAC Sampling and Testing - For each 1,000 tons of placement, have a CAT-I perform a minimum of one of each of the following test methods as modified in the MFTP:

- Asphalt Content - AASHTO T 308 with ODOT TM 323 determined Calibration Factor
- Gradation - AASHTO T 30
- Mix Moisture - AASHTO T 329
- Maximum Specific Gravity - AASHTO T 209

When less than 1,000 tons of mix is placed in a day, perform a minimum of one series of tests per day. Provide test results to the Engineer by the middle of the following work shift.

If less than three samples are obtained on a project, the Contractor may supplement test results with the Engineer's approval by:

- Accelerating testing.
- Providing test results from other projects with the same JMF within the past 120 days of first date of JMF production.
- Testing back up samples.

Provide a minimum of three test results. Provide samples or split samples to the Engineer when requested.

00744.17 Acceptance - ~~The mixture~~If the average for each mix gradation constituent and asphalt content is within the specification limits, the material will be accepted~~ by visual inspection by the Engineer. If the mixture is considered suspect, the Engineer may verify that the mixture is within tolerances and limits of 00744.14. When requested, obtain samples according to appropriate procedures in the MFTP under the observation of the Engineer at a frequency established by the Engineer. The Engineer will test for gradation, asphalt content, moisture, and RAP~~. If the average asphalt content ~~(if applicable) according to procedures specified in 00744.14 and the MFTP. Take corrective action when testing shows that MHMAC~~or one or more gradation constituents is not within the ~~tolerances and limits of 00744.14~~specification limits, the material will be accepted according to 00150.25.

Equipment

00744.23 Pavers - Provide pavers that are:

- Self-contained, self-propelled, supported on tracks or wheels, none of which contact the mixture being placed.
- Equipped with augers and a screed or strike-off assembly, heated if necessary, which:
  - Can spread and finish the ACP to a uniform texture, in the specified widths, thicknesses, lines, grades and cross sections.
  - Will not segregate, tear, shove or gouge the ACP.
- Equipped with a paver control system which:
  - Controls the ACP placement to specified slope and grade.
  - Maintains the paver screed in proper position.
  - Provides the specified results through mechanical sensors and sensor-directed devices actuated from independent line and grade control references.

00744.24 Compactors~~ - Provide self propelled rollers~~ - Provide self-propelled steel-wheeled or vibratory rollers specifically designed to compact ACP and capable of reversing without backlash~~ as follows:~~

~~**(a) Steel-Wheeled Rollers** - Steel-wheeled~~. Provide a sufficient number of appropriately weighted rollers to compact the mixture. Equip vibratory rollers ~~shall have:~~

- ~~A gross static weight of at least 8 ton.~~

~~If steel-wheeled rollers are used for finish rolling, they shall have:~~

- ~~A gross static weight of at least 6 ton.~~

~~**(b) Vibratory Rollers** - Vibratory rollers shall be:~~

- ~~Equipped~~ with amplitude and frequency controls.
- ~~Specifically designed to compact MHMAC.~~
- ~~Capable of at least 2,000 vibrations per minute.~~
- ~~Have a gross static weight of at least 8 ton.~~

Do not operate in vibratory mode for lifts thinner than two times the maximum aggregate size for the type of ~~MHMAC~~ACP being compacted.

Labor

00744.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~

~~•~~ having CAgT, CAT ~~1~~
~~-I,~~ CDT, and CMDT technical certifications.

Construction

00744.40 Season and Temperature Limitations - Place ~~MHMAC~~ACP when the temperature of the surface that is to be paved is not less than the temperature indicated:

Nominal Compacted Thickness of Individual Lifts and Courses as shown on the typical section of the plans	All Levels	Level 1 and Level 2		Level 3	
		All Courses		Travel Lane Wearing Course	All Other Courses
	Surface Temperature*	From To Inclusive		From To Inclusive	From To Inclusive
~~Dense Graded Mixes~~					
Less than 2 inches	60 °F	All Year**		3/15 9/30	All Year**
2 inches - 2 1/2 inches	50 °F	All Year**		3/15 9/30	All Year**
Greater than 2 1/2 inches	40° F	All Year**		3/15 9/30	All Year**
Temporary	40 °F	All Year**		All Year**	All Year**

~~* If placing MHMAC between March 15 and September 30, temperature requirement may be lowered 5 °F.~~

~~***~~ Do not use field burners or other devices to heat the pavement surface to the specified minimum temperature.

** If placing ACP between March 15 and September 30, temperature requirement may be lowered 5 °F.

00744.~~43 MHMAC~~ 41 Mixing Temperatures - Produce ~~MHMAC~~ACP within the temperature ranges recommended by the asphalt cement supplier for the grade of asphalt being used on the Project.

Establish the allowable mixing and placement temperature ranges by the JMF. Measure the mixture temperature at the discharge of the mixer. Measure the placement temperature behind the paver. The allowable production temperatures may be adjusted based on the asphalt cement supplier's recommendation if approved by the Engineer. The maximum mixture temperature and the minimum placement temperature shall be as follows:

	Temperature, °F	
Type	Maximum at Mixer	Minimum Behind Paver
HMAC	350	240
WMAC	275	215

Within the above limits, the Contractor with approval of the Engineer, or the Engineer may adjust this temperature in 10 °F increments from the JMF as follows:

- **Up** - If the aggregate coating, moisture content, workability or compaction requirements are not attained.
- **Down** - If the aggregate coating, moisture content, workability and compaction requirements are attained.

00744.~~44~~42 Tack Coat - Construct a tack coat ~~prior to~~before placing each lift of ~~MHMAC~~ACP according to Section 00730. A tack coat is not required ~~prior to~~before placing ~~MHMAC~~ACP on aggregate base.

Treat all paved surfaces on and against which ACP is to be placed with an asphalt tack coat according to Section 00730. Before applying the tack coat, clean and dry the surface to be tacked.

Remove all loose material that will reduce adhesion of the tack by brooming, flushing with water, or other approved methods.

00744.43 Hauling, Depositing, and Placing - Haul, deposit, and place ACP according to the following:

(a) Hauling - Cover ACP if rain is encountered any time between loading and placement.

ACP will be rejected before placing if one or more of the following occurs:

- Below temperature limit specified in 00744.41.
- Slumping or separating.
- Solidifying.

Dispose of rejected loads at no additional cost to the Agency.

Deliver the mixture to the paving machine at a rate that provides continuous operation of the paving machine, except for unavoidable delay or breakdown. If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the mixture delivery rate matches the paving machine operation.

(b) Depositing - Deposit ACP from the hauling vehicles so segregation is prevented.

(c) Placing - Alternative equipment and means may be allowed by the Engineer if the use of a paver is impractical.

Do not place ACP during rain or other adverse weather conditions, unless allowed by the Engineer. ACP in transit at the time adverse conditions occur may be placed if:

- It has been covered during transit.
- The ACP temperature is satisfactory.
- It is placed on a foundation free from pools or flow of water.

Place the mixture in the number of lifts and courses, and to the compacted thickness for each lift and course, as shown. Place each course in one lift unless otherwise specified. Do not exceed a compacted thickness of 4 inches for any lift. Limit the minimum lift thickness to twice the maximum aggregate size in the mix.

00744.44 Longitudinal Joints - At longitudinal joints, bond, compact and finish the new ACP equal to the ACP against which it is placed.

(a) Location - Place the ACP in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.

(1) Base Course - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

(2) Wearing Course - Construct longitudinal joints at either lane lines or fog lines, or as shown or directed.

(b) Drop-offs:

- Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.
- Protect edges from being broken down.

If unable to complete the pavement without drop-offs according to 00744.44(c) do the following:

- Construct and maintain a wedge of ACP at a slope of 1V:10H or flatter along the exposed longitudinal joint.
- Remove and dispose of the wedge before continuing paving operations.
- Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. ACP for the temporary wedge will be paid for at the pay item price.

(c) Placing Under Traffic - When placing ACP pavement under traffic, schedule work for the nominal thickness being laid as follows:

(1) More Than 2 Inches - Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs, unless approved.

(2) Less Than or Equal to 2 Inches - Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each week complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.

00744.45 Transverse Joints:

(a) Travel Lanes - Construct transverse joints on the travel lane portion of all specified pavement courses, except leveling courses, as follows:

(1) Temporary End Panel - Maintain pavement depth, line and grade at least 4 feet beyond the selected transverse joint location, and from that point, wedge down on the appropriate slope until the top of the course being laid meets the underlying surface (assuming a pavement course thickness of 2 inches) as follows:

- For wedges that will be under traffic for less than 24 hours, construct an 8 foot long wedge (1V:50H taper rate).
- For wedges that will be under traffic for 24 hours or longer, construct a 25 foot long wedge (1V:160H taper rate).
- Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. ACP for the temporary wedge will be paid for at the pay item price.

When the pavement course thickness is different than the above 2 inch example, use the appropriate taper rate to compute the length of the wedge. The wedge length plus the 4 feet or longer panel form the temporary end panel.

(2) Vertical Face - After the mixture has reached the required density:

- Provide a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting or other approved method.
- Remove the ACP material from the joint to the end of the panel. If removed before resuming paving beyond the joint, reconstruct the temporary end panel immediately by placing a bond-breaker of paper, dust, or other suitable material against the vertical face and on the surface to be occupied by the temporary end panel. Construct a full-depth panel at least 4 feet long, beginning at the sawed or cut joint, and taper it on a 1V:50H slope to zero thickness.

(3) Excess Asphalt Concrete Pavement - After completing a temporary end panel as specified, dispose of unused, remaining ACP as directed. Payment will be made for the entire load of ACP, but will be limited to only one load for each joint of each panel.

(4) Resume Paving - When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.

(5) Joint Requirements - Compact both sides of the joint to the specified density. When tested with a straightedge placed across the joint, the joint surface shall conform to 00744.70.

(b) Abutting Bridge Ends - Compact the ACP abutting bridge ends and other rigid type structures in the longitudinal direction and either transverse or diagonal direction, as directed.

(c) Bridge Deck Overlays - Saw cut the wearing course of pavement directly over the joints in bridge decks, bridge end joints and end panel end joints as soon as practical but within 48 hours of paving each stage of the wearing course, unless otherwise directed. Saw cut a 3/8 inch wide, ± 1/8 inch, by 1/2 inch less than the thickness of the panel of pavement depth or 1 1/2 inches deep, whichever is less.

Flush the saw cut thoroughly with a high-pressure water stream after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a poured filler from the QPL.

00744.49 Compaction - ~~Immediately after the MHMAC~~After the ACP has been spread, struck off, and surface irregularities and other defects remedied, roll it uniformly ~~with rollers meeting the requirements of 00744.24~~ until compacted ~~as specified.~~

to a minimum of 91 percent of MAMD. Perform ~~breakdown and intermediate~~finish rolling ~~until the entire surface has been compacted by at least six coverages of the roller(s). Complete breakdown and intermediate compaction before MHMAC temperature drops below 180 °F, unless otherwise directed. Perform additional coverages for finish rolling~~and continue until all roller marks are eliminated.

Determine compliance with density specifications by random testing of the compacted surface with calibrated nuclear gauges. Determine the density by averaging QC tests performed by a CDT with the nuclear gauge operated in the backscatter mode according to WAQTC T 8 at one random location for each 100 tons of asphalt concrete placed, but take no less than 10 tests each shift. Do not locate the center of a density test less than 1 foot from the panel edge. Calculate MAMD according to ODOT TM 305. The Engineer may waive compaction testing upon written notice.

Compaction to a specified density will not be required for the following:

- **Thin Pavements** - Leveling, patches, or where the nominal compacted thickness of a course of ACP will be less than 2 inches.
- **Other Areas** - Temporary surfacing, guardrail flares, mailbox turnouts, road approaches, and areas of restricted width of less than 8 feet wide or limited length, regardless of thickness.

Compact thin pavements and other areas according to 00749.45.

Maintenance

00744.60 Correction of Defects - Correct all defects in materials and work, as directed, at no additional cost to the Agency, ~~as follows~~according to the following:

(a) Fouled Surfaces - ~~Immediately repair~~Repair, clean, and retack fouled surfaces that would prevent full bond between successive lifts of mixture.

(b) Boils, Slicks, and Oversized Material - ~~Immediately replace~~Replace boils, slicks, and oversized materials with fresh mixture.

(c) Segregation - Take ~~immediate~~ corrective measures when segregation or non-uniform surface texture is occurring in the finished mat. If segregation continues to occur, stop production until a plan for providing uniform surface texture is approved.

(d) Roller Damage to ~~the~~ Surface - ~~Immediately correct~~Correct surface damage from rollers with additional fresh mixture or by other ~~means~~ approved means.

(e) Longitudinal Joints - Take ~~immediate~~ corrective measures when open longitudinal joints are being constructed or when the elevation of the two sides of a longitudinal joint does not match. If problems with the longitudinal joint continue to occur, stop production until a plan for providing tight, equal elevation longitudinal joints is approved.

(f) Other Defects - Remove and replace any ~~MHMAC~~ACP that:

- Is loose, broken, or mixed with dirt.
- Shows visually too much or too little asphalt.
- ~~Is defective in any way.~~

~~**00744.61 Longitudinal Joints** - At longitudinal joints, bond, compact and finish the new MHMAC equal to the MHMAC against which it is placed.~~

~~**(a) Location** - Place the MHMAC in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.~~

~~**(1) Base Course** - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.~~

~~**(2) Wearing Course** - Longitudinal joints shall not occur within the width of a traffic lane. They shall be located at either skip lines or fog lines unless approved. On median lanes and on shoulder areas the joints shall occur only at lane lines or at points of change in the transverse slopes, as shown or directed.~~

~~**(b) Drop-offs:**~~

- ~~Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.~~
- ~~Protect edges from being broken down.~~

~~If unable to complete the pavement without drop-offs according to 00744.61(c) do the following:~~

- ~~Construct and maintain a wedge of MHMAC at a slope of 1V:10H or flatter along the exposed longitudinal joint.~~
- ~~Remove and dispose of the wedge before continuing paving operations.~~
- ~~Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. MHMAC for the temporary wedge will be paid for at the pay item price.~~

~~**(c) Placing MHMAC Under Traffic** - When placing MHMAC pavement under traffic, schedule work for the nominal thickness being laid as follows:~~

~~**(1) More Than 2 Inches** - Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.~~

~~**(2) Less Than or equal to 2 Inches** - Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each workweek complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.~~

~~**00744.62 Transverse Joints:**~~

~~**(a) Travel Lanes** - Construct transverse joints on the travel lane portion of all specified pavement courses, except leveling courses, as follows:~~

~~**(1) Temporary End Panel** - Maintain pavement depth, line and grade at least 4 feet beyond the selected transverse joint location, and from that point, wedge down on the appropriate slope until the top of the course being laid meets the underlying surface (assuming a pavement course thickness of 2 inches) as follows:~~

- ~~For wedges that will be under traffic for less than 24 hours, construct a 8 foot long wedge (1V:50H taper rate).~~
- ~~For wedges that will be under traffic for 24 hours or longer, construct an 25 foot long wedge (1V:160H taper rate).~~
- ~~Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. MHMAC for the temporary wedge will be paid for at the pay item price.~~

~~When the pavement course thickness is different than the above 2 inch example, use the appropriate taper rate to compute the length of the wedge. The wedge length plus the 4 feet or longer panel form the "temporary end panel".~~

~~**(2) Vertical Face** - After the mixture has reached the required density:~~

- ~~Provide a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting or other approved method.~~
- ~~Remove the MHMAC material from the joint to the end of the panel. If removed before resuming paving beyond the joint, reconstruct the temporary end panel immediately by placing a bond-breaker of paper, dust, or other suitable material against the vertical face and on the surface to be occupied by the temporary end panel. Construct a full-depth panel at least 4 feet long, beginning at the sawed or cut joint, and taper it on a 1V:50H slope to zero thickness.~~

~~**(3) Excess MHMAC** - After completing a temporary end panel as specified, dispose of unused, remaining MHMAC as directed. Payment will be made for the entire load of MHMAC, but will be limited to only one load per joint per panel.~~

~~**(4) Resume Paving** - When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.~~

~~**(5) Joint Requirements** - Compact both sides of the joint to the specified density. When tested with a straightedge placed across the joint, the joint surface shall conform to the specified surface tolerances.~~

~~**(b) Abutting Bridge Ends** - Compact the MHMAC abutting bridge ends and other rigid type structures in the transverse and/or diagonal direction, as well as longitudinally, as directed.~~

~~**(c) Bridge Deck Overlays** - Saw cut the wearing course of pavement directly over the joints in bridge decks, bridge end joints and end panel end joints as soon as practical but within 48 hours of paving each stage of the wearing course, unless otherwise directed. The saw cut shall be 3/8 inch wide, ± 1/8 inch, and 1/2 inch less than the thickness of the panel of pavement, to a maximum depth of 1 1/2 inches.~~

~~Flush the saw cut thoroughly with a high-pressure water stream immediately after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a poured filler from the QPL.~~

Finishing and Cleaning Up

00744.70 Pavement Smoothness - Furnish a 12 foot straightedge. Test with a 12 foot straightedge parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch. Mark areas not meeting the surface tolerance.

00744.75 Correction of Pavement Roughness~~- Immediately correct~~ - Correct equipment or paving operation procedures when tests show the pavement smoothness does not comply with 00744.70. In addition, do the following:

(a) Methods - Correct surface roughness to the required tolerances, using one of the following methods as approved by the Engineer:

- Remove and replace the wearing surface lift.
- Profile to a maximum depth of 0.3 inch with abrasive grinders equipped with a cutting head comprised of multiple diamond blades, and apply an emulsion fog seal as directed.

(b) Time Limit - Complete correction of all surface roughness within 14 calendar days following notification, unless otherwise directed.

Measurement

00744.80 Measurement - The quantities of ~~MHMAC~~ACP will be measured on the weight basis.

No deductions ~~and no separate measurement~~ will be made for asphalt cement, mineral filler, lime, anti-strip, or any other additive used in the mixture.

~~No separate measurement will be made for asphalt tack coat. An estimated amount of asphalt in tack coat will be listed in the Special Provisions.~~

Payment

00744.90 Payment - The accepted quantities of ~~MHMAC~~ACP incorporated into the project, whether or not recycled materials are used, will be paid for at the Contract unit price, per ton, for the item "Level~~___, _____, MHMAC____, _____~~ ACP Mixture ~~,~~ _____".

The following will be inserted in the blanks:

- The level~~(s)~~ of ~~MHMAC~~ACP (1, 2, 3) will be inserted in the first blank.
- The type~~(s)~~ of ~~MHMAC~~ACP (3/4 inch ~~Dense~~, 1/2 inch ~~Dense~~, 3/8 inch ~~Dense~~), will be inserted in the second blank.
- The words "in Leveling", "in Temporary", or "in Leveling and Temporary" will be inserted in the third blank when applicable.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for ~~the~~ :

asphalt ~~tack coat.~~

- ~~No separate~~cement, mineral filler, lime, and anti-stripping or ~~additional payment will be made for~~ other additives
- sawing, cleaning, and filling joints on bridge deck overlays~~.~~

Section 00745 - ~~Hot Mixed~~ Asphalt Concrete ~~(HMAC)~~Pavement - Statistical Acceptance

Description

00745.00 Scope~~.~~ - This work consists of constructing one or more courses of hot ~~mixed~~mix or warm mix asphalt concrete ~~(HMAC)~~ pavement, plant mixed into a uniformly coated mixture, ~~hot~~ laid on a prepared foundation, compacted to specified density, and finished to a specified smoothness to the lines, grades, thickness, and cross sections shown or established.

00745.01 Abbreviations:

HMAC - Hot Mix Asphalt Concrete
MAMD - Moving Average Maximum Density
MDT - Maximum Density Test
MDV - Mix Design Verification
Gmm - Maximum Specific Gravity of Mixture
HMAC - Hot Mix Asphalt Concrete
Pbe - Effective Asphalt Content
RAM - Recycled Asphalt Material
RAS - Recycled Asphalt Shingles
SDC - Surface Damp Condition
TSR - Tensile Strength Ratio
Va - Air Voids in Compacted Mixture
VFA - Voids Filled with Asphalt
VMA - Voids in Mineral Aggregate
WMAC - Warm Mix Asphalt Concrete

00745.02 Definitions:

Asphalt Concrete Pavement - Uniformly coated mixture of asphalt cement, graded aggregate, and additives as required. The use of ACP in this section refers to either hot mix or warm mix asphalt concrete

Hot ~~Mixed~~Mix Asphalt Concrete ~~(HMAC)~~ - A hot plant mixed, uniformly coated mixture of asphalt cement, graded aggregate and additives as required.

Level 1 ~~HMAC - HMAC~~ACP - ACP for use in applications with very low traffic and only limited exposure to trucks.

Level 2 ~~HMAC - HMAC~~ACP - ACP for use in applications with low traffic volumes and low volume truck traffic.

Level 3 ~~HMAC - HMAC~~ACP - ACP for use in applications exposed to moderate truck traffic.

Level 4 ~~HMAC - HMAC~~ACP - ACP for use in applications exposed to very heavy traffic volumes or heavy truck traffic.

Lot Size - A lot is the total quantity of material or work produced per JMF per project. The following circumstances will require a different lot:

- A new JMF is used. A JMF adjusted according to 00745.16 is not considered a new JMF.
- The method for measuring compaction is changed.
- A new compaction specification limit is required according to 00745.49(b-3).
- A change from one test procedure for measuring asphalt content to another test procedure for measuring asphalt content occurs.
- WMAC technology is used.

The Engineer may allow material for irregular areas not completed during the main paving operations, such as driveways or guardrail flares to be evaluated as a separate lot.

Recycled Asphalt Material - The combination of reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS).

Sublot Size - A sublot is 1,000 tons of ~~HMAC~~ACP.

Surface Damp Condition ~~**(SDC)**~~ - When the outside of the aggregates are damp with moisture, but little or no free water is present.

Warm Mix Asphalt Concrete - An asphalt concrete mix following all requirements of HMAC, except that through use of approved additives or processes, it is mixed, placed, and compacted at lower temperatures.

Wearing Course - The top lift of ~~HMAC~~ACP, regardless of thickness.

Materials

00745.~~03~~10 Aggregate - When requested by the Engineer, supervisory personnel of the Contractor and any subcontractors who are to be involved in ACP aggregate crushing shall meet with the Engineer at a mutually agreed upon time to discuss accomplishing all phases of the crushing work.

(a) New Coarse and Fine Aggregates - Provide and stockpile new aggregates according to the following requirements:

(1) General - Produce and stockpile aggregate as follows:

a. Separated Sizes - Advise the Engineer of the separated sizes of coarse and fine aggregate that will be used and the proposed targets for each individual sieve size for each stockpile. A minimum of one coarse aggregate and one fine aggregate stockpile is required. If the Contractor proposes to produce coarse and fine aggregates in separated sizes other than those specified, request the proposed size changes in writing, and state the proposed target value and specified tolerance for each of the individual sieve sizes of the proposed materials.

The number of fine aggregate separated sizes selected by the Contractor does not relieve the Contractor of providing a JMF and producing ACP meeting the air voids, VMA, and VFA requirements of 00745.13(b) and 00745.16(b-1-a). Perform recrushing, rescreening, or other special processing of the fine aggregates necessary to achieve the air voids, VMA, or VFA requirements at no additional cost to the Agency.

b. Scalping - Scalp the rock on a 3/4 inch sieve screen deck. For quarry rock, scalp the rock after it has passed through the primary crusher. The material remaining may be accepted for use by visual inspection. The Engineer may perform verification testing of the gradation. The material shall meet the following:

Sieve Size	Percent Passing (by Weight)
8"	95 - 100

3/4"	5 max.

c. Soundness - Provide coarse and fine aggregate with a weighted loss not exceeding 12 percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

d. Durability - Provide aggregate not exceeding the following maximum values:

Test	Test Method ODOT	Test Method AASHTO	Aggregates Coarse
Abrasion		T 96	30.0%
Degradation			
Passing No. 20 sieve	TM 208		30.0%
Sediment Height	TM 208		3.0"

e. Fractured Faces - Provide crushed aggregate with not less than the minimum number of fractured faces as determined by AASHTO T 335 as follows:

	Percent of Fracture (by Weight)	
Type of Mix	Material Retained on 1 1/2", 1", 3/4", 1/2" and No. 4 Sieve (two fractured faces)	Material Retained on No. 8 Sieve (one fractured face)
All ACP	75	75

f. Harmful substances - Do not exceed the following values:

Test	Test Method ODOT	Test Method AASHTO	Aggregates Coarse	Aggregates Fine
Lightweight pieces		T 113	1.0%	
Wood Particles	TM 225		0.10%	
Elongated Pieces (at a ratio of 5:1)	TM 229		10.0%	
Plasticity Index		T 90		0 or NP
Sand Equivalent		T 176		45 min.[1]

[1] 50 min. for Level 4 ACP

(2) Coarse Aggregate - Provide coarse aggregate meeting the following:

a. General Requirements - Produce coarse aggregate from crushed rock or other inert material of similar characteristics.

b. Separated Sizes - Allowable separated sizes of coarse aggregate are as follows:

Type of Asphalt Concrete Mixture	Allowable Separated Sizes 1 1/4" - 3/4"	3/4" - No. 4	3/4" - 1/2"	1/2" - No. 4
1" ACP	Yes	Yes	Yes	Yes
3/4" ACP	–	Yes	Yes	Yes
1/2" ACP	–	–	–	Yes

c. Grading - Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Establish the target values for each allowable separated size after a maximum of 10 percent of planned stockpile quantity has been produced. Produce the aggregate within the following listed tolerances (T):

	Separated Sizes			
	1 1/4" - 3/4"	3/4" - No. 4	3/4" - 1/2"	1/2" - No. 4
	Percent Passing (by Weight)			
Sieve Size	T	T	T	T
1 1/2"	– 1	–	–	–
1 1/4"	± 5	–	–	–
1"	± 10	– 1	– 1	–
3/4"	± 5	± 5	± 7	– 1
1/2"	–	± 8	± 8	± 5
3/8" *	–	–	–	–
No. 4	± 3	± 8	± 8	± 8
No. 8	–	± 5	± 5	± 5
No. 16 *	–	–	-	–
No. 30	± 1	± 3	± 3	± 3
No. 50 *	–	–	–	–
No. 100 *	–	–	–	–
No. 200	–	± 1.0	± 1.0	± 1.0

* Report percent passing sieve when no tolerance is listed

(3) Fine Aggregate - Provide fine aggregate meeting the following:

a. General - Produce fine aggregate from crushed rock or other inert material of similar characteristics and if allowed, blend sand.

b. Separated Sizes - Allowable separated sizes for fine aggregates are:

No. 4 - 0
No. 4 - No. 8
No. 8 - 0

c. Grading - Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Establish the target values for each allowable separate size after a maximum of 10 percent of planned stockpile quantity has produced. Produce the aggregate within the following listed tolerances (T):

	Separated Sizes		
	No. 4 - 0	No. 4 - No. 8	No. 8 - 0
	Percent Passing (by Weight)		
Sieve Size	T	T	T
3/8"	– 1	– 1	–
No. 4	± 7	± 10	– 1
No. 8	± 7	± 7	± 10
No. 16 *	–	–	–
No. 30	± 7	± 5	± 8
No. 50 *	–	–	–
No. 100 *	–	–	–
No. 200	± 3.0	± 2.0	± 4.0

* Report percent passing sieve when no tolerance is listed

d. Combination of Fine Aggregate for Testing - Blend together fine aggregate produced in two separate sizes at a 1:1 ratio when testing for sand equivalent.

e. Blend Sand - No natural or uncrushed blend sand will be allowed in Level 4 ACP. Blend sand is allowed for Levels 1, 2, and 3 mixes. For these mixes, establish the target gradation and produce all material within the following tolerances (T):

Sieve Size	Percent Passing (by Weight) T
3/8"	± 1
No. 4	± 5
No. 8	± 15
No. 30	± 20
No. 200	± 5.0

Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Do not use more than 6 percent natural or uncrushed blend sand, by weight, in the total aggregate. Provide a means of verifying and documenting the amount of blend sand added to the aggregate.

(b) Reclaimed Asphalt Pavement **(RAP) Material** - Reclaimed HMAC pavement (RAP) - RAP material used in the production of new HMACACP is optional. No more than 30% RAP will be allowed in Level 1, Level 2, and Level 3 HMAC. NoNo more than 30% percent RAP will be allowed in Level 1, Level 2, and Level 3 ACP. No more than 30 percent RAP will be allowed in Level 4 base courses. No more than 20% percent RAP will be allowed in Level 4 wearing courses. RAP material will not be allowed in open graded HMAC.

The Establish the amount of asphalt cement in the RAP shall be established in the mixture design phase according to ODOT TM 323 and AASHTO T 308 TM 319 and the ODOT Contractor Mix Design Guidelines for Asphalt Concrete or other method if approved by the Engineer. Additional testing may be requested at any time by the Agency or the Contractor during the production of the RAP mixture to verify the amount of asphalt cement in the RAP. Conduct new tests by a laboratory mutually agreed upon by the Agency and the Contractor. Pay the cost of additional testing by theThe party requesting the additional testing pays the cost of the additional testing.

Materials

00745.10 Aggregate - Produce and stockpile aggregate as follows:

When requested by the Engineer, supervisory personnel of the Contractor and any subcontractors who are to be involved in HMAC aggregate crushing shall meet with the Engineer at a mutually agreed upon time to discuss accomplishing all phases of the crushing work.

Provide and stockpile new aggregates and RAP aggregates according to the following requirements:

(a) General - Produce and stockpile aggregate as follows:

(1) Separated Sizes - Advise the Engineer of the separated size(s) of coarse and fine aggregate that will be used and the proposed targets for each individual sieve size for each stockpile. A minimum of one coarse aggregate and one fine aggregate stockpile is required. If the Contractor wishes to produce coarse and fine aggregates in separated sizes other than those specified, request the proposed size changes in writing, and state the proposed target value and specified tolerance for each of the individual sieve sizes of the proposed materials.

~~The number of fine aggregate separated sizes selected by the Contractor does not relieve the Contractor of providing a JMF and producing HMAC meeting the air voids, VMA, and VFA requirements of 00745.13(b) and 00745.16(b-1-a). Perform recrushing, rescreening, or other special processing of the fine aggregates necessary to achieve the air voids, VMA, or VFA requirements at no additional cost to the Agency.~~

~~**(2) Scalping** - Scalp the rock on a 3/4 inch sieve screen deck (after it has passed through the primary crusher if quarry rock is used). The material remaining may be accepted for use by visual inspection. The Engineer may perform verification testing of the gradation. The material shall meet the following:~~

~~**Sieve Size**~~	~~**Percent Passing (by Weight)**~~
~~8"~~	~~95 - 100~~
~~3/4"~~	~~5 Max.~~

~~**(3) Soundness** - Provide coarse and fine aggregate with a weighted loss not exceeding 12% when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.~~

~~**(4) Durability** - Provide aggregate not exceeding the following maximum values:~~

~~**Test**~~	~~**Test Method ODOT**~~	~~**Test Method AASHTO**~~	~~**Aggregates Coarse**~~
~~Abrasion~~		~~T 96~~	~~30.0%~~
~~Degradation Passing No. 20 sieve~~	~~TM 208~~		~~30.0%~~
~~Sediment Height~~	~~TM 208~~	~~3.0"~~	

~~**(5) Fractured Faces** - Provide crushed aggregate with not less than the minimum number of fractured faces as determined by AASHTO TP 61 as follows:~~

~~**Percent of Fracture (by Weight)**~~

~~**Type of Mix**~~	~~**Material Retained on 1 1/2", 1", 3/4", 1/2" and No. 4 Sieve on (two fractured faces)**~~	~~**Material Retained No. 8 sieve (one fractured face)**~~
~~All Dense Graded HMAC, ATPB~~	~~75~~	~~75~~
~~All Open Graded HMAC~~	~~90~~	~~75~~

~~**(6) Harmful substances** - Do not exceed the following values:~~

~~**Test**~~	~~**Test Method ODOT**~~	~~**Test Method AASHTO**~~	~~**Aggregates Coarse**~~	~~**Aggregates Fine**~~
~~Lightweight pieces~~		~~T 113~~	~~1.0%~~	

Wood Particles	TM 225	0.10%
Elongated Pieces (at a ratio of 5:1)	TM 229	10.0%
Plasticity Index	T 90	0 or NP
Sand Equivalent	T176	45 min.[1]

[1] 50 min. for Level 4 HMAC

(b) Coarse Aggregate - Provide coarse aggregate meeting the following:

(1) General Requirements - Produce coarse aggregate from crushed rock or other inert material of similar characteristics.

(2) Separated Sizes - Allowable separated sizes of coarse aggregate are as follows:

	Type of Asphalt - Allowable Separated Sizes			
Concrete Mixture	**1 1/4" - 3/4"**	**3/4" - No. 4**	**3/4" - 1/2"**	**1/2" - No. 4**
1" Dense	Yes	Yes	Yes	Yes
3/4" Dense, Open and ATPB	–	Yes	Yes	Yes
1/2" Dense and Open	–	–	–	Yes

(3) Grading - Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Establish the target values for each allowable separated size after a maximum of 10% of planned stockpile quantity has been produced. Produce the aggregate within the following listed tolerances (T):

	Separated Sizes			
	1 1/4" - 3/4"	**3/4" - No. 4**	**3/4" - 1/2"**	**1/2" - No. 4**
	Percent Passing (by Weight)			
Sieve Size	**T**	**T**	**T**	**T**
1 1/2"	- 1	–	–	–
1 1/4"	± 5	–	–	–
1"	± 10	- 1	- 1	–
3/4"	± 5	± 5	± 7	- 1
1/2"	–	± 8	± 8	± 5
3/8" *	–	–	–	–
No. 4	± 3	± 8	± 8	± 8
No. 8		± 5	± 5	± 5
No. 30	± 1	± 3	± 3	± 3
No 200	–	± 1.0	± 1.0	± 1.0

* Report percent passing sieve when no tolerance is listed

(c) Fine Aggregate - Provide fine aggregate meeting the following:

(1) General - Produce fine aggregate from crushed rock or other inert material of similar characteristics and if allowed, blend sand.

~~**(2) Separated Sizes** - Allowable separated sizes for fine aggregates are:~~

~~No. 4 - 0~~
~~No. 4 - No. 8~~
~~No. 8 - 0~~

~~**(3) Grading** - Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Establish the target values for each allowable separate size after a maximum of 10% of planned stockpile quantity has produced. Produce the aggregate within the following listed tolerances (T):~~

	~~**Separated Sizes**~~		
	~~**No. 4 - 0**~~	~~**No. 4 - No. 8**~~	~~**No. 8 - 0**~~
	~~**Percent passing (by Weight)**~~		
~~**Sieve Size**~~	~~**T**~~	~~**T**~~	~~**T**~~
~~3/8"~~	~~- 1~~	~~- 1~~	~~-~~
~~No. 4~~	~~± 7~~	~~± 10~~	~~- 1~~
~~No. 8~~	~~± 7~~	~~± 7~~	~~± 10~~
~~No. 30~~	~~± 7~~	~~± 5~~	~~± 8~~
~~No 200~~	~~± 3.0~~	~~± 2.0~~	~~± 4.0~~

~~**(4) Combination of Fine Aggregate for Testing** - Blend together fine aggregate produced in two separated sizes at a 1:1 ratio when testing for fine degradation, and sand equivalent.~~

~~**(5) Blend Sand** - No natural or uncrushed blend sand will be allowed in Level 4 HMAC unless approved. Blend sand is allowed for Levels 1, 2, and 3 mixes. For these mixes, establish the target gradation and produce all material within the following tolerances (T):~~

	~~**Percent Passing (by Weight)**~~
~~**Sieve Size**~~	~~**T**~~
~~3/8"~~	~~- 1~~
~~No. 4~~	~~± 5~~
~~No. 8~~	~~± 15~~
~~No. 30~~	~~± 20~~
~~No. 200~~	~~± 5.0~~

~~Determine sieve analysis according to AASHTO T 27 and AASHTO T 11. Do not blend more than 10% by weight of natural or uncrushed blend sand into the total fine aggregate to produce an allowable separated size unless approved. Provide a means of verifying and documenting the amount of blend sand added to the aggregate.~~

(c) Recycled Asphalt Shingles - RAS used in the production of new ACP is optional. Either manufacturer waste (post-manufacturer) RAS or tear-off (post-consumer) RAS may be used. Manufacturer waste RAS is processed asphalt shingle material derived from manufacturer's shingle scrap. Tear-off RAS is processed asphalt shingle material derived from shingle scrap removed from structures. All percentages are based upon dry weights for calculations.

(1) Processing Shingles - Process the RAS by grinding without adding moisture so that 100 percent of the shredded pieces are less than 1/2 inch in any dimension and that 90 percent are less than 3/8 inch in any dimension when sampled according to AASHTO T 2 and tested according to AASHTO T 27. Sample and test the processed RAS according to the MFTP.

(2) Harmful Substances - Certify that the RAS does not contain asbestos fibers according to the policies and procedures established by the Department of Environmental Quality. Test deleterious materials according to ODOT TM 335 according to the MFTP. Limit the percentage of deleterious materials to 1.0 percent. If fine aggregate is added as an anti-clumping agent, sample and test processed RAS for harmful substances before adding the fine aggregates.

(3) Anti-Clumping Additive - Fine aggregate meeting the requirements of 00745.10(a-3-c) may be added to the RAS in a quantity not to exceed 4 percent by weight of RAS to keep the material workable and to prevent conglomeration of the shingle particles in the stockpile. RAS may also be blended with RAP in controlled percentages to preclude clumping. Do not contaminate stockpiled RAS with dirt or other foreign materials.

(4) Allowable Percentages - No more than 5.0 percent RAS by total weight of aggregate is allowed in ACP mixtures. Restrict the maximum allowable percentage of asphalt binder replacement to 20.0 percent for base courses and 15.0 percent for wearing courses in ACP containing only RAS.

When RAS is used in conjunction with RAP, restrict the maximum allowable percentage of binder replacement to 30.0 percent for base courses and 25.0 percent for wearing courses.

(5) Establishing Mix Design Inputs - For ACP mixtures containing RAS or RAM, following any addition of fine aggregate as an anti-clumping agent, test the material according to ODOT TM 319 to establish the asphalt content, material specific gravities, and gradation. Develop mixture designs according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

(d) ~~RAP~~Reclaimed Asphalt Pavement and Recycled Asphalt Shingle Aggregate - Blend the RAP, RAS, or RAM material with new aggregate to provide a mixture conforming to the JMF within the tolerances specified. Have a CAT-I perform sampling and testing of RAP and RAS aggregates according to Section 00165 and the MFTP.

(e) Stockpiling - Prepare the ground for the stockpile site to prevent contamination. Prevent segregation and contamination, as much as possible, when stockpiling and removing the aggregate.

(f) Aggregate Production Quality Control - ~~A~~Have a CAgT ~~shall~~ perform sampling and testing of aggregates according to Section 00165 and the MFTP. Statistically evaluate the aggregates according to Section 00165 and the MFTP. Sample before treating with hydrated lime, when lime is required.

(g) Preproduced Aggregate - Compliance of aggregates produced and stockpiled before the award date or notice to proceed of this Contract will be determined by (1) or (2) below. The material shall meet the requirements of 00745.10.

(1) Continuing production records meeting the requirements of Section 00165 and the MFTP.

(2) Sampling and testing of the entire stockpile according to Section 00165 and the MFTP.

00745.11 Asphalt Cement, Additives, and Aggregate Treatment - Furnish the following asphalt cement, additives and aggregate treatments:

(a) Asphalt Cement - Use the grade of asphalt specified in the Contract Documents. Provide asphalt cement conforming to the requirement of ODOT's publication "Standard Specifications for Asphalt Materials". Copies of the publication are available from ODOT's Pavement Services Engineer. The applicable specifications are those contained in the current publication on the date the project is advertised.

PG 64-22 or PG 64-28 asphalt cement may be substituted for the grade of asphalt cement specified in the Contract for guardrail flares, mailbox turnouts, road approaches, driveways, and non-travel lane areas of restricted widths that are less than 8 feet wide, excluding shoulders. Use of substitute asphalt cement for these areas will not require a new JMF.

(b) Asphalt Cement Additives - ~~When required by the JMF, add antistripping additives meeting the requirements below and satisfying the Tensile Strength Ratio (TSR) specified in 00745.13.~~

~~Additives to prevent stripping or separation of asphalt coatings from aggregates, and admixtures used to aid in the mixing or use of asphalt mixes or for experimental purposes, shall be~~ Use standard recognized asphalt cement additive products that are of known value for the intended purpose and approved for use on the basis of laboratory tests~~. They shall~~ and capable of being thoroughly mixed. Do not use asphalt cement additives that have ~~no~~ deleterious ~~effect~~effects on the asphalt material~~ and be completely miscible.~~. Do not use silicones as an additive. Add the following asphalt cement additives when required by the JMF:

- Anti-stripping asphalt cement additives to prevent stripping or separation of asphalt coatings from aggregates to satisfy the TSR specified in 00745.13.
- Asphalt cement admixtures used to aid in the mixing.

When WMAC is used, select one of the WMAC technologies and process and additive types identified on ODOT's publication "Approved WMAC Technologies".

Submit the proposed WMAC technology to be used and a plan for its implementation at the pre-construction conference.

Comply with the manufacturer's recommendations for incorporating additives and WMAC technologies into the mix. Comply with manufacturer's recommendations regarding receiving, storing, and delivering the additives.

(c) Aggregate Treatment - When lime treated aggregate is specified in the Contract Documents or required to satisfy the TSR specified in 00745.13, treat new crushed aggregates, except those in RAP, RAS, or RAM materials, with dry hydrated lime meeting the requirements of ASTM C 1097. Treat aggregate as follows:

(1) General:

a. Mix the hydrated lime, water, and aggregate thoroughly in a pug ~~-~~mill.

b. Determine the quantity of lime in aggregate for each sublot according to ODOT TM 321. If the rates of application specified in 00745.11(c-2-b) are not met, take corrective action. Document the corrective action and notify the Engineer.

(2) Treatment During ~~HMAC~~ Production:

a. Mix dry lime, water (if necessary to achieve SDC), and aggregates thoroughly in a pug ~~-~~mill before they enter the paving plant dryer.

b. Proportions of hydrated lime ~~and aggregate moisture (percents~~(percent by dry weight of dry aggregates~~):~~) and aggregate moisture:

		~~Dense~~	~~Open~~
Hydrated Lime (%)	1.0	~~0.7~~	
Lime Tolerance (%)		- 0.2/+ 0.5	~~- 0.2/+ 0.5~~

00745.12 Mix Type and Broadband Limits~~ Mix~~ - Furnish the mix type ~~and~~ specified in the Contract Documents within the broadband limits ~~shall meet~~according to the following:

(a) Mix Type - Furnish the ~~type(s)~~types of ~~HMAC~~ACP shown or as directed. ~~The broadband limits for each of the mix types are specified in 00745.12(b).~~ When the plans allow an option of two types for a course of pavement, use only one type throughout the course.

(b) Broadband Limits - Provide a JMF for the specified mix type within the control points listed below:

~~Dense Graded Mixes~~

Sieve Size	~~1" Dense~~		3/4" ~~Dense~~ACP Control Points (% passing by Weight)		1/2" ~~Dense~~ACP Control Points (% passing by Weight)		3/8" ~~Dense~~ACP Control Points (% passing by Weight)		~~Control Points (% passing by Weight)~~	
	~~Min.~~	~~Max.~~	~~Min.~~	~~Max.~~		~~Min.~~	~~Max.~~	~~Min.~~		
~~1 1/2"~~	~~100~~									
~~1"~~	~~90~~	~~100~~	~~100~~							
~~3/4"~~		~~90~~	~~90~~	~~100~~		~~100~~				
~~1/2"~~				~~90~~		~~90~~	~~100~~	~~100~~		
~~3/8"~~							~~90~~	~~90~~		
~~No. 4~~										
~~No. 8~~	~~19~~	~~45~~	~~23~~	~~49~~		~~28~~	~~58~~	~~32~~		
~~o. 200~~	~~1.0~~	~~7.0~~	~~2.0~~	~~8.0~~		~~2.0~~	~~10.0~~	~~2.0~~		

~~Open Graded Mixes~~

~~Sieve Size~~	~~1/2" Open~~		~~3/4" Open~~		~~3/4" ATPB~~	
	~~Control Points (% passing by Weight)~~		~~Control Points (% passing by Weight)~~		~~Control Points (% passing by Weight)~~	
	Min.	Max.	Min.	Max.	Min.	Max.
1"	100		~~99~~	~~100~~	~~99~~	~~100~~
3/4"	~~99~~90	100	~~85~~100	~~96~~	~~85~~	~~95~~
1/2"	~~90~~	~~98~~90	~~55~~90	~~71~~100	~~35~~100	~~68~~
~~No. 4~~3/8"	~~18~~	~~32~~	~~10~~	~~24~~90	~~2~~90	~~10~~100
No. ~~8~~4	~~3~~	~~15~~	~~6~~	~~16~~	~~0~~	~~5~~90
No. ~~200~~8	~~1.0~~23	~~5.0~~49	~~1.0~~28	~~6.0~~58	~~0.0~~32	~~2.0~~67
~~Asphalt Cement~~No. 200	~~*~~2.0	~~*~~8.0	~~*~~2.0	~~*~~10.0	2.~~5~~0	~~3.5~~10.0

~~* Per JMF~~

00745.13 Job Mix Formula ~~(JMF)~~ Requirements~~ -~~ - Do not begin production of ~~HMAC~~ACP for use on the project until the JMF is reviewed by the Engineer and written consent is provided to proceed. The JMF proposed for use on the project will be evaluated based on the criteria identified in

00745.13(b) and 00745.13(c) and the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete. ~~For all mixes, complete TSR testing at least once per calendar year on mix from the first week of production of that JMF for that year.~~ A new JMF is required if the asphalt cement grade, any additives, or the source of the aggregate change during production. A change in the source of asphalt cement requires a new ~~JMF for open graded HMAC, but only a new~~ passing TSR ~~for dense graded HMAC~~.

Provide a range of proposed JMF targets to the CMDT. The CMDT will select targets from within the proposed range if all of the JMF requirements of 00745.13(b) are met.

~~**(a) Contractor Provided**~~A separate JMF ~~. The~~ will be issued for WMAC. Do not use RAS in WMAC mixes with minimum compaction temperatures less than 260 °F.

When WMAC is used, provide the following information in addition to the requirements listed for HMAC:

- WMAC technology and WMAC additives information.
- WMAC technology manufacturer's established recommendations of usage.
- WMAC technology manufacturer's established target rate for water and additives, and the acceptable variation for production.
- WMAC technology material safety data sheets if applicable.
- Temperature range for mixing.
- Temperature range for compacting.
- Except for foaming technology, asphalt binder performance grade test data of the asphalt binder and chemical additive at the manufacturer's recommended dosage rate.
- Except for foaming technology, WMAC mixture performance test results. Perform testing for foaming technology on the production mix on specimens compacted at WMAC compaction temperatures.

Have a CMDT ~~shall~~ prepare, sign and submit a JMF to the Engineer for each mixture required at least 10 calendar days ~~prior to~~before the anticipated use in ~~HMAC~~ACP, and according to the latest copy of the ODOT Contractor Mix Design Guidelines for Asphalt Concrete. If requested, submit material samples 10 calendar days ~~prior to~~before use.

~~**(b) JMF**~~
(a) Job Mix Formula Requirements - ~~The~~Provide a JMF ~~shall meet~~meeting the following mixture requirements:

~~**Dense Graded Mixture**~~

	Level 1	**Level 2**	**Level 3**	**Level 4**
Design Method	Superpave	Superpave	Superpave	Superpave
Compaction Level	65 Gyrations	65 Gyrations	80 Gyrations	100 Gyrations
Air Voids, %	3.5	4.0	4.0	4.0
VMA, % minimum	1/2 inch - 14.0 3/8 inch - 15.0	3/4 inch - 13.0 1/2 inch - 14.0 3/8 inch - 15.0	3/4 inch - 13.0 1/2 inch - 14.0 3/8 inch - 15.0	3/4 inch - 13.0 1/2 inch - 14.0 3/8 inch - 15.0
VMA, % maximum	min + 2.0%	min + 2.0%	min + 2.0%	min + 2.0%
P No. 200 / Eff. AC ratio	0.8 to 1.6	0.8 to 1.6	0.8 to 1.6	0.8 to 1.6
TSR, % minimum	80	80	80	80
VFA, %	70 - 80 3/8 inch: 70 - 80	65 - 78 3/8 inch: 70 - 80	65 - 75 3/8 inch: 70 - 80	65 - 75 3/8 inch: 70 - 80

~~**Open Graded Mixture**~~

	~~**3/4" Open and**~~	~~**1/2" Open 3/4" ATPB**~~
~~Design Method~~	~~ODOT~~	~~ODOT~~
~~Air Voids, %~~	~~13.5 - 16.0~~	
~~Draindown, %~~	~~70 - 80~~	
~~TSR *, minimum~~	~~80~~	
~~Coating, %, minimum~~	~~90~~	
~~VFA, %~~	~~40 - 50~~	

~~* Run the TSR for open graded mixtures on a surrogate dense graded mixture. If a dense graded JMF has been prepared for the same material sources in the last year, the results for the most recent TSR may be applied to the open graded mixture. If not, prepare the TSR test samples for a dense graded mix using the equivalent top size stone and materials from the same sources, which will represent the open graded mixture.~~

~~(c~~(b) **Performance Test** - For ~~dense graded~~ Level 3 wearing course mixes and all ~~dense graded~~ Level 4 mixes, the mix design submittal shall include the results of performance testing as outlined in the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

00745.14 Tolerances and Limits ~~-~~ - For gradation, measure the sieves with a weighting factor of one or more according to 00745.95. Produce and place ~~HMAC~~ACP within the following JMF tolerances and limits:

~~Gradation~~ Gradation Constituent	~~Dense-Graded HMAC Type~~				~~Open-Graded HMAC Type~~			
	~~1"~~	3/4"	1/2"	3/8"	~~3/4"~~	~~1/2"~~	~~ATPB~~	
1 ~~1/2~~"	JMF ± 5~~%~~*%							
~~1"~~	~~90 - 100%~~	~~JMF ± 5%*~~					~~99 -~~	~~99 -~~
3/4"	~~JMF ± 5%~~	90 - 100%	JMF ± 5~~%~~*% *		~~85 - 96%~~	~~99 - 100%~~	~~85 - 95%~~	
1/2"	JMF ± 5%	~~JMF ± 5%~~	90 - 100%	JMF ± 5~~%~~*%	~~55 - 71%~~	~~90 - 98%~~	~~35 - 68%~~	
3/8" **	–		–	90 - 100%	–	–	–	
No. 4	JMF ± 5%		JMF ± 5%	JMF ± 5%	~~JMF ± 5%~~	~~JMF ± 5%~~	~~JMF ± 5%~~	~~JMF ± 5%~~
No. 8	JMF ± 4%		JMF ± 4%	JMF ± 4%	~~JMF ± 4%~~	~~JMF ± 4%~~	~~JMF ± 4%~~	~~JMF ± 4%~~
No. 16 **	=		=			=		
No. 30	JMF ± 4%		JMF ± 4%	JMF ± 4%	~~JMF ± 4%~~	~~JMF ± 4%~~	~~JMF ± 4%~~	–
No. 50 **	=		=			=		
No. 100 **	=		=			=		
No. 200	JMF ± 2.0%		JMF ± 2.0%	JMF ± 2.0%	~~JMF ± 2.0~~	~~JMF ± 2.0~~	~~JMF ± 2.0%~~	~~JMF ± 2.0%~~

	%	%

* Maximum not to exceed 100 %
** Report percent passing sieve when no tolerance is listed

* Maximum not to exceed 100%

Constituent of Mixture	HMAC All TypesACP
Asphalt Cement - ODOT TM 321	(Cold Feed/Meter) JMF ± 0.20%
Asphalt Cement - AASHTO T 308 (Ignition) and ODOT TM 323	JMF ± 0.50%
RAP Content - ODOT TM 321	JMF ± 2.0%
RAS Content - ODOT TM 321	JMF ± 1.0%
RAM Content - ODOT TM 321	JMF ± 2.0%
Moisture content at time of discharge from the mixing plant - WAQTC TM 6	Open-graded * 1.10% max.
Dense-gradedAASHTO T 329	0.80% max.

* Does not apply to 3/4" ATPB

When a JMF tolerance applies to a constituent, full tolerance will be given even if it exceeds the Control Pointscontrol points established in 00745.12(b). Full tolerance will be given for RAP content even if it exceeds the limits established in 00745.03.10(b). Full tolerance will be given for RAS or RAM content even if it exceeds the limits established in 00745.10(c).

Take corrective action when the RAP, RAS, or RAM content exceeds the above tolerance. If the RAP, RAS, or RAM content continues to be outside tolerance, stop production until a plan for corrective action is approved by the Engineer.

00745.16 HMACAsphalt Concrete Pavement Production QC/QA - The - Provide ACP according to the following provisions apply to all HMAC:

(a) Quality Control - Provide and maintain a quality control program as defined in Section 00165, the MFTP, and according to the following:

(1) Personnel Requirements - Maintain quality control by:

- Obtaining samples under the direct supervision of a CAT-Iaccording to the MFTP with certified technicians.
- Having all testing, data analysis and reporting of test results performed by a CAT-I or an assistant technician under the direct observation of a CAT-I.,
- Having a CAT-II available to evaluate and reconcile laboratory and field test results, submit required forms within required timeframes, and make necessary process adjustments.
- Providing at least one CAT-I full-time at each plant site when producing mixture for the Project.
- Providing access to laboratory facilities, technicians, and test results to the Engineer at all times during the production and testing process.

(2) Laboratory Requirements - Furnish and maintain an ODOT certified quality control laboratory. Furnish the laboratory with the necessary equipment and supplies for performing Contractor quality control testing. Calibrate all testing equipment according to the required test methods. The Engineer may inspect measuring and testing devices to confirm both calibration and condition.

The laboratory shall be operational ~~prior to the~~before beginning ~~of HMAC~~the ACP production and be equipped with a telephone or cellular telephone, if either service is available. Provide laboratory equipment meeting the requirements of the applicable test methods identified in these Specifications and selected for use on the project.

(3) ~~HMAC~~ Production Sampling and Testing - Perform sampling and testing according to Section 00165 and the MFTP.

(4) Testing Frequency - Conduct the above testing program, once for each sublot, on randomly selected samples for each design mixture. ~~(~~Do not obtain the first sample of the day in the first 25 tons of production~~.)~~. If the random number indicates that the sample is to be obtained in the first 25 tons, sample at 25 tons. In addition, test the asphalt content at least once during each day of production. This requirement may be waived by the Engineer.

~~After the Mix Design Verification (MDV) testing requirements of 00745.16(b) have been met, the frequency for Maximum Specific Gravity (AASHTO T 209) testing may be reduced to only the first sublot produced each day, or a minimum of one test per day.~~

Provide "QC Program" sampling and testing frequencies (random numbers) to the Engineer ~~prior to~~before starting production. Provide QC test results to the Engineer by the middle of the following work shift.

~~When the Statistical Evaluation Method of 00745.95 is used, stop~~Stop production when the pay factor for any constituent with a weighting factor greater than one falls below 0.75. Resume production when a plan for correction is accepted by the Engineer.

(5) Plant Calibration - Calibrate all meters and belt scales at the ACP mixing plant according to ODOT TM 322 before beginning production.

(b) Mix Design Verification ~~(MDV):~~:

(1) ~~MDV~~Mix Design Verification Quality Control~~:~~:

a. General - Before beginning production and placement of WMAC, perform mix design verification (MDV) tests on the HMAC as required at start-up according to 00745.16(b-1-d). Two consecutive MDV test results from testing of HMAC shall be within the limits of 00745.16(b-1-a). The Engineer may waive ODOT TM 306 for HMAC production required before WMAC production for one shift.

Perform MDV testing on projects with Level 2, Level 3, or Level 4 ~~dense graded HMAC and at least once per calendar year for each JMF. If MDV testing has been completed for the JMF previously, submit verification to the Engineer.~~

ACP. Perform MDV tests on every sublot and as required at start up according to 00745.16(b-1-c) and the MFTP. Perform gradation and asphalt content testing with each MDV test~~.~~:

- Air Voids

- Voids in Mineral Aggregate (VMA)
- Voids Filled with Asphalt (VFA)
- ~~P~~Passing No. 200~~ / ~~/Effective ~~AC~~Asphalt Content (Pbe) Ratio

~~MDV testing may be discontinued when at least two~~ The running averages of four MDV results ~~are~~shall be within the limits given below:

	Average of	Limit
Air Voids	4 samples	JMF Target ± 1.0%
VMA	4 samples	12.5 - 17.0 (3/4" Mix)
		13.5 - 17.0 (1/2" Mix)
		14.5 - 17.0 (3/8" Mix)
VFA	4 samples	~~Match 00745.13(b)~~ 65 - 75 (3/4" and 1/2" Mix in Level 3 and 4)
		65 - 78 (3/4" and 1/2" Mix in Level 2)
		70 - 80 (1/2" Mix in Level 1 and 3/8" Mix in Levels 1 - 4)
~~P~~Passing No. 200~~ / ~~/Pbe	4 samples	0.8~~ to ~~ - 1.6

~~Restart MDV testing when any individual Maximum Specific Gravity test deviates from the last (MAMD divided by 62.4 pounds per cubic foot) by 0.020 or more. Begin retesting according to the start-up MDV requirements of 00745.16(b-1-c). MDV testing may be discontinued again when the above criteria is met.~~

~~The CDT shall~~ **b. Laboratory Compactor Selection** - Use the equivalent laboratory compactor for MDV as used to develop the JMF.

c. Reconciliation of Laboratory and In-place Properties - Have a CDT provide the results from the initial control strip to the CAT-II for evaluation and comparison with the MDV results~~.~~ at the completion of the control strip. If the MDV and density test results are contradictory, inform the Engineer and initiate an investigation. The CAT-II shall recommend a plan to the Engineer for resolving the discrepancy based on the results of the investigation. Submit results of investigation and plan no later than the end of two shifts after investigation has been initiated.

d. Mix Design Verification Requirements at Start-Up - Perform ~~a Tensile Strength Ratio (TSR) test (AASHTO T 283) on a sample obtained during~~MDV testing at the ~~first two days~~start-up of the JMF production ~~after QC test results verify that HMAC constituents with a weighting factor greater than one~~ according to ~~00745.95 are in tolerance. Provide test results to the Engineer within five calendar days~~the following process:

1. Obtain a sample in the first 100 tons of ~~obtaining the sample. The TSR shall be within 20 points of the value reported on the JMF. Stop~~ production and immediately perform MDV testing.

2. If the Va and VMA mix properties of 00745.16(b-1-a) are within tolerance, then continue subsequent MDV testing at the established random QC sublot interval. If not, then go to step "3".

3. If the Va and VMA mix properties are out of tolerance in 00745.16(b-1-a), then make mix adjustments ~~if the TSR is 20 points or more lower than the design value. Restart~~within the requirements of 00745.16(b-1-e) and immediately obtain another sample and perform MDV testing. Two adjustments will be given. If any of the test

results for Va and VMA are not within the limits of 00745.16(b-1-a) after second adjustment, then stop production ~~only after~~and go to step "4".

4. Have the CAT-II submit the revised JMF targets and production and plant adjustments to the Engineer. Obtain the approval of the Engineer ~~has approved the proposed adjustments~~before restarting production. Production will be restarted with MDV testing according to this subsection.

Use the initial MDV sample as the first random QC sublot test. Subsequent MDV samples required due to failure of start-up criteria will be used for a sublot QC test if the sample is taken within 100 tons of the scheduled random QC sample location. If not, perform the MDV testing separate from, and not included in, the random QC testing program. Complete all required MDV testing at no additional cost to the Agency.

e. Corrective Action - Take corrective action when required by the MDV start-up process of 00745.16(b~~-~~1~~-c~~-d). After the requirements of 00745.16(b-1-~~c~~d) have been met, take corrective action if the MDV test results show that two consecutive ~~individual~~running averages of four samples are outside the ~~above~~ limits for air voids, VMA, ~~or VFA.~~VFA, or P No. 200/Pbe ratio according to 00745.16(b-1-a). Document the corrective action and ~~notify~~submit to the Engineer. If the subsequent MDV test results ~~continue to be~~following the corrective action are outside the ~~tolerance,~~limits of 00745.16(b-1-a), immediately stop production and make adjustments. Restart production according to 00745.16(b-1-d) only after the Engineer has approved the proposed adjustments. If the MDV test results are outside ~~tolerance,~~the limits of 00745.16(b-1-a), but the mixture meets the current requirements for gradation and asphalt content, an adjustment to the JMF targets is required. ~~Do not start a~~A new lot is not required as a result of the adjustment.

f. Field Tensile Strength Ratio Testing - Perform a Tensile Strength Ratio (TSR) test according to AASHTO T 283 on a sample obtained during the first 2 days of production after QC test results verify that ACP constituents with a weighting factor greater than one according to 00745.95 are in tolerance. Provide test results to the Engineer within 6 calendar days of obtaining the sample. Stop production and make adjustments if the TSR is less than 70. Restart production only after the Engineer has approved the proposed adjustments.

The Engineer may waive Field TSR testing if the Contractor provides Field TSR data dated within the prior 3 months of the first MDV sample.

g. Request for Job Mix Formula Target Adjustment - A request for an adjustment to the JMF targets may be made to the Engineer by the Contractor's CAT-II. The requested change will be reviewed and documented by the Engineer. If acceptable, a revised JMF will be allowed. ~~Clearly document~~Document the sublot test for which the adjusted targets are in effect. ~~Adjustments~~When making adjustments for gradation ~~shall~~do not exceed the tolerances specified for the original JMF limits. ~~Adjustments for~~ Keep AC content ~~shall be~~adjustments for HMAC within 0.5~~%~~ percent of the original JMF. Keep AC content adjustments for WMAC within 0.3 percent of the original JMF. The JMF asphalt content may only be ~~reduced~~adjusted if the production VMA meets ~~or exceeds~~ the ~~above~~ requirements~~. Adjustments~~ of 00745.16(b-1-a). Keep adjustments for RAP ~~content shall be~~or RAM within 5~~%~~ percent of the original JMF blend percentage, but ~~shall~~do not exceed the requirements of ~~00745.03.~~ 00745.10(b) or 00745.10(c). Adjusting proportions of the combined RAP and RAS will not be allowed during production of the mixture. Keep adjustments for RAS content within 1 percent of the original JMF, but do not exceed the requirements of 00745.10(c). A gradation adjustment is required if the VMA is outside of the 00745.16(b-1-a) limits. Regardless of these tolerances, keep the adjusted JMF ~~shall be~~ within the mixture specification control points of 00745.12. If a redesign of the mixture

becomes necessary, submit a new JMF according to the requirements of these ~~Specifications~~specifications.

~~**b. Laboratory Compactor** - Use a Gyratory compactor for MDV when a Gyratory compactor is used to develop the JMF and for all other cases.~~

~~**c. MDV Requirements at Start-Up** - Conduct gradation and asphalt content tests for each MDV test. Perform MDV testing at the start-up of the JMF production according to the following process:~~

~~**1.** Obtain a sample during the first 100 tons of production and immediately perform MDV testing.~~

~~**2.** If air voids and VMA are within tolerance, then continue remaining MDV testing at the established random QC sublot interval until requirements of 00745.16(b-1) are met. If not, then go to step "3".~~

~~**3.** If air voids and/or VMA are out of tolerance according to 00745.16(b-1-a), then make adjustments and immediately obtain another sample and perform MDV testing. Go to step "4".~~

~~**4.** If air voids and VMA from the MDV testing in step "3" are within tolerance, then continue remaining MDV testing at the established random QC sublot interval until requirements of 00745.16(b-1) are met. If not, go to step "5".~~

~~**5.** If air voids from step "3" are more than plus or minus 1.5% from the target, then stop production immediately and make adjustments. If they are not, then go to step "6". Obtain approval of the Engineer before restarting production. Begin MDV testing again at step "1".~~

~~**6.** If air voids from step "3" are out of tolerance and 1.5% or less from the target, or the VMA from step "3" is out of tolerance, then make adjustments and immediately obtain another sample and perform MDV testing. Go to step "4".~~

~~Use the initial MDV sample as the first random QC sublot test. Subsequent MDV samples required due to failure of start-up criteria will be used for a sublot QC test if the sample is taken within 100 tons of the scheduled random QC sample location. If not, the MDV testing shall be performed separate from, and not included in, the random QC testing program. Complete all required MDV testing at no additional cost to the Agency.~~

~~**(2) MDV**~~**(2) Mix Design Verification** **Quality Assurance** - The Engineer will observe and document the Contractor's performing of MDV test procedures and calculations. Immediately correct any deviations from the specified test procedures. The Engineer may conduct MDV assurance testing at any time.

(3) Mix Design Verification for Warm Mix Asphalt Concrete - Perform MDV ~~**for Open Graded HMAC** - Adjust asphalt content and gradation targets for open graded HMAC during~~testing on WMAC according to 00745.16(b-1-a). Continued production ~~as directed. The Engineer~~and placement of WMAC will ~~document~~be allowed at the ~~sublot test for which~~discretion of the ~~adjusted targets are in effect~~Engineer.

(c) Quality Assurance and Acceptance - Any quality assurance testing for Level 1 and Level 2 ~~HMAC~~ACP will be at the discretion of the Engineer. The Agency will provide quality assurance according to Section 00165 for Level 3 and Level 4 ~~HMAC~~ACP. When QA testing is

performed, the Contractor's quality control results will be used for acceptance if they are within acceptable limits of the QA test results as defined by ODOT's Quality Assurance Program.

00745.17 Small Quantity Acceptance - When the quantity of ~~HMAC~~ACP in a lot is less than 2,500 tons, the Engineer may accept the ~~HMAC~~ACP according to Section 4(B) of the MFTP or by test results according to the following:

(a) Within Specification Limits - If all sublot sample test results are within specification limits for all constituents~~ (~~, including compaction~~)~~, the material will be accepted and the full bid price will be paid for the material represented by that test.

(b) Outside Specification Limits - If a sublot sample test result for any constituent is outside the specification limit the Engineer will have the backup sample tested.

(1) Backup Within Specifications - If the backup sample test results for all constituents are within specification, the material will be accepted and the full bid price will be paid for the material represented by that test.

(2) Backup Out of Specifications - If the backup sample test results are out of specification, the Contractor may choose to accept the price adjustment calculated according to 00745.95 or may choose to sample the in-place material for further testing ~~following~~according to 00745.17(b-3). The price adjustments will be computed using all original test results as well as all backup test results. ~~(~~If there are less than three tests, average the two tests ~~you have~~ and use the average as ~~the~~a third test result~~.) In no case will the~~. The maximum composite pay factor (CPF) will be ~~greater than~~ 1.0.

(3) In-Place Samples - If the Contractor chooses to sample the in-place material, sample from a minimum of three random locations from the area represented by the lot in question under the observation of the Engineer. ~~Those samples will be tested and if found to be~~If the in-place sample test results are within specification, the material will be accepted and paid for at the full bid price. ~~If the material proves to be outside of~~If the in-place sample test results are not within specification~~ limits~~, the material will be accepted and paid for at an adjusted price according to 00745.95. ~~In no case will the~~The maximum CPF will be ~~above~~ 1.0. Perform sampling and testing of in-place material at no additional cost to the Agency.

Equipment

00745.20 Lime Treated Aggregate Plant~~ -~~ - When lime treated aggregate is specified, provide a mixing plant that includes:

- ~~**(a) Pug Mill** -~~ A pug mill that mixes the aggregate and lime until the aggregate is uniformly coated and the lime is distributed throughout the aggregate.
- Provide a system for adding water to the pug mill if necessary to achieve aggregate that is in SDC. This requirement may be waived by the Engineer if the stockpiled aggregates are watered to the satisfaction of the Engineer.
- ~~**(b) Lime Metering Device** -~~ A lime metering or weighing device that determines the amount of lime incorporated within any selected time period. Provide a device that is of sufficient accuracy to supply lime within the tolerances specified in 00745.11(c).

00745.21 ~~**HMAC**~~ **Mixing Plant** - Provide ~~HMAC~~ACP plants that comply with the following:

(a) DEQ Permits - Before producing ~~HMAC~~ACP for this Contract at a new or revised plant location, provide the Engineer with copies of all permits according to 00160.70.

(b) Scales - Provide required scales to assure a uniform mixture. Check and adjust scales according to 00190.30.

(c) Vibratory Scalping Devices - Provide vibratory scalping devices ahead of the mixer to reject aggregate, RAP, RAS, or RAM and lumps of cemented material that are detrimental to the mix.

(d) Asphalt Antistrip Additive Metering Device - When asphalt antistrip additive is added into the asphalt at the ~~HMAC~~ACP mixing plant, provide a means to weigh or meter the additive at a specified rate that has an accuracy of plus or minus 0.5~~%.~~ percent.

(e) Thermometers - Provide the following:

- A direct reading, full operating range thermometer in the asphalt feed line near the mixer unit.
- A thermometric instrument that automatically registers the temperature of the materials at the discharge of the mixer.

(f) Sampling Devices - Provide and operate a device that produces a representative sample of the quantity of material required for the appropriate tests when sampling at or around crushing, screening or mixing plants.

(g) Warm Mix Asphalt Concrete Mixing Production - Modify the asphalt mixing plant as required by the manufacturer to introduce the WMAC technology. Plant modifications may include additional plant instrumentation, the installation of asphalt binder foaming systems and WMAC additive delivery systems, tuning the plant burner, and adjusting the flights in order to operate at lower production temperatures and reduced tonnage. Document the integration of plant controls and interlocks.

00745.22 Hauling Equipment - Provide hauling vehicles in good operating condition with tight, clean, smooth beds. Coat the beds with a minimum amount of an approved material to keep the ~~HMAC~~ACP from sticking to the beds. Do not use diesel oil. Drain excess coating material before loading by raising the truck bed, opening belly dump gates, or operating the conveyor belt, as appropriate.

00745.23 ~~HMAC~~ Pavers ~~- Pavers shall comply with the following:~~ - Provide pavers that are:

- ~~**(a) Power and Support** -~~ Self-contained, self-propelled, supported on tracks or wheels, none of which contact the mixture being placed.

- ~~**(b) Augers and Screed** -~~ Equipped with augers and a screed or strike-off assembly, heated if necessary, which:
  - Can spread and finish the ~~HMAC~~ACP to a uniform texture, in the specified widths, thicknesses, lines, grades and cross sections.
  - Will not segregate, tear, shove or gouge the ~~HMAC~~ACP.

- ~~**(c) Control System** -~~ Equipped with a paver control system which:
  - Controls the ~~HMAC~~ACP placement to specified slope and grade.
  - Maintains the paver screed in proper position.
  - Provides the specified results through mechanical sensors and sensor-directed devices actuated from independent line and grade control references.

- ~~**(d) Illumination** - Provide~~Equipped with adequate lighting to illuminate the paver and the roadway in front of and behind the paver during the period from 30 minutes after sunset to 30 minutes before sunrise, or as ~~deemed necessary by the Engineer.~~directed. Shield lighting from adjacent traffic as necessary. Provide a minimum light level of 10 footcandles as measured by the Engineer on the roadway surface at a distance of 16 feet from the front and back edges of the paver.

00745.24 Compactors~~.~~ - Provide the specified self-propelled rollers capable of reversing without backlash, as follows:

(a) Steel-Wheeled Rollers - Steel-wheeled rollers ~~shall have~~with a minimum gross static weight as follows:

~~• A gross static weight of at least 8 tons.~~

~~If steel-wheeled rollers are used for finish rolling, they shall have:~~

~~• A gross static weight of at least 6 tons.~~

	Level 1 and Level 2	Level 3	Level 4
Breakdown and Intermediate	8 ton	10 ton	12 ton
Finish	6 ton	8 ton	10 ton

(b) Vibratory Rollers - Vibratory rollers ~~shall be~~that:

- ~~Equipped~~Are equipped with amplitude and frequency controls.
- ~~Specifically~~Are specifically designed to compact ~~HMAC~~ACP.
- Are Capable of at least 2000 vibrations per minute.

Have a minimum gross static weight meeting the requirements of 00745.24(a).

Do not operate in vibratory mode for lifts thinner than two times the maximum aggregate size for the type of ~~HMAC~~ACP being compacted.

If vibratory rollers are used for finish rolling, they shall:

- Have a minimum gross static weight meeting the requirements of 00745.24(a).
- Not be operated in the vibratory mode.

(c) Pneumatic-tired Rollers - Pneumatic-tired rollers shall:

- Be tandem, or multiple axle, multiple wheel type.
- Have smooth-tread, pneumatic tires of equal size.
- Have tires staggered on the axles, spaced and overlapped to provide uniform compacting pressure for the full compacting width.
- Have a minimum total load of 2,800 pounds per tire with tire inflation pressures of 45 psi to 90 psi
- Be fully skirted to reduce tire heat loss and mixture pick up.

(d) Illumination - Provide adequate lighting to illuminate each compactor and the roadway in front of and behind each compactor during the period 30 minutes after sunset to 30 minutes before sunrise, or as ~~deemed necessary by the Engineer.~~directed. Shield lighting from adjacent traffic as necessary. Provide a minimum light level of 10 footcandles as measured by the

Engineer on the roadway surface at a distance of 60 feet from the front and back edges of each compactor.

Labor

00745.30 Quality Control Personnel~~--~~ - Provide ~~certified~~ technicians ~~in the following fields:~~

having CAgT, CAT~~-~~-I, CAT~~-~~-II, CDT, and CMDT technical certifications.

Construction

00745.40 Season and Temperature Limitations~~--~~ - Place ~~HMAC~~ACP during the dates indicated, and when the temperature of the surface that is to be paved is not less than the temperature indicated:

Nominal Compacted Thickness of Individual Lifts and Courses as shown on the typical section of the plans	All Levels	Level 1 and Level 2	Level 3 and Level 4	
		All Courses	Travel Lane Wearing Course	All Other Courses
	Surface Temperature*	From To Inclusive	From To Inclusive	From To Inclusive
~~**Open Graded Mixes**~~				
~~Less than 2 inches~~	~~60 °F~~		All Year**	3/15 9/30
~~3/15 9/30~~		~~3/15 9/30~~		
~~2 inches and Greater~~			~~50 °F~~	~~3/15 9/30~~
~~3/15 9/30~~		~~3/15 9/30~~		
~~ATPB~~	~~40 °F~~	~~All Year~~	~~NA NA~~	All Year**
~~**Dense Graded Mixes**~~				
~~Less than 2 inches~~	~~60 °F~~		~~All Year**~~	~~3/15 9/30~~
~~All Year**~~				
2 inches - 2 1/2 inches	~~50~~40 °F	All Year**	3/15 9/30	All Year**
Greater than 2 1/2 inches	40° F	All Year**	3/15 9/30	All Year**
Temporary	40 °F	All Year**	All Year**	All Year**

* Do not use field burners or other devices to heat the pavement surface to the specified minimum temperature unless approved.

** If placing ~~HMAC~~ACP between March 15 and September 30, temperature requirement may be lowered 5 °F.

00745.41 Prepaving Conference~~- Supervisory~~ - Have a prepaving conference with all Contractor supervisory personnel~~ of the Contractor, including any~~, all subcontractors who are to be involved in the paving work, ~~shall meet with~~ and the Engineer. Meet at a mutually agreed time ~~to~~and discuss all methods of accomplishing all phases of the paving work. ~~A representative of the Contractor responsible for quality control on the project shall also attend for all~~When Level 3 and Level 4 mixes ~~where~~ quantities ~~exceed~~are greater than 5,000 tons~~.~~ include in the prepaving conference a Contractor representative who is responsible for project quality control..

00745.42 Preparation of Underlying Surfaces~~--~~ - All bases and foundations on which the pavement is to be constructed shall meet the applicable Specifications and be approved ~~prior to~~before the start of paving. Recondition existing bases and foundations according to Section 00610. Trim broken or ragged edges to firm material when directed.

Treat all paved surfaces on and against which ~~HMAC~~ACP is to be placed with an asphalt tack coat, according to Section 00730.~~ Immediately before applying the tack coat, clean and dry the surface to be tacked. Remove all material, loose or otherwise, that will reduce adhesion of the tack by brooming, flushing with water, or other approved methods.~~

Level and compact depressed areas with ~~HMAC~~ACP as specified or directed. Perform the leveling work as a separate operation and at the locations and to the extent as shown or directed. Spread the leveling material with a paving machine, unless otherwise directed.

Protect all existing structures from the overlay operation and check and clean as necessary after the overlay.

~~The pavement surface shall be dry prior to the preparation work and paving.~~ Remove existing pavement markers, recessed markers, and pavement legends ~~prior to~~before paving. Remove pavement lines, bars, and pavement legends as shown or directed and according to 00851.40.

00745.43 Drying and Heating Aggregates ~~for HMAC~~:

(a) Burner Operation - Operate the burner used to heat the aggregates to completely burn the fuel so the aggregate and asphalt are not contaminated and the asphalt is suitably aged.

(b) Heating Temperatures - Establish the allowable mixing and placement temperature ranges by the JMF. Measure the mixture temperature at the discharge of the mixer. Measure the placement temperature behind the paver. The allowable production temperatures may be adjusted based on the asphalt cement supplier's recommendation if approved by the Engineer. The maximum mixture temperature of the ~~HMAC~~ACP and the minimum placement temperature shall be as follows:

	AC Temperature ~~,~~ °F	
Grading	**Maximum ~~at~~ Type**	**Minimum ~~Behind~~ At Mixer Behind Paver**
~~Dense~~HMAC	350	240
~~Open~~		~~350 205~~
WMAC	–	215

Within the above limits, the Contractor ~~(~~with approval of the Engineer~~)~~, or the Engineer may adjust this temperature in 10 °F increments from the JMF as follows:

- **Up** - If the aggregate coating, moisture content, workability or compaction requirements are not attained.
- **Down** - If the aggregate coating, moisture content, workability and compaction requirements are attained.

00745.~~45 HMAC~~44 Asphalt Concrete Pavement Storage ~~–~~ - Temporary storing or holding of ~~hot HMAC~~ACP in storage silos will be allowed if the Contractor complies with the following:

(a) Flow Diverter - Provide a device to divert the flow of ~~HMAC~~ACP away from the silo when starting or stopping plant production, or at any other time necessary, so improperly proportioned mixture or incompletely mixed portions of the mixture do not enter the silo.

(b) Batcher - Equip storage silos with a batcher, rotating chute, or similar device to prevent segregation of ~~HMAC~~ACP as it enters the silo.

(c) Unheated Silos - Store ~~HMAC~~ACP in unheated silos only when the total elapsed time from the mixing to placing is less than ~~six~~6 hours.

(d) Heated Silos - Store ~~HMAC~~ACP in heated, insulated silos no more than 72 hours only if an atmosphere is maintained in the silo at all times which prevents damage to the mixture or asphalt properties.

(e) Discharging AC and Loading Trucks - Discharge the ~~HMAC~~ACP and load trucks so segregation is prevented. If the ~~HMAC~~ACP is segregated, dispose of segregated ~~HMAC~~ACP and stop temporary storage of the ~~HMAC~~ACP at no additional cost to the Agency.

00745.~~46~~45 Control of Line and Grade~~.~~ - Use a floating beam device of adequate length and sensitivity to control the grade of the paver. Where this method is impractical, manual control of grade will be allowed when approved.

00745.~~48~~46 Hauling, Depositing, and Placing~~.~~ - Haul, deposit, and place ~~HMAC~~ACP as follows:

(a) Hauling - Cover ~~HMAC~~ACP if rain or cold air temperatures are encountered any time between loading and placement.

~~HMAC~~ACP will be rejected before placing if one or more of the following ~~is found~~occurs:

- Below ~~specified placing~~ temperature limit specified in 00745.43
- Slumping or separating
- Solidifying ~~or crusting~~
- ~~Absorbing moisture~~

Dispose of rejected loads at no additional cost to the Agency.

Deliver the mixture to the paving machine at a rate that provides continuous operation of the paving machine, except for unavoidable delay or breakdown. If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the mixture delivery rate matches the paving machine operation.

(b) Depositing - Deposit ~~HMAC~~ACP from the hauling vehicles so segregation is prevented.

When ~~HMAC~~ACP is windrowed, the pick-up equipment shall:

- Pick up substantially all of the ~~HMAC~~ACP deposited on the roadway.
- Be self-supporting, not exerting any vertical load on the paving machine, or causing vibrations or other motions which could have a harmful effect on the riding quality of the completed pavement.

(c) Placing - Alternative equipment and means may be allowed by the Engineer if the use of a paver is impractical.

Do not place ~~HMAC~~ACP during rain or other adverse weather conditions, unless allowed by the Engineer. ~~HMAC~~ACP in transit at the time adverse conditions occur may be placed if:

- It has been covered during transit.

- The ~~HMAC~~ACP temperature is satisfactory.
- It is placed on a foundation free from pools or flow of water.
- All other requirements are met.

When leveling irregular surfaces and raising low areas, do not exceed 2 inches actual compacted thickness of any one lift, except the actual compacted thickness of intermittent areas of 1,000 square feet or less may exceed 2 inches, but not more than 4 inches. This may require portions of the mixture to be laid in two or more lifts.

Place the mixture in the number of lifts and courses, and to the compacted thickness for each lift and course, as shown. Place each course in one lift unless otherwise specified. Do not exceed a compacted thickness of 4 inches for any lift. Limit the minimum lift thickness to twice the maximum aggregate size in the mix.

Do not intermingle ~~HMAC~~ACP produced from more than one JMF. Each base course panel placed during a working shift shall conform to a single JMF. The wearing course shall conform to a single JMF, except for adjustments in the JMF according to 00745.16(b-1).

00745.47 Longitudinal Joints - At longitudinal joints, bond, compact and finish the new ACP equal to the ACP against which it is placed.

(a) Location - Place the ACP in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.

(1) Base Course - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

(2) Wearing Course - Construct longitudinal joints at either lane lines or fog lines, or as shown or directed.

(b) Drop-offs:

- Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.
- Protect edges from being broken down.

If unable to complete the pavement without drop-offs according to 00745.47(c) do the following:

- Construct and maintain a wedge of ACP at a slope of 1V:10H or flatter along the exposed longitudinal joint.
- Remove and dispose of the wedge before continuing paving operations.
- Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. ACP for the temporary wedge will be paid for at the pay item price.

(c) Placing Under Traffic - When placing ACP pavement under traffic, schedule work for the nominal thickness being laid as follows:

(1) More Than 2 Inches - Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.

(2) Less Than or Equal to 2 Inches - Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each week complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.

00745.48 Transverse Joints:

(a) Travel Lanes - Construct transverse joints on the travel lane portion of all specified pavement courses, except leveling courses, as follows:

(1) Temporary End Panel - Maintain pavement depth, line and grade at least 4 feet beyond the selected transverse joint location, and from that point, wedge down on the appropriate slope until the top of the course being laid meets the underlying surface (assuming a pavement course thickness of 2 inches) as follows:

- For wedges that will be under traffic for less than 24 hours, construct an 8 foot long wedge (1V:50H taper rate).
- For wedges that will be under traffic for 24 hours or longer, construct a 25 foot long wedge (1V:160H taper rate).
- Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. ACP for the temporary wedge will be paid for at the pay item price.

When the pavement course thickness is different than the above 2 inch example, use the appropriate taper rate to compute the length of the wedge. The wedge length plus the 4 feet or longer panel form the temporary end panel.

(2) Vertical Face - After the mixture has reached the required density:

- Provide a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting or other approved method.
- Remove the ACP material from the joint to the end of the panel. If removed before resuming paving beyond the joint, reconstruct the temporary end panel immediately by placing a bond-breaker of paper, dust, or other suitable material against the vertical face and on the surface to be occupied by the temporary end panel. Construct a full-depth panel at least 4 feet long, beginning at the sawed or cut joint, and taper it on a 1V:50H slope to zero thickness.

(3) Excess Asphalt Concrete Pavement - After completing a temporary end panel as specified, dispose of unused, remaining ACP as directed. Payment will be made for the entire load of ACP, but will be limited to only one load for each joint of each panel.

(4) Resume Paving - When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.

(5) Joint Requirements - Compact both sides of the joint to the specified density. When tested with a straightedge placed across the joint, the joint surface shall conform to 00745.70.

(b) Abutting Bridge Ends - Compact the ACP abutting bridge ends and other rigid type structures in the longitudinal direction and either transverse or diagonal direction, as directed.

(c) Bridge Deck Overlays - Saw cut the wearing course of pavement directly over the joints in bridge decks, bridge end joints and end panel end joints as soon as practical but within 48 hours of paving each stage of the wearing course, unless otherwise directed. Saw the cut 3/8 inch wide, ± 1/8 inch, by 1/2 inch less than the thickness of the panel of pavement depth or 1 1/2 inches deep, whichever is less.

Flush the saw cut thoroughly with a high-pressure water stream after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a poured filler from the QPL.

00745.49 Compaction~~, QC - Provide a technician certified in density testing (CDT).~~:

(a) General - ~~Immediately after~~After the ~~HMAC~~ACP has been spread, struck off, and surface irregularities and other defects remedied, roll it uniformly until compacted as specified.

(1) Temperature - Complete breakdown and intermediate compaction before the ~~HMAC~~ACP temperature drops below 180 °F, unless otherwise directed or required based on the control strip. For WMAC, complete breakdown and intermediate compaction before the WMAC temperature drops below 160 °F. When the rolling causes tearing, displacement, cracking or shoving, make necessary changes in compaction temperature, type of compaction equipment, and rolling procedures.

(2) Rolling - ~~Compact the HMAC with rollers conforming to 00745.24.~~ Provide sufficient rollers of the types appropriate to compact the mixture while it is still within the specified temperature. Do not use equipment which crushes the aggregate. Do not displace the line and grade of edges. Moisten steel roller wheels with a minimum amount of water, or other approved material, necessary to prevent the ~~HMAC~~ACP from sticking to them and spotting or defacing the ~~HMAC~~ACP.

Operate rollers at a slow, uniform speed recommended by the manufacturer. Drive rolls or wheels shall be nearest the paver unless otherwise approved. Operate pneumatic rollers no faster than 3 mph. Operate vibratory rollers at frequencies of at least 2,000 vibrations per minute.

Begin rolling at the sides and proceed longitudinally, parallel to the road centerline, gradually progressing to the center, unless otherwise directed. On superelevated curves, begin rolling at the low side and progress to the high side. When paving in echelon, or when abutting a previously placed lane, roll the longitudinal joint first, followed by the regular rolling pattern. Do not make sharp turns or park rollers on hot ~~HMAC~~ACP. Stop each pass at least 5 feet longitudinally from preceding stops.

Perform finish rolling with rollers meeting the requirements of 00745.24(a) or 00745.24(b), and continue until all roller marks are eliminated.

(b) Normal Pavement (Nominal Thickness 2 Inches or Greater):

(1) General - Compliance with the density specifications for ~~dense graded HMAC~~ACP shall be determined by random testing of the compacted road surface with calibrated nuclear gauges. Use the MAMD method of compaction measurement~~ unless the control strip method is approved by the Engineer~~.

For Level 2, Level 3 and Level 4 mixes, construct a control strip at the beginning of work on each JMF on the project according to ODOT TM 306. The purpose of the control strip is to

determine the maximum density that can be achieved for the JMF, paving conditions, and equipment on the project~~, and to establish a target density when the control strip method of compaction is allowed by the Engineer~~. Additional control strips are necessary when there is a change in compaction equipment or when JMF targets are adjusted according to 00745.16(b-1-a). The Engineer may waive the control strip for irregular areas or areas too small to establish a reasonable roller pattern.

Stop paving if three consecutive control strips fail to achieve the specified density. Take all actions necessary to resolve compaction problems. Do not resume paving until allowed by the Engineer.

A pneumatic tired roller is not required for Level 1 and Level 2 ~~HMAC. The Contractor shall have~~ACP. Have at least one available pneumatic tired roller conforming to 00745.24(c) on the project and in good operating condition for Level 3 and Level 4 ~~HMAC~~ACP.

~~The~~Have the CDT ~~shall~~ notify the Engineer and CAT-II when the average density for a sublot exceeds 95~~%~~ percent of MAMD. Initiate an investigation to determine if the results indicate that a problem with the mix is developing. An adjustment to the JMF will not be allowed unless MDV testing supports a required change.

(2) Random Testing - Determine the density of each sublot by averaging five QC tests performed at random locations with the nuclear gauge operated in the backscatter mode. Lots and sublots shall correspond with those defined in 00745.02. In addition, perform at least one density test each day of production. The additional testing may be waived by the Engineer.

a. Testing - After completion of the finish rolling, test according to WAQTC TM 8. Do not locate the center of a density test less than 1 foot from the panel edge. Complete density testing before traffic is allowed on the new mat.

b. Core Correlation of Nuclear Gauge Readings - Correlate each nuclear gauge on the Project when requested or required. New correlations are required if the aggregate source or the asphalt cement source changes. Apply correlation factors to all nuclear gauge readings for all ~~dense graded~~ mixtures placed on the Project. ~~Cut the required cores and patch the core holes with dense graded HMAC.~~ Determine the core correlation factor according to WAQTC TM 8 and ODOT TM 327.

Perform core correlation of nuclear gauge readings for each new lift when requested by the Engineer or Contractor. The party requesting the core correlation pays the costs of coring and lab testing of the cores. The party performing nuclear gauge testing pays the costs of the nuclear gauge testing.

(3) Moving Average Maximum Density ~~(MAMD)~~ Method - The MAMD is the average of the current MDT and, if available, the four previous MDT's for the JMF used. Determine each MDT using the Gmm determined according to AASHTO T 209 and calculate the MAMD according to ODOT TM 305.

When this method is used, compact the ~~HMAC~~ACP to at least the percent of the MAMD applicable for the mix type and lift as follows:

~~Level 1, Level 2, Level 4~~	
Course of Construction~~and Level 3 HMAC HMAC~~ACP	
First ~~Lift~~ACP lift less than 3 inches placed on aggregate base	91.0 *
All other	92.0

~~Single~~	~~91.0 *~~	~~92.0~~
~~All Other~~	~~92.0~~	~~92.0~~

* If any part of the width of a lift at a station requires 91.0~~%,~~ percent, then the entire width of that lift at that station shall be 91.0~~%~~ percent

~~When using the MAMD method, a new control strip will be required when there is a new JMF. The Engineer may waive the control strip for irregular areas or areas too small to establish a reasonable roller pattern.~~

~~**(4) Control Strip Method** - This method consists of constructing and testing a designated strip to establish optimum rolling procedures and target density. The target density is then used as a basis for acceptance of compaction of the HMAC.~~

~~**a. Construction of Control Strip** - When beginning work on each lift of pavement, construct one or more control strips that are:~~

- ~~The length of the rolling pattern (maximum 500 feet).~~
- ~~Part of the roadway.~~
- ~~Placed to the specified width and thickness.~~
- ~~Composed of the same materials as the rest of the lift.~~
- ~~Compacted with the same equipment as the rest of the lift.~~

~~The first valid target density for each lift of pavement shall be applied to sublot density tests for previously placed pavement with the same JMF.~~

~~A target density is not valid if it is less than the percent of the MAMD in 00745.49(b-3) for the applicable mix type and lift.~~

~~Construct a new control strip when:~~

- ~~There is a new JMF.~~
- ~~10 days of production have been accepted without construction of a new control strip.~~
- ~~A new lift of pavement is started.~~

~~**b. Establishing Target Density** - Determine the target density of the control strip according to ODOT TM 306 and WAQTC TM 8 by averaging the final results of five density tests taken with a nuclear gauge at random sites within the control strip selected according to ODOT TM 306.~~

~~**c. Compaction Requirement** - Compact the HMAC mixture to a density of at least 98.0% of the target density.~~

~~**d. Control of Operations** - Stop paving if three consecutive control strips fail to achieve the target density. Take all necessary actions to resolve compaction problems. Do not resume paving without the approval of the Engineer.~~

~~(5~~(4) **Test Results** - Provide density results for the completed sublots to the Engineer by the middle of the following working shift.

(c) Thin Pavement - Compaction to a specified density will not be required for leveling, patches, or where the nominal compacted thickness of a course of ~~dense graded mixtures~~ACP will be less than 2 inches.

Perform breakdown and intermediate rolling until the entire surface has been compacted by at least four coverages of the ~~roller(s).~~rollers. Perform additional coverages, as directed, to obtain finish rolling of the ~~HMAC~~ACP.

~~**(d) Open Graded HMAC** - Compaction of open graded HMAC to a specified density will not be required.~~

~~Use only steel-wheeled roller(s) for compaction. Continue the breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the roller(s). Perform additional coverages, as directed, to obtain finish rolling of the HMAC.~~

~~(e~~(d) **Other Areas** - Compaction to a specified density will not be required on temporary surfacing~~ (see 00745.50),~~, guardrail flares, mailbox turnouts, road approaches, pavement repair, and areas ~~of restricted width (~~less than 8 feet wide~~)~~ or limited length, regardless of thickness. Compact these surfaces according to 00749.45.

(e) **Bridge Decks and End Panels** - Compaction to a specified density will not be required for ACP placed on bridge decks and end panels. Perform the same rolling pattern, without vibration, as established by 00745.49(b-1). In the absence of a rolling pattern established by 00745.49(b-1), perform breakdown and intermediate rolling until the entire surface has been compacted by at least six coverages of the rollers. Perform additional coverages, as directed, to obtain finish rolling of the ACP.

Temporary

00745.50 Temporary Surfacing Course~~ -~~ - Provide ~~HMAC~~ACP for temporary surfacing that is a well-graded, uniform, durable commercial mix. All new materials, or a combination of new materials and reclaimed materials, may be used, according to 00745.03. The Contractor is responsible for the quality of material furnished according to Section 00165 and for maintaining the surface in a condition appropriate for the facility. Mix used for temporary surfacing will not be eligible for price adjustment under 00745.95.

Maintenance

00745.60 Correction of Defects - Correct all defects in material and work, as directed, at no additional cost to the Agency, according to the following:

(a) Fouled Surfaces - ~~Immediately~~Before the ACP cools repair, clean, and retack fouled surfaces that would prevent full bond between successive lifts of mixture.

(b) Boils, Slicks, and Oversized Material - ~~Immediately~~Before the ACP cools replace boils, slicks, and oversized material with fresh mixture.

(c) Segregation - Take~~ immediate~~ corrective measures when segregation or non-uniform surface texture is occurring in the finished mat. If segregation continues to occur, stop production until a plan for providing uniform surface texture is approved~~ by the Engineer~~.

(d) Roller Damage to Surface - ~~Immediately~~Before the ACP cools correct surface damage from rollers with additional fresh mixture or by other ~~means~~ approved ~~by the Engineer~~means.

(e) Longitudinal Joints - Take~~ immediate~~ corrective measures when open longitudinal joints are being constructed or when the elevation of the two sides of a longitudinal joint does not match. If problems with the longitudinal joint continue to occur, stop production until a plan for providing tight, equal elevation longitudinal joints is approved~~ by the Engineer~~.

(f) ~~**Nonspecification**~~**Non-specification** **Compaction** - Take~~ immediate~~ corrective measures when the specified compaction density is not being achieved.

(g) Other Defects - Remove and replace any ~~HMAC~~ACP that:

- Is loose, broken, or mixed with dirt.
- Shows visually too much or too little asphalt.
- ~~Is defective in any way.~~

~~**00745.61 Longitudinal Joints** - At longitudinal joints, bond, compact and finish the new HMAC equal to the HMAC against which it is placed.~~

~~**(a) Location** - Place the HMAC in panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one panel by at least 6 inches from the longitudinal joints in the panel immediately below.~~

~~**(1) Base Course** - Place base course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.~~

~~**(2) Wearing Course** - Longitudinal joints shall not occur within the width of a traffic lane. They shall be located at either skip lines or fog lines unless approved by the Engineer. On median lanes and on shoulder areas the joints shall occur only at lane lines or at points of change in the transverse slopes, as shown or as directed.~~

~~**(b) Drop-offs:**~~

- ~~Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 1 inch or more in height occur.~~
- ~~Protect edges from being broken down.~~

~~If unable to complete the pavement without drop-offs according to 00745.61(c) do the following:~~

- ~~Construct and maintain a wedge of HMAC at a slope of 1V:10H or flatter along the exposed longitudinal joint.~~
- ~~Remove and dispose of the wedge before continuing paving operations.~~
- ~~Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. HMAC for the temporary wedge will be paid for at the pay item price.~~

~~**(c) Placing HMAC Under Traffic** - When placing HMAC pavement under traffic, schedule work for the nominal thickness being laid as follows:~~

~~**(1) More Than 2 Inches** - Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.~~

~~**(2) Less Than or equal to 2 Inches** - Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each workweek complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-offs.~~

~~**00745.62 Transverse Joints:**~~

~~**(a) Travel Lanes** - Construct transverse joints on the travel lane portion of all specified pavement courses, except leveling courses, as follows:~~

~~**(1) Temporary End Panel** - Maintain pavement depth, line and grade at least 4 feet beyond the selected transverse joint location, and from that point, wedge down on the appropriate slope until the top of the course being laid meets the underlying surface (assuming a pavement course thickness of 2 inches) as follows:~~

- ~~For wedges that will be under traffic for less than 24 hours, construct a 8 foot long wedge (1V:50H taper rate).~~
- ~~For wedges that will be under traffic for 24 hours or longer, construct an 25 foot long wedge (1V:160H taper rate).~~
- ~~Construct, maintain, remove, and dispose of the temporary wedge at no additional cost to the Agency. HMAC for the temporary wedge will be paid for at the pay item price.~~

~~When the pavement course thickness is different than the above 2 inch example, use the appropriate taper rate to compute the length of the wedge. The wedge length plus the 4 feet or longer panel form the "temporary end panel".~~

~~**(2) Vertical Face** - After the mixture has reached the required density:~~

- ~~Provide a smooth, vertical face the full depth of the course being laid at the location selected for the joint by sawing, cutting or other approved method.~~
- ~~Remove the HMAC material from the joint to the end of the panel. If removed before resuming paving beyond the joint, reconstruct the temporary end panel immediately by placing a bond-breaker of paper, dust, or other suitable material against the vertical face and on the surface to be occupied by the temporary end panel. Construct a full-depth panel at least 4 feet long, beginning at the sawed or cut joint, and taper it on a 1V:50H slope to zero thickness.~~

~~**(3) Excess HMAC** - After completing a temporary end panel as specified, dispose of unused, remaining HMAC as directed. Payment will be made for the entire load of HMAC, but will be limited to only one load per joint per panel.~~

~~**(4) Resume Paving** - When permanent paving resumes, remove the temporary end panel and any bond-breakers. Clean the surface of all debris and apply a tack coat to the vertical edge and the surface to be paved.~~

~~**(5) Joint Requirements** - Compact both sides of the joint to the specified density. When tested with a straightedge placed across the joint, the joint surface shall conform to the specified surface tolerances.~~

~~**(b) Abutting Bridge Ends** - Compact the HMAC abutting bridge ends and other rigid type structures in the transverse and/or diagonal direction, as well as longitudinally, as directed.~~

~~**(c) Bridge Deck Overlays** - Saw cut the wearing course of pavement directly over the joints in bridge decks, bridge end joints and end panel end joints as soon as practical but within 48 hours of paving each stage of the wearing course, unless otherwise directed. The saw cut shall be 3/8 inch wide, plus or minus 1/8 inch, and 1/2 inch less than the thickness of the panel of pavement, to a maximum depth of 1 1/2 inches.~~

~~Flush the saw cut thoroughly with a high-pressure water stream immediately after the cut has been made. Before the cut dries out, blow it free of water and debris with compressed air. Fill the joint with a poured filler from the QPL.~~

Finishing and Cleaning Up

00745.70 Pavement Smoothness~~—~~ - Furnish a 12 foot straightedge and~~/or~~, when required a 12 foot rolling straightedge, and test as specified. Additional testing may be required. Mark areas not meeting the surface tolerance.

~~**(a) Level 1 and Level 2 HMAC** - Test with the 12 foot straightedge in travel lanes parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch.~~

~~**(b) Level 3 and Level 4 HMAC:**~~

~~**(1) Single Course Construction**~~**(a) Level 1 and Level 2 ACP** - Test with the 12 foot straightedge in travel lanes parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch.

(b) Level 3 and Level 4 ACP:

(1) Single Course Construction - Test with the 12 foot straightedge in travel lanes parallel to and perpendicular to the centerline, as directed. The pavement surface shall not vary by more than 1/4 inch.

(2) Multiple Course Construction - Test the surface of the course on which the wearing course is placed according to 00745.70(a~~) above~~.).

Test the wearing surface with the rolling straightedge in the designated wheel path of a 0.1 mile strip of each travel lane per mile, where directed, and on each transverse joint throughout the project. Operate the rolling straightedge parallel to the centerline. The surface shall not vary more than 0.015 foot.

Also test the wearing surface with a 12 foot straightedge placed perpendicular to the centerline at least once within the above-mentioned 0.1 mile strip. It shall not vary by more than 1/4 inch.

If the 0.1 mile testing strip meets the Specifications, no further testing of the mile represented by the testing strip will be required, except at the transverse joints. If any part of the testing strip does not meet the Specifications, test both wheel paths of the entire mile.

(c) Utility Appurtenances - If the Contractor ~~is required to construct~~constructs or ~~adjust~~adjusts utility appurtenances, ~~such as~~ manhole covers, and valve boxes, the tolerances ~~stated in~~ of 00745.70(a) and 00745.70(b) ~~above~~ apply. ~~These tolerances do not apply at~~If the utility appurtenances are adjusted by others, these tolerances do not apply.

(d) Shoulders and Paved Medians - Test the base and wearing course with the 12 foot straightedge parallel to and perpendicular to the centerline for shoulders and paved medians where permanent traffic barriers will be located. The pavement surface shall not vary by more than 1/4 inch.

00745.75 Correction of Pavement Roughness~~- Immediately correct~~ - Correct equipment or paving operation procedures when tests show the pavement smoothness does not comply with 00745.70. In addition, do the following:

(a) Methods - Correct surface roughness to the required tolerances, using one of the following methods as approved by the Engineer:

(1) Base Course:

- Profile to a maximum depth of 0.4 inch with equipment meeting the requirements of 00620.20.
- Profile to a maximum depth of 0.4 inch with abrasive ~~grinder(s)~~grinders equipped with a cutting head comprised of multiple diamond blades.
- Remove and replace the base lift.

(2) Wearing Course:

- Remove and replace the wearing surface lift.
- Profile to a maximum depth of 0.3 inch with abrasive ~~grinder(s)~~grinders equipped with a cutting head comprised of multiple diamond blades and apply an emulsion fog seal as directed.

(b) Time Limit - Complete correction of all surface roughness within 14 calendar days following notification, unless otherwise directed.

Measurement

00745.80 Measurement - The quantities of ~~HMAC~~ACP will be measured on the weight basis, with separate measurement being made for the asphalt concrete mixture and the asphalt cement contained in the mixture. No deduction will be made for lime or any other additive used in the mixture.

When RAP, RAS, or RAM materials are used, measurement of the total asphalt quantity will be based on quality control tests averaged ~~to the nearest 0.01%.~~at least to the nearest 0.01 percent. For mixtures not containing RAP, RAS or RAM materials, measurement of the total asphalt quantity will be based on quality control tests averaged at least to the nearest 0.01 percent when the Engineer determines that payment by invoice and tank sticking is impractical.

If an estimated bulk specific gravity for the aggregates is shown in the Special Provisions, determine the actual bulk specific gravity for the aggregates, recompute the quantities of ~~HMAC~~ACP to be used, and inform the Agency in writing. The quantities of ~~HMAC~~ACP will be adjusted accordingly with no adjustment in Contract unit prices. The provisions of 00140.20 and 00195.20 will apply.

~~**00745.83 Other Items** -~~When listed in the Contract Schedule of Items, extra or additional work for approaches, driveways, walks, and other miscellaneous structures will be measured according to 00749.80 through 00749.82.

If there is no separate item listed in the Contract Scheduled of Items for leveling work, the quantities will be included in the appropriate ~~HMAC~~ACP items.

~~No separate measurement will be made for lime.~~

Payment

00745.90 Payment - The accepted quantities of ~~HMAC~~ACP incorporated into the Project, whether or not recycled materials are used, will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item **Unit of Measurement**

(a) Level ___, ~~_____, _____, HMAC, _____ _____~~ ACP _____.....Ton
(b) _____ Asphalt in _____ ~~HMAC~~ACP .....Ton

In item (a), the following will be inserted in the blanks:

- The level~~(s)~~ of ~~HMAC~~ACP (1, 2, 3, 4) will be inserted in the first blank.
- The type~~(s)~~ of ~~HMAC (1 inch Dense,~~ ACP (3/4 inch ~~Dense~~, 1/2 inch ~~Dense~~, 3/8 inch ~~Dense, 3/4 inch Open, 1/2 inch Open, 3/4 inch ATPB),~~) will be inserted in the second blank.
- The words "Lime Treated" will be inserted in the third blank when applicable.
- The words "in Leveling", "in Temporary", or "in Leveling and Temporary" will be inserted in the fourth blank when applicable.

In item (b), the performance graded asphalt binder will be inserted in the first blank. The ~~type(s)~~types of ~~HMAC~~ACP will be inserted in the second blank. This item applies to all asphalt used in ~~HMAC~~ACP, including residual asphalt in RAP~~.~~, RAS, or combined RAP and RAS. Substituted asphalt cement described in 00745.11(a) will be paid for under the asphalt specified in the Contract Schedule of Items.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

~~**00745.93 Other Items** - Unless indicated in the Contract Schedule of Items, no~~No separate or additional payment will be made for ~~the following~~:

- reconditioning existing roadway
- leveling work
- lime
- QC testing
- ~~anti-stripping additives~~
- sawing, cleaning, and filling joints on bridge deck overlays

When indicated by other pay items in the Contract Schedule of Items, separate payment will be made for ~~the following:~~work described in 00745.42, 00749.91 and 00749.92.

- ~~work described in 00745.42~~
- ~~work described in 00749.91 and 00749.92~~

When a panel consists of both temporary and permanent courses, payment for the entire panel will be based on the permanent course.

~~No separate or additional payment will be made for sawing, cleaning, and filling joints on bridge deck overlays.~~

Anti-stripping asphalt cement additives will be paid for at the Contractor's actual documented costs with no percentage allowance or markup allowed. No additional payment will be made for anti-stripping additives or treatments that are not anti-stripping asphalt cement additives.

00745.95 ~~HMAC~~ Price Adjustments - The Composite Pay Factor (CPF), calculated according to 00165.40, 00745.16, and 00745.95, will be applied to the Contract unit price for pay items (a) and

(b) of 00745.90 and to the applicable lot quantities. The CPF will be made available to the Contractor within 24 hours of receipt of the required quality control test results. If less than three samples are tested, the CPF will be computed as outlined in 00745.17 and 00745.95, the maximum CPF for material represented by less than three samples will be 1.0.

To accommodate the lot definition of 00745.02, interpret the upper specification limit (USL) and the lower specification limit (LSL) in 00165.40 to allow adjustments to a JMF according to 00745.16 without changing lots. Include all material from the original JMF and revisions of that JMF in the statistical analysis unless a change in the lot is required by 00745.02. If JMF target values are modified according to 00745.16, the CPF will be calculated in the following manner:

- The adjusted target value will be evaluated as zero with the USL and LSL representing the allowable tolerances of 00745.14. All sample test values for the changed constituents will be compared to the target for each sublot. The differences between the target values and sample test values are the adjusted sample test values for each sublot. These will be analyzed for determination of the pay factor for the constituent.

The Pay Factor (PF) for compaction will be:

Type/Method	PF	Maximum PF
Normal Pavement		
Control Strip Method	1.00	
MAMD Method	1.05	
Thin Pavement	1.00	
~~Open-Graded HMAC~~	~~1.00~~	
Other Areas	1.00	

Use the following table to determine price adjustments in the CPF for constituents of ~~HMAC~~ACP.

Gradation Constituents	~~Dense Graded HMAC Type Weighting Factor (f)~~				~~Open Graded HMAC Weighting Factor~~		
All Aggregate Passing	~~1"~~	3/4"	1/2"	3/8"	~~3/4"~~	~~1/2"~~	~~A~~
1 1/2"	~~1~~						
1"	1	~~1~~				~~1~~	
3/4"	1	1	~~1~~			~~1~~	~~1~~
1/2"	1	1	1	~~1~~		~~1~~	~~1~~
3/8"	–	–	~~–~~1	~~1~~		~~–~~	~~–~~
No. 4	5	5	5	~~5~~		~~5~~	~~5~~
No. 8	5 ~~5~~	6	6	~~5~~		~~6~~	
No. 30	~~2~~	3	3	~~3~~		~~3~~	
No. 200	10	10	10	~~10~~		~~10~~	~~10~~
Other Constituents							
Asphalt Content	26	26	26	~~26~~		~~26~~	~~26~~
Moisture Content	8	8	8	~~8~~		~~8~~	~~8~~
Compaction	40	40	40	~~40~~		~~40~~	~~40~~

Those ~~HMAC~~ACP constituents statistically evaluated will be eligible for a maximum PF of 1.05 (see 00165.50(b-1)), unless otherwise specified.

When the CPF is greater than 1.000 for material used in leveling courses for ~~HMAC~~ACP, it will be reduced as follows:

Reduction in CPF = (CPF-1) x 0.5

If these Specifications do not require measurement of a constituent, its individual PF will be considered 1.00 in calculating the CPF according to 00165.40.

A price adjustment will be determined by the following formulas:

(CPF - 1) x [(JMF% ÷ 100 x Asphalt Unit Price) + (~~HMAC~~ACP Unit Price)] x (LQ) = ____

Where:

JMF% is the asphalt cement % from the JMF
LQ is the quantity of mixture in the lot

Section 00746 - Crack Sealing Flexible Pavements

Description

00746.00 Scope - This work consists of repairing and resealing cracks in flexible pavements at locations designated by the Engineer.

Materials

00746.10 Sealants - Furnish all sealant materials for crack repair of flexible pavements that is approved by the Engineer before being incorporated into the work. Before beginning work, furnish a complete written statement of the origin, composition and manufacturer of materials that are to be used.

Furnish hot -poured sealants of the type intended for use in sealing cracks in asphalt concrete pavement that meet the requirements of ~~ASTM D 6690~~02440.30.

Equipment

00746.20 Equipment - Use proper sealing equipment for the specific material listed according to the manufacturer's recommendations. The equipment for sealing compounds shall be a melting kettle of the double boiler, indirect heating type, using oil as a heat-transfer medium. The kettle shall be an effective, mechanically operated agitator equipped with a positive, thermostatic temperature control.

Construction

00746.40 General - Provide traffic control according to Sections 00220 and 00225.

00746.41 Mixing and Heating - Follow the manufacturer's recommendations for application. Mix and heat the sealant materials to a minimum temperature of 280 °F. Do not heat the material above 400 °F.

00746.42 Installation Procedure - Where installation procedures, or any part of the procedures are required to be done according to the recommendations of the manufacturer of the sealing compound, submit catalogue data and copies of the recommendations before installing the materials.

Clean all cracks designated for sealing of loose and foreign matter. Use a hot lance to perform this cleaning. Use this wand to both clean and dry the crack just prior to sealing.

Do not place any sealant without the prior approval of the Engineer. The Engineer will inspect all cracks.

The face of the crack shall be surface dry, and the ambient and pavement temperatures shall both be at least 45 °F and rising at the time of application of the sealant.

Install the sealant so that the in-place sealant is well bonded to the pavement and free of voids or entrapped air.

Seal the cracks from the bottom up in a neat manner, so that upon completion of the work the surface of the sealant material is flush to 3/16 inch below the adjacent pavement surface. Refill or "spot" all low areas before continuing work.

Level sealant material flush to the surface with a 'V' shaped squeegee device. Squeegee the excess material so it does not exceed 1 1/2 inches on either side of the crack. If any sealant remains in the squeegee when the end of the crack is reached, distribute this excess material over the crack in a return motion.

00746.43 Cleaning and Sanding - Perform the following work when crack sealing prior to a hot mix asphalt overlay or to prevent traffic damage and "pickup":

- Completely cover the sealed cracks with a clean sanding material, then sweep the pavement surface and leave in a clean condition.
- Do not allow any traffic or construction equipment on the newly sealed cracks for at least ~~one~~ 1 hour after placement of the sealant and refilling has been completed.

Measurement

00746.80 Measurement - The quantities of sealed cracks will be measured on either the length basis, or the weight basis.

Payment

00746.90 Payment - The accepted quantities of sealed cracks will be paid for at the Contract unit price, per foot or pound, as appropriate, for the item "Crack Sealing".

Payment will payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for required cleaning and routing.

Section 00748 - Asphalt Concrete Pavement Repair

Description

00748.00 Scope - This work consists of excavating and removing existing asphalt concrete surfaces, aggregate bases, and aggregate subbases and constructing new subbases, bases, and asphalt concrete surfaces to the lines and grades shown or directed.

Materials

00748.10 Materials - Furnish materials meeting the following requirements:

Aggregate Base 02630
Aggregate Subbase..... 00641.10(b)
Asphalt Concrete Pavement (ACP).....00744 and 00745
Emulsified Asphalt Concrete (EAC).....00735
~~HMAC.....00745~~
Stone Embankment.....00330.16
Subgrade Geotextile, Level B.....02320
Subgrade Reinforcement Geogrid, Level B.....02320
Water.....00340

00748.16 Acceptance of Material - All material will be accepted by visual inspection by the Engineer. The Engineer may perform tests to verify that the materials meet the appropriate specifications.

Equipment

00748.20 Equipment - Provide appropriate equipment necessary to perform the work according to Sections 00320, 00330, 00340, 00350, 00620, 00641, 00735, 00744, and 00745.

Construction

00748.40 Excavation - Excavate and remove material to the lines and grades shown or directed. Dispose of the excavated material according to 00330.41(a-5).

00748.41 ~~Geotextile~~Cold Plane Pavement Removal - Remove the existing pavement to the depth, width, grade, and cross section as shown or directed. Perform cold plane pavement removal according to 00620.40.

00748.42 Geosynthetics:

(a) Geotextile - Place geotextile as shown.

(b) Subgrade Reinforcement Geogrid:

(1) Placement - Prepare the surface receiving geogrid to a smooth, uncompacted condition to the depth shown and as follows:

- Orient the geogrid rolls parallel to the roadway centerline.
- Unroll the geogrid in the same direction as aggregate base placement. If the geogrid shifts or becomes misaligned, realign it and anchor it according to the manufacturer's recommendations.

(2) Overlaps - Overlap the geogrid a minimum of 24 inches. Overlap the geogrid in the same direction as aggregate base placement with the preceding layer lapped on top of the following layer.

(3) Protection of Geogrid - Drive rubber tired equipment on the geogrid at no more than 5 mph. Drive tracked equipment on the geogrid only after placing a minimum of 6 inches of aggregate base on top of the geogrid. Do not turn or make sudden stops or starts on the geogrid or the aggregate base.

During installation cover the geogrid with the aggregate base as soon as possible. Do not leave uncovered for more than 5 calendar days.

(4) Repair - Repair or replace damaged or torn geogrid according to manufacturer's recommendations at no cost to the Agency.

00748.~~42 Embankment and Aggregate~~ 43 Backfill - Place the backfill to lines and grades shown or directed. Compact each layer of material until there is no reaction or yielding under the compactor.

00748.~~43~~44 Asphalt Concrete - Place EAC or ~~HMAC~~ACP to the lines and grades shown or directed. Compact the EAC according to 00735.46. Compact ~~HMAC~~ACP according to 00744.49 and 00745.49(~~e).~~d), as applicable.

Measurement

00748.80 Measurement - The quantities of asphalt concrete pavement repair will be measured on the area basis, of surfacing area repaired to the full depth as shown. The surfacing area will be determined by horizontal measurements. In areas where directed to repair to a depth other than shown, the areas will be adjusted by converting to an equivalent number of square yards on a proportionate volume basis.

EAC and ~~HMAC~~ACP will be measured according to 00735.80~~ or~~, 00744.80, and 00745.80~~.~~, as applicable.

Payment

00748.90 Payment - The accepted quantities of asphalt concrete pavement repair will be paid for at the Contract unit price, per square yard, for the item " _____ inch Asphalt Concrete Pavement Repair".

The depth will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

EAC and ~~HMAC~~ACP will be paid for according to 00735.90~~ or~~, 00744.90, and 00745.90~~.~~, as applicable.

No separate or additional payment will be made for excavation, ~~geotextile~~cold plane pavement removal, geosynthetics, stone embankment, aggregate, and water.

Section 00749 - Miscellaneous Asphalt Concrete Structures

Description

00749.00 Scope - This work consists of furnishing and placing asphalt concrete in road approaches, street connections, driveways, guardrail flares, mailbox turnouts, raised traffic islands, sidewalks, footpaths, gutters, ditch linings, spillways, dikes, and other miscellaneous or minor items of asphalt concrete except asphalt curbs as shown, specified, or directed. These items in this Section will be collectively referred to as "structures". See Section 00480 for asphalt curbs.

This work does not include asphalt concrete construction on traffic lanes, auxiliary lanes, shoulders, median areas, tapers, widenings, parking areas, exit and entrance ramps, patching and leveling on similar areas.

00749.02 Limited Application - This Section applies only when separate pay items for the work appears in the Contract Schedule of Items according to 00749.91 and 00749.92, or when called for by the ~~special provisions~~Special Provisions.

Materials

00749.11 Aggregate Base - Furnish aggregate base materials for base, foundation courses, leveling courses, and bedding meeting the requirements of Section 02630. If a designated size is not shown, or given, furnish either 1" - 0 or 3/4" - 0, as the Contractor elects.

00749.12 Asphalt Tack Coat - Furnish asphalt tack coat material meeting the requirements of Section 00730.

00749.13 Asphalt Concrete - Unless another class is shown, furnish Level 2, 1/2 inch ~~Dense HMAC~~ACP according to ~~Section~~Sections 00744 and 00745, as applicable. When conditions justify, the mixture may be varied, if approved. Acceptance will be based on testing the Engineer deems appropriate. Statistical analysis will not apply.

00749.14 Concrete - Furnish commercial grade concrete meeting the requirements of Section 00440.

Equipment

00749.20 Equipment - ~~Plant~~Provide plant and equipment ~~shall conform to~~meeting the requirements of Section 00745.

Construction

00749.41 Earthwork - Make excavations and backfills for the structures according to Section 00330 and to the depths, widths and cross-sections shown, specified, or directed.

00749.42 Foundations - Construct foundations or other bedding using selected granular backfill material according to Section 00330 or using aggregate base when shown or directed.

For aggregate base, do one of the following:

- When existing aggregate base materials of the kind specified in 00749.11 are already in place, salvage and reuse.
- Use new aggregate base materials conforming to 00749.11.

00749.43 Foundation Preparation - Bring areas on which structures are to be constructed to established grade, and make firm, dry and free of unsuitable material before placing asphalt concrete.

Tack contact areas where asphalt concrete is to come in contact with previously placed portland cement concrete, asphalt concrete, or bituminous surfaces according to Section 00730.

00749.44 Placing Asphalt Concrete - Place asphalt concrete according to ~~00745.48~~00744.43(c~~),~~) and 00745.46(c), as applicable, except place asphalt concrete structures of uniform width by either mechanical extrusion methods or between suitable forms, as the Contractor elects. Other structures may be constructed without the use of forms unless otherwise directed.

The Engineer may allow small or special pavers, spreader boxes, or blade graders for placing asphalt concrete. Where allowed, the Engineer may allow mixture to be placed by hand methods.

Construct all structures within the following lines and grades:

- 1 inch of true line
- 0.04 foot of established surface grade, cross section and slope
- 0.04 foot of specified thickness

00749.45 Compacting Asphalt Concrete - Compact asphalt concrete according to the following or as directed:

- Compaction to a specified density will not be required, regardless of thickness. Perform breakdown and intermediate rolling until the entire surface has been compacted with at least four coverages by the ~~roller(s).~~rollers. Perform additional coverages, as directed, to obtain finish rolling of the ~~HMAC~~ACP.
- Along curbs and walls, on walks, irregular areas, and other areas not practically accessible to rollers conforming to 00744.24 or 00745.24, compact the mixture with small, self-propelled rollers, mechanical tampers, hot hand tampers, or hand rollers. On depressed areas a trench roller may be used, or cleated compression strips may be used under the roller to transmit compression to the depressed area.

00749.46 Pavement Smoothness - Finish asphalt concrete to a uniform texture.

Test top surfaces with a 12 foot straightedge furnished and operated by the Contractor under the Engineer's direction. The surface shall not vary more than 1/4 inch from the straightedge except at grade changes.

00749.47 Concrete - Construct concrete curbs according to the applicable provisions of Section 00759.

Measurement

00749.80 Measurement - Work performed under this Section will be measured by one of the methods described in 00749.81 and 00749.82. Street connections which occur at the beginning or end of the Project, or which have a line designation, typical section and profile, and are not noted on the plans as being pay items will not be measured for payment.

The quantities of structures will be measured according to the following:

- **Unit Basis** - Measurement will be the actual count of each location where the structure is constructed.

- **Area Basis** - Measurement will be the ground surface, limited to the neat lines of the structure~~, and converted to the nearest square foot,~~. as shown or directed.

- **Length Basis** - Measurement will be from end to end of the pertinent structure along its longitudinal axis for each separate item or continuous run.

00749.81 Method "A" - Weight and Extras Basis - Under this method, asphalt concrete actually incorporated into the structure will be measured for payment according to 00744.80 and 00745.80~~.~~, as applicable. In addition, measurement will be made for extra costs of placing asphalt concrete in the structures if pay items are included in the Contract Schedule of Items.

00749.82 Method "B" - Complete in Place Basis - Under this method, measurement will be of the structure complete in place.

Payment

00749.90 Payment - The accepted quantities of structures placed under this Section will be paid for at the Contract unit price, per unit of measurement, for the items listed in 00749.91 and 00749.92.

When earthwork is included as separate pay items, payment will be made according to 00330.90 through 00330.94 as appropriate.

When earthwork is not included as separate pay items, no separate or additional payment will be made for earthwork.

Aggregate will be paid for according to 00640.90 and 00641.90 as appropriate.

Payment for street connections, or the extra costs for them, which meet the criteria described in 00749.80 will be included in payment for the pavement items.

00749.91 Method "A" - Weight and Extras Basis - The items to be paid for under Method "A" are:

	Pay Item	Unit of Measurement
(a)	Extra for Asphalt Approaches	Each
(b)	Extra for Asphalt Drains	Each
(c)	Extra for Pedestrian Landings	Each
(d)	Extra for Asphalt Dikes	Foot
(e)	Extra for Asphalt Islands	Square Foot
(f)	Extra for Asphalt Walks	Square Foot
(g)	Extra for Asphalt Ditch Lining	Square Foot
(h)	Extra for Asphalt Slope Paving	Square Foot
(i)	Extra for Pavement Repair	Square Foot

Item (a) includes road approaches, street connections, alley approaches, driveways, guardrail flares, and mailbox turnouts.

Item (e) includes raised traffic islands and raised traffic separators.

Item (f) includes sidewalks, footpaths, and narrow strips of asphalt concrete abutting curbs not intended for vehicular use.

Item (g) includes gutters, ditch linings, spillways, and other such structures specifically designed and provided for conveyance of surface water.

Payment will be payment in full for all extra or additional costs involved in placing asphalt concrete in the respective structures as specified. These costs are in addition to those which are included in the payment made for the asphalt concrete incorporated into the structures.

00749.92 Method "B" - Complete in Place Basis - The items to be paid for under Method "B" are:

	Pay Item	Unit of Measurement
(a)	Asphalt Approaches	Each
(b)	Asphalt Dikes	Foot
(c)	Asphalt Islands	Square Foot
(d)	Asphalt Walks	Square Foot
(e)	Asphalt Ditch Lining	Square Foot
(f)	Asphalt Slope Paving	Square Foot

Item (a) includes road approaches, street connections, alley approaches, driveways, guardrail flares, and mailbox turnouts.

Item (c) includes raised traffic islands ~~and~~, traffic separators, and concrete curbs necessary for the islands.

Item (d) includes sidewalks, footpaths, and narrow strips of asphalt concrete abutting curbs, not intended for vehicular use.

Item (e) includes gutters, ditch linings, spillways and other such structures specifically designed and provided for conveyance of surface water.

Payment will be payment in full for furnishing and placing all materials, including asphalt concrete and asphalt tack coat, and for furnishing all equipment, labor, and incidentals necessary to complete the respective structures in place as specified.

Section 00754 - Plain Concrete Pavement Repair

Description

00754.00 Scope - This work consists of saw cutting and removing existing concrete pavement and constructing new plain portland concrete pavement repairs as shown and specified.

00754.01 Abbreviations:

SSD - Saturated Surface-Dry

SSFC - Stationary Side Form Construction

00754.02 Areas of Work - Locations of the areas for repair are as shown. Additional areas of repair may be required as determined by the Engineer.

00754.04 Prepaving Conference - Supervisory personnel of the Contractor and any subcontractors who are to be involved in the concrete paving work shall meet with the Project Manager, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

Materials

00754.10 Materials - Furnish materials meeting the following requirements:

Resin Bonded Anchors.....00535
Bar Reinforcement.....02510
Concrete Materials.....02001
Curing Materials.....02050
Epoxy and Nonepoxy Bonding Agents.....02070
Epoxy and Nonepoxy Grouts.....02080
Galvanizing.....02530.70
Portland Cement Concrete Repair Materials.....02015
Poured Joint Fillers.....02440.30
Preformed Expansion Joint Filler.....02440.10

00754.11 Classes of Concrete - If the time frame designated for opening traffic is less than 72 hours after concrete placement, provide Class HES4000 - 1 1/2 concrete designed to attain a minimum average compressive strength of 3,000 psi prior to allowing traffic on the concrete. Otherwise furnish Class 4000 - 1 1/2 paving concrete.

00754.13 Concrete Mix Designs - Prepare and submit either new mix designs or current mix designs for each class of concrete required according to Section 02001.

00754.15 Quality Control - Provide quality control according to Section 00165, Section 02001, and the following:

(a) Concrete Mixture - If the results of any test are outside of the specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the specification limits. If the load cannot be corrected, reject it and do not incorporate it into the work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the specification limits.

(b) Records - Deliver all batch tickets, water-cement ration calculations, and all other records required to the Engineer upon availability but no later than the morning of the next day.

00754.16 Acceptance of Concrete:

(a) General - Acceptance of concrete will be based on the results of the Contractor's quality control testing according to Section 00165 and the MFTP.

(b) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified by the Agency according to Section 00165 and the MFTP.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level indicated in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165-2 for a 1.00 PF.

(c) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits of Section 02001.

(d) Hardened Concrete - Cast and cure the test cylinders according to AASHTO T 23 in single use plastic molds and test at 28 days according to AASHTO T 22.

(1) General - For all classes of concrete, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test cylinders at an ODOT certified laboratory.

(2) Actual Strength Test Value - The ASTV at 28 days is the average compressive strength of the three cylinders tested. If the compressive strength of a single test specimen varies by more than 10 percent from the average of the other two specimens, that compressive strength value will be discarded. The average compressive strength test of the two remaining specimens will be the ASTV.

(3) Sampling and Testing - Sample and test according to Section 00165 and the MFTP.

(4) Acceptance - The ASTV shall exceed the $f'c$ (specified strength) for the mix design. If a set of cylinders has an ASTV less than $f'c$, the Engineer will review the results to determine if the concrete represented by the cylinders shall be removed. In any case, concrete that has an ASTV of less than 85 percent of the specified strength shall be removed unless otherwise authorized, in writing, by the Engineer. The cost of removal, replacement, and all related work shall be the Contractor's responsibility, subject, if the concrete is allowed to remain in place, to a price adjustment according to 00150.25.

If an ASTV falls below the $f'c$, the Contractor may submit a written plan within 3 days of the test for review by the Engineer. The plan shall outline a proposed alternate method of evaluating compressive strength. The plan shall provide evidence that a reasonable $f'cr$ (over design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. If the Engineer determines that the compressive strength

test results are suspect from definable external factors, the Engineer may allow an alternate method of acceptance.

00754.17 Spall Repair Material - For spall repair, furnish a PCC repair material meeting the requirements of Section 02015 except do not use products that contain magnesium phosphate. Use either "Rapid Setting" or "Very Rapid Setting" material.

00754.18 Bond Breaker - Bond breaker must be one of the following:

- Non-woven geotextile meeting the property requirements listed in Table 02320-4.
- Liquid curing compound evenly applied as a bond breaker in two applications, at a rate of 1 gallon per 130 to 165 square feet for each application, over the entire surface area.

Equipment

00754.20 Batch Plant - Provide batch plants according to 02001.40.

00754.21 Mixers - Provide mixers according to 02001.40.

For projects requiring Class HES concrete, mobile mixers may be used if the mixers conform to the following:

- The mixer is self-propelled and carries sufficient unmixed dry bulk cement, sand, coarse aggregate, admixtures, and water to produce a minimum of 6 cubic yards of concrete on site.
- The mixer provides positive measurement of cement being introduced into the mix by meter or counter.
- The mixer provides positive control of the flow of water into the mixing chamber. Water flow is readily adjustable to provide for minor variations in aggregate moisture.
- Each mixer is calibrated to automatically proportion and blend all components according to the mix design on a continuous or intermittent basis as required by the placing operation.

Perform a calibration and yield test on each mixer prior to the first placement to accurately proportion the specified mix. Use a written calibration procedure from the mixer manufacturer, a procedure provided by the agency or other written procedure acceptable to the agency. The calibration process may be witnessed by the Engineer. Provide the Engineer with information about the scheduled date, time and place for the calibration. Perform a new calibration when the source of materials changes, when the mixer undergoes a major repair, or when requested by the Engineer.

00754.22 Hauling Equipment - Use truck mixers to transport concrete. Provide hauling equipment conforming to AASHTO M 157.12 or AASHTO M 157.11.6.

00754.23 Paving Equipment - Provide paving equipment conforming to the following:

- Able to vibrate, consolidate, and finish the slab to proper grade and cross section for the full width and depth of the concrete being placed.
- Capable of meeting the smoothness requirements.
- Approved by the Engineer.

00754.24 Concrete Saws - Provide power driven concrete saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. Also provide a standby saw on the jobsite.

00754.25 Smoothness Testing Equipment - Provide one 12 foot straightedge.

00754.26 Concrete Drills - Provide a drilling system consisting of drilling equipment and drilling supports that:

- Is capable of drilling holes of the required diameter and depth.
- Can produce holes parallel to the pavement surface and parallel to each other within a tolerance of ± 1/8 inch.
- Can provide hole alignments at mid-depth of PCC pavement.

Labor

00754.30 Quality Control Personnel - In addition to the certified technicians required in 02001.50 provide and designate an individual to be present at the placement site at all times during concrete placements and who is authorized and responsible for acceptance and rejection of materials.

Construction

00754.40 Weather Limitations - Coordinate all operations involved in repairing the pavement so the work will result in a finished pavement conforming to the Specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is permitted to proceed.

Do not place PCC during periods of rain. Do not place PCC on frozen bases. Stop placement when descending air temperature falls below 35 °F. Do not begin placement until the air temperature is 35 °F in the shade and rising and is forecast to remain above 35 °F.

Protect the pavement from weather damage. Protect unhardened PCC from precipitation with protective material. When PCC is placed during cold weather and the air temperature is forecast to drop below 33 °F, prevent the concrete from freezing for a minimum of 7 days after placement.

Remove and replace weather-damaged pavement at no additional cost to the Agency.

00754.41 Preparation:

(a) Removal of Existing Pavement - Remove full panels of existing concrete pavement full depth as shown or directed. A vertical full depth saw cut is required along all longitudinal joints and at transverse locations. Cut concrete through tie bars and dowels. Remove concrete pavement with equipment approved by the Engineer in a manner that does not damage remaining pavement or connections and allows for specified connections. Repair damage to the existing pavement due to the Contractor's operations, at the Contractor's expense, by extending the full depth repair to the satisfaction of the Engineer.

(b) Concrete Pavement Base Repair - Use material similar to existing base material or use commercial concrete. If concrete is used, place a bond breaker between the new concrete base and the new concrete pavement. If the repair is a nominal 2 inches deep or less, the repair may be accomplished by pouring the patch monolithically with the new concrete pavement, without a bond breaker. Cost of incidental base repair, leveling, or backfilling, up to a nominal 2 inches deep, will be included in the concrete pavement repair pay item. Base repair, leveling, and related backfilling of subbases or subgrade in excess of a nominal 2 inches will be paid for as concrete pavement base repair with quantities computed from bottom of slab downward to limits of removal. PPC repair material may be substituted for commercial grade concrete.

Compact unbound granular materials used in the base repair as directed. Allow concrete or substitutes to cure sufficiently to support necessary construction activities without yielding prior to continuing those activities. No further testing of pavement base material is required.

(c) Spall Repair Area - Saw cut the existing concrete pavement to a nominal depth of 2 inches. Remove existing concrete within the perimeter of the saw cut to a depth of 2.0 inches, or to sound concrete as determined by the Engineer. If jack hammers are used for removing pavement, they shall not weigh more than 30 pounds, and chipping hammers shall not weigh more than 15 pounds. Do not operate hammers at an angle greater than 45 degrees measured from the surface of the pavement. Any existing pavement that is to remain that has been damaged shall be repaired at the Contractor's expense.

(d) Preparation of Existing Concrete - Before placement of concrete, blow clean the existing concrete surfaces within the pour area with compressed air and dampen the area to be paved with a light application of water. If the area becomes dry before new concrete is placed, blow clean and dampen the area again.

00754.43 Placing Dowel Bars and Tie Bars:

(a) Dowel Bars - Provide smooth, round, epoxy coated dowel bars. Coat with plastic, heavy oil, or other approved material that will neither bond with nor be harmful to the PCC. Use a framework to place dowels that is continuous across the entire lane width, holds the dowels parallel with each other, holds the dowels parallel with the surface of the pavement, and holds the dowels parallel to the roadway centerline. For dowels placed across an expansion joint, use a dowel bar basket or other system of support that leaves no permanent incompressible members in place within the joint. Maximum alignment tolerance shall be 5 degrees or 3/16 inch in the length of the dowel. Place dowels within 3/8 inch of the center of the slab vertically.

Place dowel bars for joint contact at existing concrete pavement surfaces by drilling the existing concrete section and then inserting the dowel bars and grouting them in place. Drill the holes large and deep enough to insert the dowel bars with adequate epoxy or nonepoxy grout. Adjust hole locations to avoid damaging any existing reinforcement when drilling the holes. Blow the dowel bar holes clean with compressed air before grouting. Center the bar in the hole for the full length of embedment before grouting. Pump the grout into the hole around the bar so the back of the hole will be filled first. Do not allow blocking or shimming to impede the flow of the grout into the hole. If dams are needed, place them at the front of the holes to confine the grout. Place the dams to permit the escape of air without leaking grout. Do not remove dams until grout has cured in the hole.

(b) Tie Bars - Provide epoxy coated tie bars and place them for contact-type longitudinal joints by one of the following methods:

- By drilling the hardened concrete section and then inserting the tie bars as resin-bonded anchors in accordance with construction and testing procedures in Section 00535.
- By inserting the tie bars into the plastic slipformed concrete before vibrating and finishing the concrete. The tie bars may be bent before insertion. Replace any loose tie bars by drilling and grouting, as described above, at no additional cost to the Agency.
- By using threaded mechanical splice couplers from the QPL. Submit splices for approval before using. Rebar splices shall be:
  - Accompanied by manufacturer's quality compliance certificate according to 00165.35.
  - Installed according to manufacturer's recommendations.

00754.44 Handling, Measuring, and Batching Materials - The plant site, layout, equipment and provisions for transporting material shall be adequate to assure a continuous supply of material to the worksite.

(a) Aggregates - Stockpile and remove the aggregate from stockpiles in a manner that holds segregation to a minimum.

Do not use aggregates that become segregated, mixed with earth or foreign material, or contain lumps of hardened material. Thaw frozen aggregates or aggregates containing frozen lumps before use.

(b) Batching - Separately weigh into the hoppers the fine aggregate, each separated size of coarse aggregate, cement and fly ash in the respective proportions set by the mix design. Provide a device to indicate positively that the full amount of cement and fly ash was discharged into the batch box or container. Measure water and admixtures either by volume or by weight.

Conduct batching so that the individual weights of each material required are within the following tolerances:

Aggregates	± 2%
Cement	- 1% to + 4%
Fly Ash	- 1% to + 4%

00754.45 Mixing Concrete:

(a) General - Mix the concrete in a batch plant mixer, truck mixer, or mobile mixer and the following:

- Charge the batch into the receiving drum so some water enters before the solids and continues to flow uniformly for a portion of the mixing time.
- Keep the skip and the throats of drums free of accumulations.
- Mix the concrete only in the quantity required for immediate use.
- Do not intermix batches.
- Do not retemper concrete by adding water or by other means.

(b) Batch Plant Mixers - The mixing time for batch plant mixers shall be at least 60 seconds unless the Contractor's CCT documents meeting "Concrete Uniformity", according to AASHTO M 157, Annex A1 for concrete produced at the batch plant mixer set up for this Project, to the satisfaction of the Engineer. The mixing time may then be reduced to the extent the test permits but not less than 45 seconds.

(c) Truck Mixers - The mixing time for truck mixers shall be 70 to 100 revolutions at a mixing speed recommended by the manufacturer of the truck mixer.

00754.46 Placing Concrete:

(a) General - Perform the strike-off, consolidation, final floating and surface finishing according to the following:

- Vibrate throughout the concrete until it is uniformly consolidated. Do not segregate.
- Strike off the concrete with templates or screeds designed and manipulated to shape the concrete to the specified cross section between the forms, carrying a slight excess of concrete in front of the leading edge of templates or screeds at all times.

- Following the vibrating and strike-off operations, float the concrete. Include transverse floating or other smoothing and finishing actions as necessary. Check and correct the surface according to 00754.49. Keep the surface free from laitance, soupy mortar, marks or irregularities.
- Finish the surface according to 00754.49.

Correct all damage to the subgrade or base due to the Contractor's operations, at no additional cost to the Agency, to the satisfaction of the Engineer.

(b) One Lift - Place the concrete in final position in one lift so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grades and cross sections.

(c) Provision for Joints and Other Devices - While placing concrete, make provision for constructing joints, placing dowels, tie bars, and other devices, as shown and directed, and as provided in 00754.43 and 00754.48.

(d) Reject Concrete Material - Reject concrete if it:

- Is not in place within 90 minutes after being mixed.
- Has begun to take an initial set before placement.

(e) Hand Operated Equipment - Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not foul the concrete with foreign matter, or disturb joint devices during such operations. Furnish hand operated mechanical vibrators satisfactory to the Engineer. Use the vibrators to consolidate the concrete pavement at least 6 feet each side of construction and expansion joints and all other areas as directed.

(f) Illumination - During hours of darkness, adequately illuminate work areas at the Contractor's expense.

00754.48 Joints:

(a) General - Construct joints of the kinds shown and where shown or directed. Joint types in the concrete pavement will be contraction, construction or expansion. They shall be transverse or longitudinal, as shown or directed. Extend all joints and joint filler to pavement edges or to each other.

Joints shall not vary from specified or indicated line by more than 1/4 inch. The tops of joint filler, when required, shall be slightly, but not more than 1/8 inch, below and paralleling finished pavement grade and cross section. Protect top edges of filler from damage by paving operations.

Construct all joints which contain preformed filler before the final floating and surface finishing of the concrete, unless otherwise directed.

(b) Longitudinal Joints - If the Contractor elects to pour the entire width of pavement at one time, construct the longitudinal joint as shown. Longitudinal joints shall be the contact type or weakened plane type as shown:

(1) Longitudinal Contact Joints - Construct longitudinal contact joints when concrete is placed against hardened concrete regardless of age, between strips of pavement or between a strip of pavement and a concrete gutter.

(2) Longitudinal Weakened Plane Joints - Construct weakened plane joints by sawing to the depths and maximum width shown. Saw longitudinal weakened plane joints at the earliest possible time following placement of the concrete to prevent uncontrolled cracking without damaging the pavement or joint. Saws may be single or tandem, as the Contractor elects, and be controlled by guides to true line. Restore curing agents broken or damaged by the sawing operations.

(c) Construction Joints - Construct construction joints when there is an interruption of 30 minutes in the concrete placing operations.

The new concrete placed against the joint shall conform closely to the proportions and consistency of the previously placed concrete except vibrate and consolidate it to a greater degree and with more care than normal. Unless otherwise shown, do not construct construction joints within 10 feet of a transverse expansion or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, remove the concrete back to the last joint and dispose of as directed.

(d) Transverse Contraction Joints - Form transverse contraction joints by sawing to the required dimensions shown on the Plans. Saw transverse contraction joints at the earliest possible time following placement of the concrete to prevent uncontrolled cracking without damaging the pavement or joint. Repair any damage to the curing material during the sawing operations immediately after the sawing is completed.

(e) Sealing Sawed Joints - Fill sawed longitudinal weakened plane joints and transverse contraction joints with poured joint filler. Thoroughly clean joints at the time of sealing. Ensure the curing period for joints is complete before allowing construction equipment and vehicles on the pavement.

00754.49 Surface Finishing - After the concrete has been given a preliminary finish, check the surface of the fresh concrete in the longitudinal and transverse direction with a 12 foot straightedge. Correct surface deviations more than allowed by 00754.56(a). Lap each successive check with the previous check path by at least half the length of the straightedge.

(a) Textured Finish - Upon completion of the machine floating, straightedge testing, edge tooling and, if necessary, hand floating, and before initial set of the surface concrete, give the surface of the concrete a textured finish.

Accomplish the textured finish with a steel-tine tool with 1/8 inch tines that will mark the finished concrete to a depth of 1/8 inch to 3/16 inch. Randomly space the markings from 1/2 inch to 1 1/4 inches as approved. Avoid overlaps of the texturing. Construct markings either perpendicular or parallel to the roadway centerline to match the adjacent concrete pavement textured finish.

With approval of the Engineer, an astroturf or broom finish may be used in place of tining on roads to receive an overlay.

(b) Transverse Profile - Match the surface of the fresh concrete in the transverse direction to the surface of the existing concrete at the ends of the patch. Taper into existing pavement ruts in the first and last 10 feet to 20 feet to provide a transverse surface finish for the remainder of the patch meeting the requirements of this section.

00754.52 Edge Tooling and Filling - Tool edges at longitudinal joints and construction joints of new pavement and clean joints of previously placed concrete to remove laitance and mortar resulting from finishing operations, and to provide clean rounded edges without ridges on the

surface. Perform tooling of edges at construction joints so that no more than a 1/8 inch radius is produced.

Fill all areas of minor honeycomb or other minor defect in composition of the concrete along the exposed sides of concrete with a stiff mortar of cement and fine aggregate, and apply to the moistened concrete to the satisfaction of the Engineer. Remove and replace areas showing serious defects in composition of the concrete with specified quality concrete for full panel width between longitudinal joints or edges, and for a length not less than a full panel length. Low spots exceeding 1/4 inch in depth, if in hardened concrete, may be filled with an epoxy grout, provided the filling is neat and blends inconspicuously with adjoining concrete. Prepare the area according to the grout manufacturer's recommendations.

00754.53 Curing Concrete - Immediately after the final floating, surface finishing and edging have been completed, and while the concrete surface is still moist, cover and cure the entire exposed surface of the newly placed concrete for at least 72 hours. If the specifications require opening the lanes to traffic in less than 72 hours, remove curing covers just prior to opening to traffic. Use one of the following provisions:

(a) Liquid Membrane-Forming Compounds - Apply liquid membrane-forming compound uniformly to the concrete by pressure-spray methods at a rate of at least 1 gallon per 150 square feet. Mix the liquid membrane-forming compound thoroughly before and during use. Liquid membrane-forming compounds are not allowed when an asphalt concrete layer will be placed on the new concrete.

(b) Other Coverings - Apply clear or white polyethylene film or insulated curing blankets as a waterproof and moisture-proof covering. Place the film or blankets beyond the edge of the repaired areas and weight to hold in position. Do not mar the concrete with the covering.

00754.54 Longitudinal Pavement Cracks - Remove and replace all patches that show longitudinal cracking or do not bond at no additional cost to the Agency.

00754.55 Spall Repair - In spalled areas, remove the existing pavement according to 00754.41(c). The repair limits shall extend beyond the spalled area a minimum of 3.0 inches. Use only rectangular or square repair shapes. Prepare the repair area according to 00754.41(d) and the PCC repair material manufacturer's recommendations, then apply a coat of epoxy grout or bonding agent to all vertical surfaces and place PCC repair material before grout dries. When a spall repair is placed directly against an adjacent longitudinal joint, place a bond breaker between the existing concrete and the area to be patched. Mix and place PCC repair material according to the manufacturer's recommendation. Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not contaminate the concrete with foreign matter. Cure PCC repair material according to the manufacturer's recommendation.

00754.56 Surface Tolerance, Testing, and Correction - The surface of finished pavement shall not deviate from longitudinal and transverse smoothness more than the limits identified below. Perform straightedge testing under the supervision of the Engineer as soon as the hardness of the concrete permits.

(a) Straightedge Testing and Tolerance - Test pavement surface longitudinal and transverse smoothness with a 12 foot straightedge. The extent of the testing will be determined by the Engineer. The pavement surface shall not deviate from the straightedge at any point by more than 1/8 inch, except the transverse surface at the patch ends may vary as required in 00754.49(b).

(b) Correcting Deficiencies - Correct all segments that exceed the requirements of 00754.56(a) by one of the following methods:

(1) Remove the non-specification concrete pavement as determined by the Engineer and replace with specification concrete pavement.

(2) Profile with an abrasive grinder equipped with a cutting head comprised of multiple diamond blades.

Retest according to 00754.56(a). Perform all corrective work at no additional cost to the Agency, including traffic control.

Maintenance

00754.60 Protection of Concrete - Repair or replace any part of the pavement damaged by traffic or damaged from any other causes before its official acceptance, according to 00170.80. Do not operate construction equipment or allow public traffic on newly placed concrete until all of the following requirements are met:

(a) The Contractor complies with 00150.60.

(b) The concrete attains a compressive strength of at least 3,000 psi as determined by testing at least two cylinders cured according to AASHTO T 23 (field cure) and tested according to AASHTO T 22.

(c) Approval is given by the Engineer before opening to traffic.

(d) The surface of the concrete is protected from scarring or abrasion and kept free of stones, loose mortar and other matter apt to be deleterious to the concrete in the paths of equipment.

00754.61 Protection of Shoulders - A portion of the shoulder adjacent to the proposed patch, may be removed as necessary to ensure proper forming at the edge or the patch. Prior to opening to traffic, the disturbed shoulder area shall be replaced with material types and thickness similar to the existing shoulder, compacted, and restored to the existing line and grade. Include all cost of the shoulder replacement in the price bid for Concrete Pavement Repair.

Measurement

00754.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Concrete Pavement Repair - Concrete pavement repair will be measured on the area basis and will be determined by measuring the width and length of each separately constructed panel of pavement. The width is the measured edge-to-edge width on the surface of the pavement, perpendicular to centerline. The length is the measurement from end-to-end of pavement along the center line of the roadway, including the length of the bar lap splices.

The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

(b) Spall Repair - Spall repair will be measured on the area basis and will be determined by measuring the width and length of each separate repair. The width is the measured edge-to-edge width on the surface of the pavement. The length is the measurement from end-to-end of pavement along the center line of the roadway.

The measurement of extra thickness beyond the depth shown in the plans or as ordered by the Engineer, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of the specified thickness.

Payment

00754.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Plain Concrete Pavement Repair	Square Yard
(b) Concrete Pavement Spall Repair	Square Yard
(c) Concrete Pavement Base Repair	Square Yard

Item (a) includes saw cutting, removing concrete pavement, preparing the base, and preparing the cut edges.

Item (b) includes sawing and removing concrete.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00755 - Continuously Reinforced Concrete Pavement

Description

00755.00 Scope - This work consists of constructing continuously reinforced portland concrete pavement with metal reinforcement, and associated reinforced concrete pavement as shown and specified.

00755.01 Abbreviations:

GPT - Graphic Profile Test

LSL - Lower Specification Limit

PI - Profile Index

SSD - Saturated Surface-Dry

SSFC - Stationary Side Form Construction

SSTV - Sublot Strength Test Value

USL - Upper Specification Limit

00755.04 Aggregate Production and Prepaving Conference:

(a) Aggregate Production Conference - Supervisory personnel of the Contractor and any subcontractor's or supplier's who are to be involved in the aggregate production work shall meet with the Engineer, at a mutually agreed time, to discuss methods of accomplishing aggregate production.

(b) Prepaving Conference - Supervisory personnel of the Contractor and any subcontractor's who are to be involved in the concrete paving work shall meet with the Engineer, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

Materials

00755.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement 02510
Concrete Materials 02001
Curing Materials 02050
Epoxy and Nonepoxy Bonding Agents 02070
Epoxy and Nonepoxy Grouts 02080
Galvanizing 02530.70
Poured Joint Fillers.....02440.30
Preformed Expansion Joint Filler 02440.10
Structural Steel.....02530
Welded Wire Fabric.....02510.40

00755.11 Classes of Concrete - Furnish Class 4000 - 1 1/2 paving concrete unless otherwise shown or indicated in the Special Provisions.

00755.13 Concrete Mix Designs - Prepare and submit either new mix designs or current mix designs for each class of concrete required according to Section 02001.

00755.15 Quality Control - Provide quality control according to Section 00165, Section 02001, and the following:

(a) Concrete Mixture - If the results of any test are outside of the specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the specification limits. If the load cannot be corrected, reject it and do not incorporate it into the work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the specification limits.

(b) Records - Deliver all batch tickets, water-cement ratio calculations, and all other records required to the Engineer upon availability but no later than the morning of the next day.

00755.16 Acceptance of Concrete:

(a) General - Acceptance of concrete will be based on the results of the Contractor's quality control testing according to Section 00165.

(b) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified by the Agency according to Section 00165.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level indicated in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165-2 for a 1.00 PF.

(c) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits of Section 02001.

(d) Hardened Concrete - Acceptance of hardened concrete will be based on statistical analysis, according to Section 00165, of the compressive strength tests of the cylinders cast by the QCT. Test the cylinders at an ODOT certified laboratory.

(1) Random Sampling and Testing - Obtain samples from each sublot on a random basis. Cast a minimum of 3 cylinders. Cast and cure the test specimens according to AASHTO T 23 in 6 inch x 12 inch single-use plastic molds and test at 28 days according to AASHTO T 22.

(2) Lots - A lot is the total quantity of concrete produced for each mix design with the same specification limits of all constituents in each stage. Slipformed and ~~nonslipformed~~non-slipformed concrete will be sampled and evaluated as separate lots.

In lots with less than three sublots, the valid individual cylinders each will be considered a sublot and statistically evaluated. Obtain at least one set of cylinders for each lot.

(3) Sublot Strength Test Value - The average of the 28 day compressive strength tests of the three cylinders will constitute the SSTV.

Any cylinders in a sublot showing definite evidence (other than low strength) of improper sampling, molding, curing or testing will be discarded, and the average of the strengths of the

remaining cylinders will constitute the SSTV. If all three cylinders comprising a sublot are discarded, the lot will be evaluated on the basis of the reduced number of sublots.

If the compressive strength of the lowest strength cylinder in a sublot is lower than the average strength of the remaining cylinders in that sublot by more than 10~~%,~~ percent, that cylinder strength will be discarded and the average of the remaining cylinders will comprise the SSTV.

(4) Quality Level Analysis - Statistically analyze the SSTV's and determine the PF for each lot of concrete, except that there will be no USL, and the LSL will equal the specified design strength.

Equipment

00755.20 Batch Plant - Provide batch plants according to Section 02001.

00755.21 Mixers - Provide mixers according to Section 02001 except mix concrete in the batch plant mixer. Truck mixers may be used only as allowed in 00755.45.

00755.22 Hauling Equipment - Transport concrete in non-agitating equipment. Truck mixers may be used to transport concrete only as allowed in 00755.45. Hauling equipment shall conform to AASHTO M 157.12 or AASHTO M 157.11.6 when allowed.

00755.23 Paving Equipment - Provide self-propelled paving machines conforming to the following:

(a) Placer/Spreader - Provide a ~~Placer/Spreader~~placer/spreader that will:

- Receive the concrete mixture in its hopper on the shoulder area.
- Deliver the concrete mixture to the slipform paver and uniformly spread at the proper thickness for the full width of the area being paved.
- Not segregate the concrete mixture or displace the reinforcing steel.

(b) Slipform Paver - Provide a ~~Slipform Paver~~slipform paver that is:

- Equipped with electronic or hydraulic controls to automatically control line and grade from both sides.
- Able to vibrate, consolidate and finish the slab to proper grade and cross section for the full width and depth of the concrete being placed.
- Equipped with vibrating tubes or arms to work in the concrete.
- Equipped with sliding forms held together rigidly to prevent them from spreading.
- Equipped with sliding forms long enough so that slumping of the concrete does not exceed 1/4 inch, according to 00755.49(a).
- Equipped with a positive interlock system to stop all vibration and tamping elements when the forward motion of the machine is interrupted.
- For projects that have more than 1,000 feet of concrete paving, equipped with an electronic monitoring device that:
  - Is near the operator's controls visible to the paver operator and Engineer.
  - Operates continuously while paving.
  - Displays the operating frequency of each individual internal vibrator for both manual and automatic sequencing.
  - Records the time of day, station location, paver track speed and the operating frequencies.

00755.24 Concrete Saws - Provide power driven concrete saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. Also provide a standby saw on the jobsite.

00755.25 Smoothness Testing Equipment - Provide all equipment and supplies for determining smoothness according to 00755.55.

(a) Straightedge - Provide two 12 foot straightedges.

(b) Profilograph - Provide a California type profilograph computerized or not computerized, complete with recorder, for determining the profile index of the pavement according to ODOT TM 770.

Have the profilograph on the Project, calibrated, in good working condition and ready for operation before construction of any concrete pavement begins. Provide a competent operator experienced in the operation of the equipment.

(c) Profilometer - Provide a profiling device that employs an accelerometer established inertial profiling reference and a laser height sensing instrument to produce a true profile of the pavement surface. The device shall be capable of reporting elevations with a resolution of 0.004 inch or finer at an interval of 6 inches or less. The unit shall be able to generate the equivalent California-type profilograph plot and values according to ODOT TM 770 as well as the locations and heights of bumps and dips as required in this Specification. The profilometer shall be calibrated, in good working condition, and ready for operation prior to performing smoothness measurements.

Provide competent and experienced ~~operator(s)~~operators for the equipment. The profilometer operator shall meet with the Engineer at a mutually agreed upon time prior to beginning smoothness measurements to discuss all aspects of smoothness measurement on the Project.

00755.26 Concrete Drills - Provide a drilling system consisting of drilling equipment and drilling supports that:

- Is capable of drilling holes of the required diameter and depth.
- Can produce holes parallel to the pavement surface and parallel to the longitudinal joint within a tolerance of ± 1/8 inch.
- Can provide hole alignments at mid-depth of PCC pavement.

Labor

00755.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~

having CAgT, CSTT, CCT, and QCT technical certifications.

Additional Contractor quality control responsibilities include the following:

- Provide and designate an individual who shall be present at the placement site at all times during concrete placements, and who is authorized and responsible for acceptance and rejection of materials.
- Reject loads which arrive at the jobsite without a batch ticket.
- Require the truck driver to record on the batch ticket and initial the amounts of water added in transit and at the jobsite.

- Reject plastic concrete that is outside of the specified limits.

Construction

00755.40 Weather Limitations - Coordinate all operations involved in constructing the pavement so the work will result in a finished pavement conforming to the Specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is allowed to proceed.

Do not place PCC during periods of rain. Do not place PCC on frozen bases. Stop placement when descending air temperature falls below 35 °F. Do not begin placement until the air temperature is 35 °F in the shade and rising and is forecast to remain above 35 °F.

Protect the pavement from weather damage. Protect unhardened PCC from precipitation with protective material. When PCC is placed during cold weather and the air temperature is forecast to drop below 33 °F, prevent the concrete from freezing for a minimum of ~~seven~~7 days after placement.

Remove and replace weather damaged pavement at no additional cost to the Agency.

00755.41 Preparation of Base:

(a) Condition - Before paving operations begin, bring the base on which the pavement is to be constructed to a finished condition required by the Specifications.

Clean the surface of all loose material. Remove all pooling and flowing water. Place concrete on existing and new asphalt only when the asphalt surface is less than 90 °F.

(b) Area - Bring the full width and length of the area on which the tracks of the paving equipment are to operate to the density and surface tolerance required of the base material.

00755.42 Construction Widths - When the pavement consists of two or more traffic lanes, construct at least two traffic lanes in one strip panel unless shown otherwise.

If the Contractor proposes a method of placement other than that shown or specified, the Contractor shall pay all costs to implement the change. Any changes require Engineer's approval.

00755.43 Placing Reinforcement:

(a) General - Place reinforcement as shown and specified. The Contractor's equipment hauling reinforcement to the site will not be allowed on the concrete subgrade or base.

The reinforcement shall be straight, clean, and free of scale or other matter which would interfere with its bonding to the concrete.

Place the reinforcement on support devices that maintain it in specified position during concrete placement. The use of tube feeding to place rebar in plastic concrete mix will not be allowed.

On areas where traffic is operating adjacent to concrete paving operations, do not lift reinforcement from the surface or place on supporting devices more than ~~two~~2 hours before placing the concrete, unless otherwise approved by the Engineer.

(b) Deformed Bar Reinforcement - Tie or clip at every other transverse bar intersection, as a minimum, in a manner that does not allow for displacement. Tie or clip every lap splice as shown.

(c) Welded Wire Fabric - Store, handle and place with care to prevent distortion.

(d) Support Devices - Support devices used to hold reinforcement in proper position in the concrete shall:

- Hold the reinforcement within ~~1~~1 1/2 inch of the vertical position shown.
- Not displace more than ~~2~~3 cubic inches of concrete when embedded in the slab.

Obtain approval of the proposed support devices before use.

If concrete placement operations displace the reinforcement, stop production and place additional support devices.

(e) Tie Bars - Place tie bars required for contact-type longitudinal joints by one of the following methods:

(1) By drilling the hardened concrete section and then inserting and grouting the tie bars into place. Drill the holes large and deep enough to insert the tie bars with adequate epoxy or nonepoxy grout. Take care not to damage the reinforcement when drilling the holes. Drill after the concrete attains enough strength so no damage to the concrete is caused by the drilling. Replace loose tie bars at no additional cost to the Agency.

(2) By inserting the tie bars into the plastic slipformed concrete before vibrating and finishing the concrete. The tie bars may be bent before insertion. Replace any loose tie bars by drilling and grouting, as described in 00755.43(e-1), at no additional cost to the Agency.

(3) By using threaded mechanical splice couplers from the QPL~~, or approved equal.~~. Submit splices for approval before using. Rebar splices shall be:

- Accompanied by manufacturer's quality compliance certificate according to 00165.35.
- Installed according to manufacturer's recommendations.

(f) Dowel Bars - Place dowel bars for joint contact at existing concrete pavement surfaces by drilling the existing concrete section and then inserting the dowel bars and grouting them in place. Drill the holes large and deep enough to insert the dowel bars with adequate epoxy or nonepoxy grout. Adjust hole locations to avoid damaging any existing reinforcement when drilling the holes. Blow the dowel bar holes clean with compressed air before grouting. Center the bar in the hole for the full length of embedment before grouting. Pump the grout into the hole around the bar so the back of the hole will be filled first. Do not allow blocking or shimming to impede the flow of the grout into the hole. If dams are needed, place them at the front of the holes to confine the grout. Place the dams to permit the escape of air without leaking grout. Do not remove dams until grout has cured in the hole.

00755.44 Handling, Measuring, and Batching Materials - The plant site, layout, equipment and provisions for transporting material shall be adequate to assure a continuous supply of material to the worksite.

(a) Aggregates - Stockpile and remove the aggregate from stockpiles in a manner that holds segregation to a minimum.

Do not use aggregates that become segregated, mixed with earth or foreign material, or contain lumps of hardened material. Thaw frozen aggregates or aggregates containing frozen lumps before use.

(b) Batching - Batch materials according to 02001.40.

00755.45 Mixing Concrete - Mix the concrete according to 02001.40. Mix the concrete in a batch plant mixer, except truck mixers may mix and deliver concrete only to areas inaccessible to paving equipment.

00755.46 Placing Concrete:

(a) Delivery To Spreader - Deliver the concrete from the hauling vehicles to the placer/spreader hopper on the shoulder area. Do not permit equipment hauling concrete on the subgrade or on the base, except for a minimum number of approved right angle or near right angle crossings. Correct damage to the subgrade or base due to the Contractor's operations to the satisfaction of the Engineer at no additional cost to the Agency. Keep the surface of the subgrade or base moist in front of the paving operation.

(b) One Lift - Place the concrete in final position by the slipform method in one lift, so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grade and cross section, except when 00755.50 applies.

(c) ~~Two Separate Machines~~Spreading and Finishing Construction - Except for concrete pavement to be placed and finished ~~near obstructions~~at locations inaccessible to slipform paving equipment, place the concrete with ~~two separate machines, one a placer/spreader and one a slipform paver. The machines shall operate in tandem and~~slipform paving equipment designed to spread, consolidate, screed, and float~~-~~-finish the ~~freshly placed~~plastic concrete in one complete pass of the machine to provide a dense and homogeneous pavement surface with a minimum of hand finishing. Use hand screeding and float finishing only on small irregular areas.

Consolidate the plastic concrete by internal vibration with transverse vibrating units located within the specified thickness of pavement sections for the full width of pavement. A series of equally spaced longitudinal vibrating units may be used to supplement or replace the transverse vibrating units.

Maintain the frequency of vibration of each vibrating unit above 7,500 cycles per minute. Maintain the frequency or amplitude of vibration to consolidate the plastic concrete along the entire length of the vibrating unit and for a distance of at least 1 foot. Vary the frequency or vibration of amplitude proportionately with the rate of travel to result in a uniform density and air content.

Horizontally space vibrators according to the manufacturer's recommendations or not more than 18 inches, center-to-center, whichever is less. Do not exceed a 9 inch space from the outer edge of the pavement to the outside vibrator.

(d) Continuous Forward Motion - Coordinate all operations of mixing, delivering and spreading concrete to provide uniform progress. Operate the slipform paver with as nearly continuous forward movement as possible. Hold stopping and starting the paver to an absolute minimum. If, for any reason, it is necessary to stop the forward motion of the paver, the vibratory and tamping elements shall also be stopped immediately. Apply no external force to the paver.

(e) Provision for Joints and Other Devices - While placing concrete, make provision for constructing joints, placing dowels, tie bars, and other devices, as shown and directed, and as provided in 00755.43 and 00755.48.

(f) Reject Concrete Material - Reject concrete if it:

- Is not in place within ~~one~~ 1 hour after being mixed.

- Has begun to take an initial set before placement.
- Has been retempered with water.

(g) Protect Surface - Equip supports of the slipform paver, and other equipment which ride on previously placed pavement to meet the requirements of 00755.60, to prevent marring, edge breaking or chipping of the previously placed pavement.

When concrete is placed adjacent to an existing pavement, equip that part of the equipment which is supported on the existing pavement with protective pads on crawler tracks or use rubber-tired wheels. Offset the track or wheels to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

(h) Hand Operated Equipment - Use shovels, not rakes, to hand spread and distribute the concrete. Do not foul the concrete with foreign matter, or disturb joint devices during such operations. Furnish hand operated mechanical vibrators satisfactory to the Engineer. Use these vibrators to consolidate the concrete pavement at least 6 feet each side of construction and expansion joints and any other areas as directed.

(i) Illumination - During hours of darkness, adequately illuminate work areas at no additional cost to the Agency.

00755.47 Test Strip - At the beginning of paving operations, construct one initial test strip of concrete pavement at least 0.1 mile, but not more than 0.2 mile in length at the specified paving width. Use the same equipment for the remainder of the paving. Do not perform further paving until the test strip is evaluated according to 00755.55. An additional test strip will be required when:

- The Contractor proposes using different paving equipment.
- Any portion of a test strip fails to meet the smoothness requirements of 00755.55.

Change methods and/or equipment and construct additional test strips until a test strip meets smoothness requirements without grinding or other corrective work. Limit these additional test strips to 0.1 mile in length.

If three test strips fail to meet smoothness requirements before grinding, remove all three strips and construct additional test strips at no additional cost to the Agency.

The Engineer may waive the initial test strip if the Contractor is proposing to use a batch plant mixer and paving equipment that were satisfactorily used on a Department project within the preceding 12 months and the mixer hasn't been altered or moved.

00755.48 Joints:

(a) General - Construct joints of the kinds shown and where shown or directed. Joint types in the concrete pavement will be contraction, construction or expansion. They shall be transverse or longitudinal, as shown or directed. Extend all joints and joint filler to pavement edges or to each other.

Construct all joints at right angles to the surface of the pavement. Joints shall not vary from specified or indicated line by more than 1/4 inch. The tops of joint filler, when required, shall be slightly, but not more than 1/8 inch, below and paralleling finished pavement grade and cross section. Protect top edges of filler from damage by paving operations.

All joints which contain preformed filler are to be constructed before the final floating and surface finishing of the concrete, unless otherwise directed.

(b) Longitudinal Joints - Longitudinal joints shall be the contact type or weakened plane type as shown.

(1) Longitudinal Contact Joints - Construct longitudinal contact joints when concrete is placed against hardened concrete, between strips of pavement or between a strip of pavement and a concrete gutter.

(2) Longitudinal Weakened Plane Joints - Construct weakened plane joints by sawing to the depths and maximum width shown. ~~Perform sawing as soon as~~ Saw longitudinal weakened plane joints at the earliest possible time following placement of the concrete ~~has set enough~~ to ~~permit sawing~~prevent uncontrolled cracking without ~~tearing~~damaging the pavement or ~~raveling~~joint. Saws may be single or tandem, as the Contractor elects, and be controlled by guides to true line. Restore curing agents broken or damaged by the sawing operations.

If the top width of sawed joints exceeds 1/4 inch, fill the joint with a poured joint filler.

(c) Construction Joints - Construct construction joints when there is an interruption of ~~20~~ 45 minutes in the concrete placing operations.

The new concrete placed against the joint shall conform closely to the proportions and consistency of the previously placed concrete except vibrate and consolidate it to a greater degree and with more care than normal.

(1) Continuously Reinforced Pavement - Furnish a self-supported working platform at each construction joint. This working platform shall be at least 4 feet wide and long enough to span the entire width of the pavement panel being constructed. Construct and support the platform so it does not rest upon or touch the reinforcing steel. Have the workers use this platform when working in the area around construction joints and do not walk on the reinforcing steel. Remove any debris or spilled concrete at and beyond the joint, and support the reinforcement in proper position.

Form construction joints with a special header board. Take care when forming construction joints to assure that the reinforcement and its supports are not displaced, distorted or otherwise disturbed. When concrete placement resumes, remove the header board so neither the reinforcement nor the bond between the reinforcement and the previously placed concrete is disturbed.

(2) Other Pavements - Unless otherwise shown, do not construct construction joints within 10 feet of a transverse expansion or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, remove the concrete back to the last joint and dispose of as directed.

(d) Terminal Expansion Joints - Locate terminal expansion joints at the ends of runs of continuously reinforced concrete pavement and construct to the dimensions and details shown.

The concrete in sleeper slabs shall conform to 00755.11. The steel reinforcement shall conform to Section 02510.

Vibrate concrete in sleeper slabs until it is completely consolidated and the excavations are completely filled. Construct sleeper slabs at least 24 hours before paving operations, unless otherwise allowed. Cure the surfaces of sleeper slab concrete according to 00755.53 until covered with concrete pavement.

00755.49 Surface Finishing - After the concrete has been given a preliminary finish by the finishing devices in the slipform paving equipment, check the surface of the fresh concrete in the longitudinal and transverse direction with a 12 foot straightedge. Correct surface deviations more than allowed by 00755.55(a). Lap each successive check with the previous check path by at least half the length of the straightedge. This longitudinal checking and correction on areas to be graphically profiled will be waived if it is successfully demonstrated that a pavement surface is otherwise produced which conforms to 00755.55(b-1-a).

(a) Edge Slump - Correct any edge slump of the concrete in excess of 1/4 inch before the concrete hardens.

(b) Textured Finish - Upon completion of the machine floating, straightedge testing, edge tooling and, if necessary, hand floating, and before initial set of the surface concrete, give the surface of the concrete a textured finish.

Accomplish the textured finish with ~~a~~at steel-tine tool with 1/8 inch wide tines spaced 3/4 inches apart that will mark the finished ~~concrete~~surface to a depth of 1/8 ~~inch~~ to 3/16 inch~~. Randomly space~~ without tearing the ~~markings from 1/2 inch to 1 1/4 inches as approved.~~surface. Avoid overlaps of the texturing. ~~Markings shall be transverse~~Texture the surface parallel to the roadway centerline and full roadway width.

00755.50 Stationary Side Form Construction - Consolidate and finish according to 00755.51.

(a) Mandatory SSFC - Use stationary side form construction on the standard reinforced concrete pavement at the ends of structures.

(b) Optional SSFC - With the approval of the Engineer, pavement may be constructed between stationary side forms in:

- Areas inaccessible to slipform paving equipment.
- Irregular areas.
- Short sections of pavement which are necessary to facilitate traffic movement.

00755.51 Modification of Strike-off, Consolidation, Final Floating, and Surface Finishing - Where the width of pavement is narrow, tapering, or of irregular pattern not lending itself to being constructed by prescribed machine methods, the Contractor will be allowed to perform the strike-off, consolidation, final floating and surface finishing with equipment, tools, means, labor and methods other than those specified, provided the work meets with the approval of the Engineer and the following requirements:

- Without causing segregation, vibrate throughout the concrete being placed until it is uniformly consolidated.
- Strike off the concrete with templates or screeds designed and manipulated to shape the concrete to specified cross section between the forms, carrying a slight excess of concrete in front of the leading edge of templates or screeds at all times.
- Following the vibrating and strike-off operations, float the concrete. Include transverse floating or other smoothing and finishing actions as necessary. Check and correct the surface according to 00755.49. Keep the surface free from laitance, soupy mortar, marks or irregularities.
- Finish the surface according to 00755.49.

00755.52 Edge Tooling and Filling - Tool edges at transverse joints and longitudinal joints of new pavement and clean joints of previously placed concrete to remove laitance and mortar resulting from finishing operations, and to provide clean rounded edges without ridges on the surface.

Fill any areas of minor honeycomb or other minor defect in composition of the concrete along the exposed sides of concrete with a stiff mortar of cement and fine aggregate, and apply to the moistened concrete to the satisfaction of the Engineer. Remove and replace areas showing serious defects in composition of the concrete with specified quality concrete for full panel width between longitudinal joints or edges, and for a length not less than 10 feet. Low spots exceeding 1/4 inch in depth, if in hardened concrete, may be filled with an epoxy grout, provided the filling is neat and blends inconspicuously with adjoining concrete. Prepare the area according to the grout manufacturer's recommendations.

00755.53 Curing Concrete - Immediately after the final floating, surface finishing and edging have been completed, and while the concrete surface is still moist, cover and cure the entire exposed surface of the newly placed concrete for at least 72 hours according to one of the following provisions:

(a) Liquid Membrane-Forming Compounds - Apply liquid membrane-forming compound uniformly to the concrete by pressure-spray methods at a rate of at least 1 gallon per 150 square feet. Mix the liquid membrane-forming compound thoroughly before and during use.

(b) Other Coverings - Apply the covering to damp concrete as soon as it can be placed without marring the surface. Place the membrane in contact with the surface, extend beyond the sides or edges of the slabs or forms, and weight down as required to hold it in position as a waterproof and moisture-proof covering. Laps shall be sufficient to maintain tightness equivalent to the sheeting and use:

(1) Polyethylene Film - Sheeting shall be clear or white.

(2) Waterproof Paper - Transverse laps shall be at least 18 inches, and cement longitudinal seams.

(3) Cotton or Jute Mats - Before placing, saturate the mats with water and keep fully wetted during the curing period.

00755.54 Longitudinal Pavement Cracks - Within 28 days after concrete placement and before opening the pavement to public traffic, the Engineer will perform a pavement crack survey. Clean the pavement before the crack survey. Pavement with uncontrolled longitudinal cracks which are visible without magnification will be considered unacceptable and be repaired or removed as determined by the Engineer. Perform all remedial work at the no additional cost to the Agency.

00755.55 Surface Tolerance, Testing, and Correction - The surface of finished pavement shall not deviate from longitudinal and transverse smoothness more than the prescribed limits. Perform straightedge testing and graphic profile testing under the supervision of the Engineer with equipment furnished and operated by the Contractor as soon as the hardness of the concrete permits.

(a) Straightedge Testing and Tolerance - Longitudinal and transverse smoothness testing of the pavement surface shall be done with a 12 foot straightedge. The extent of the testing will be as the Engineer determines necessary or expedient. The pavement surface shall not deviate from the straightedge at any point by more than 1/8 inch for all areas that are constructed by the prescribed machine methods and for all traffic lanes and ramps. Other areas shall not deviate by more than 1/4 inch. Longitudinal 12 foot straightedge testing will not be required for pavement accepted under 00755.55(b).

(b) Graphic Profile Testing (GPT) and Tolerance:

(1) General - Test the longitudinal surface of all traffic lanes, ramps, shoulders and bridges for smoothness by the graphic profile method according to ODOT TM 770. Before paving commences on the Project, demonstrate the profilograph or profilometer operation by conducting a calibration test according to ODOT TM 770, and running the machine twice over a 0.1 mile section of pavement with repeating results.

a. Graphic Profile Tolerance - The pavement shall have a profile index of 7.0 inches per mile or less for each wheel path in each 0.1 mile segment or partial segment, and shall have no individual deviation of 0.3 inch or more. On ramps, shoulders and auxiliary lanes the profile index shall be 12.0 inches per mile subject to the above criteria. Bonus payment for smoothness will be made according to 00755.95.

b. Daily GPT - If the average profile index exceeds 7.0 inches per mile for all segments and partial segments of pavement constructed in any day's production, discontinue paving operations and construct one or more test strips as described in 00755.47. The test strip may be comprised of pavement placed during the shift that the shutdown is ordered, but in no case shall it be less than 0.1 mile in length.

(2) Surface Test - Run the profilograph or profilometer over the full length of the Project and 50 feet beyond the Project ends to provide a complete graphic profile. This includes all concrete traffic lanes and auxiliary lanes.

Obtain profiles on the pavement surface along lines parallel to and approximately 3 feet from each edge and longitudinal ~~joint(s)~~joints for 12 foot wide lanes and 4 feet from each edge and longitudinal ~~joint(s)~~joints for 14 foot wide lanes. The intent is to provide a profile in each vehicle wheel path. Take ~~profile(s)~~profiles on transition areas of entrance and exit ramps as close to the wheel path as practical.

Start the profiles that represent a day's production 50 feet before the beginning of that day's production and stop 50 feet before the end of that day's production.

Run the profiles for each day's production as soon as possible without damaging the surface. Analyze the daily GPT profiles according to 00755.55(b-3), and give the profiles and results to the Engineer within 24 hours of the conclusion of the day's production.

(3) Determining Profile Index:

a. General - Determine the profile index of pavement in 0.1 mile segments and partial segments. Segments shall begin 13 feet into the Project and run consecutively in either the direction of travel or the concrete placement, as determined by the Engineer. A segment will end as a partial segment and a new segment will begin when the segment sequence is interrupted by stage construction or by profiled areas excluded from the GPT smoothness requirements.

The following profiled areas of pavement are excluded from the GPT smoothness requirements:

- Profiles extending beyond the Project ends.
- Bridge decks and bridge panels.
- First and last 13 feet at the Project ends and bridge end panels.
- Pavement on horizontal curves with radii less than 1,000 feet.

Include and analyze separately those areas in the profile charts that are not subject to the GPT smoothness profile index requirements.

b. Method of Analysis - Determine the profile index and individual deviations of 0.3 inch or more by analyzing the profile charts according to ODOT TM 770 and provide the profile charts and results to the Engineer for review.

c. Profile Index - The profile index is the inches per mile in excess of the 0.2 inch blanking band. The formula for converting counts to profile index is:

$$\text{Profile Index} = \frac{\text{Total Count} \times 0.10}{\text{Length of Full 0.10 Mile Segment or of Partial } \underline{\quad * \quad} \text{ Mile Segment}}$$

* Report to the nearest 0.01 mile

(c) Correcting Deficiencies - Should testing described in 00755.49, 00755.51, and 00755.55 show the pavement does not conform to the prescribed limits of deviation, the following shall apply:

(1) Failure To Meet Straightedge Requirements:

a. Plastic Concrete - If the requirements of 00755.49 or 00755.51 are not met, stop the paving operations until revised methods, changes in equipment, or correction of procedures are made or proposed for trial, and are approved by the Engineer for trial. Also stop those revisions, changes and corrections if they do not produce a specified surface.

b. Hardened Concrete - If the requirements of 00755.51 or 00755.55(a) are not met, correct according to 00755.55(c-2-a) or 00755.55(c-2-b) and retest.

(2) Failure To Meet Graphic Profile Requirements - Correct any segment or partial segment that exceeds the requirements of 00755.55(b) in either wheel path by one of the methods listed below to the specified limits except correct deviations of 0.3 inch or more at least to the edge of the blanking band:

a. Remove - Remove the ~~nonspecification~~non-specification concrete pavement as determined by the Engineer and replace with specification concrete pavement.

b. Grind - Profile with abrasive ~~grinder(s),~~grinders, equipped with a cutting head comprised of multiple diamond blades. The Engineer will determine and mark the areas to be profiled. For all areas corrected by grinding, restore the required surface texture, as specified in 00755.49(b), by transverse sawing with diamond blade saws.

Retest their entire length, according to 00755.55(b), all segments requiring corrective work with the profilograph or profilometer under the supervision of the Engineer. Perform all corrective work and graphic profiling, including traffic control, at no additional cost to the Agency.

00755.56 Pavement Thickness - Construct the pavement to the thickness shown. Pavement not so constructed will be subject to replacement according to 00755.57, or to payment at adjusted prices according to 00755.93.

(a) Sticking Measurements - Determine conformance with minimum thickness requirements by random sticking measurements of the plastic concrete according to ODOT TM 775 under the Engineer's observation. Report thickness to the nearest 0.1 inch.

Divide the panel into units and partial units equivalent to a maximum of 200 lane feet. Normally, unit lengths will be 200 feet for one lane, 100 feet for two lanes, 70 feet for three lanes and as appropriate for transition areas. When directed, take one sticking measurement at a randomly selected location in each unit and partial unit. Record measurements to the nearest 0.1 inch. Take the measurements:

- After consolidation and screeding and before the float finish.
- No closer than 2 feet from the panel edges.
- Within 10 feet longitudinally and 1 foot transversely from the calculated random location determined by the Engineer.

If a sticking is not obtained for a unit or a partial unit, or is not available to represent the area of pavement remaining after the limits of pavement over 1.0 inch deficient is determined, the measurement will be assumed to be the same as the preceding or following sticking measurement, that is nearest in distance.

(b) Thickness 0.5 Inch Deficient - If a sticking measurement indicates the pavement is 0.5 inch or more deficient in thickness, stop forward paving progress until appropriate adjustments are made or corrective action is taken.

(c) Coring Requirements - Perform required coring, or coring requested by the Engineer according to AASHTO T 24 and repair core holes as directed, at no additional cost to the Agency. Cores will be measured by the Engineer according to AASHTO T 148 and the measurements reported to the nearest 0.1 inch. Core measurements will replace sticking measurements.

(1) Corrective Grinding Areas - If corrective grinding required by 00755.55(c) is performed at a sticking measurement site, obtain a core at the sticking measurement site according to the following:

a. Profile Indexes 7.0 Inches Per Mile or Less - If the original profile indexes for a segment or partial segment determined by 00755.55 is 7.0 inches per mile or less in each wheel path, a core is not required after corrective grinding is performed at a sticking measurement site within the segment or partial segment represented by the profile indexes.

b. Profile Index Greater 7.0 Inches Per Mile - If an original graphic profile index for a segment or partial segment determined by 00755.55 is more than 7.0 inches per mile for a wheel path, obtain a core, after corrective grinding has been performed, at a sticking measurement site within the segment or partial segment represented by the profile indexes if the sticking measurement is the specified depth or less.

(2) Cores Requested By Contractor - If the Contractor believes that a sticking measurement or a core is not representative of the actual pavement thickness, the Contractor may take a replacement core. Take replacement cores at a location as directed, 10 feet from the sticking measurement or core site in question and the same distance from centerline. The replacement core measurement will replace the original sticking or core measurement.

(d) Thickness Over 1.0 Inch Deficient - If a sticking measurement shows pavement over 1.0 inch deficient, obtain a core at the sticking measurement site. If this core, or a core determined by 00755.56(c-1), shows pavement over 1.0 inch deficient, obtain additional cores. Take these additional cores at the same distance from the centerline and at 25 foot intervals each direction from the first core until a core in each direction shows pavement 1.0 inch deficient or less. These two core locations will be considered the limits of the pavement more than 1.0 inch deficient. The pavement panel between these two cores will represent the area of pavement subject to removal and replacement under 00755.57 or no payment under 00755.93.

When it is suspected by the Engineer that the pavement in the adjacent travel ~~lane(s)~~lanes in the panel may be more than 1.0 inch deficient for a greater distance than determined by the above procedure, core the pavement in the adjacent travel ~~lane(s)~~lanes in the nearest wheel track (3 feet from the nearest edge) opposite both limit cores. If these cores are more than 1.0 inch deficient, the above procedure shall be followed to determine the limits.

00755.57 Deficient Pavement - Remove and replace pavement deficient in thickness by more than 1.0 inch, according to 00755.56(d), at no additional cost to the Agency. If allowed by the Engineer, the pavement may be left in place without payment. Replacement pavement shall be of the specified design, quality and thickness as follows:

- Be the full width of the pavement panel involved.
- Extend far enough to replace at least a 20 foot length.
- Extend to the construction joint if closer than 20 feet to a construction joint.

00755.58 Terminal Anchors - Furnish concrete for anchors according to 00755.11. Furnish steel meeting the requirements for standard pavement reinforcement as shown.

Vibrate the concrete in anchors until it is consolidated and the excavations are filled. Construct anchors at least 24 hours before paving operations. Keep the surfaces of anchor concrete moist and clean until covered with pavement concrete.

00755.59 Flexible to Rigid Pavement Transition Systems - Furnish the concrete in pavement transition systems according to 00755.11. Furnish steel meeting the requirements for standard pavement reinforcement as shown.

Vibrate the concrete in pavement transition systems until it is consolidated and the excavations are filled. Construct pavement transition systems at least 24 hours before paving operations.

Maintenance

00755.60 Protection of Concrete - Repair or replace any part of the pavement damaged by traffic or damaged from any other cause before its official acceptance, according to 00170.80.

The maturity method, AASHTO T 325, may be used to estimate concrete strength for opening pavement to construction traffic. Install at least two maturity thermocouples for each day's placement in areas where the maturity method will be used for early opening. Install the thermocouples near the day's final placement for areas being evaluated for early opening.

When the maturity method is used, the Engineer may verify the maturity method with strength specimens. Establish a new strength-maturity relationship if strength specimens deviate more than 10 percent from the maturity-estimated strengths. Suspend use of the maturity method for opening pavements to traffic when the strength-maturity relationship deviates by more than 10 percent until a new strength-maturity relationship is established.

Do not operate construction equipment on newly placed concrete until the requirements of (a), (b), and (c) are met. Do not allow public traffic on newly placed concrete until all of the following requirements are met:

(a) The Contractor complies with 00150.60.

(b) The concrete attains a compressive strength of at least 70~~%~~ percent of the specified 28 day strength as determined by testing at least three cylinders cured according to AASHTO T 23 (field cure) and tested according to AASHTO T 22.

(c) The surface of the concrete is protected from scarring or abrasion and kept free of stones, loose mortar and other matter apt to be deleterious to the concrete in the paths of equipment.

(d) The pavement meets all of the requirements of 00755.55.

Measurement

00755.80 Measurement - The quantities of concrete pavement will be measured on the area basis. The area will be determined by measuring the width and length of each separately constructed panel of pavement. The width is the design width or measured edge-to-edge width on the surface of the pavement, whichever is less. The length is the horizontal measurement from end to end of pavement along the center line of the strip.

The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

The quantities of terminal ~~expansion joints~~anchors will be measured on the length basis, along the center line of each ~~expansion joint~~anchor as constructed.

Payment

00755.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Continuously Reinforced Concrete Pavement	Square Yard
(b) Continuously Reinforced Concrete Pavement _____ Inches Thick	Square Yard
(c) Reinforced Concrete Pavement	Square Yard
(d) Reinforced Concrete Pavement _____ Inches Thick	Square Yard
(e) Terminal ~~Expansion Joints~~Anchors	Foot
(f) Flexible to Rigid Pavement Transitions	Each

In items (b) and (d), the thickness of the pavement will be inserted in the blank when more ~~then~~than one thickness is required under the Contract.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for ~~sleeper slabs or~~ splices in the terminal ~~expansion joints~~anchors required due to staged construction.

00755.92 Price Adjustment for Strength - For each lot of concrete for which a PF is determined, the following will apply:

- In no case will the actual payment exceed the Contract Unit Price.
- When the PF is less than 1.00, the price adjustment will be determined as follows:

$$\text{Price Adjustment} = 0.3 \times (PF - 1) \times \text{Unit Price}$$

00755.93 Price Adjustment for Variation in Thickness - No additional payment over the Contract unit price will be made for pavement having a thickness greater than shown or ordered by the Engineer. When the pavement is found deficient in thickness by more than 0.2 inch, but not more than 1.0 inch, as determined according to 00755.56, payment will be made at an adjusted price according to the following table:

Deficiency in Thickness (Inch)	Proportional Part of Contract Unit Price Allowed
0.00 to 0.20	100%
0.21 to 0.30	83%
0.31 to 0.40	76%
0.41 to 0.50	73%
0.51 to 0.75	63%
0.76 to 1.00	59%

No payment will be made for any area of pavement found deficient in thickness by more than 1.0 inch even though such pavement is allowed by the Engineer to remain in place under the provisions of 00755.57.

00755.95 Bonus Payment for Smoothness - A bonus payment of up to 1.5~~%~~ percent will be made to the Contractor for each 0.1 mile segment or partial segment of pavement except shoulders, as determined in 00755.55(b) if:

- The profile index for each wheel path is 7.0 inches per mile or less.
- No individual deviation is 0.3 inch or more.
- The average of the two profile indexes is less than 5.0 inches per mile.
- These requirements are met without any corrective action specified in 00755.55(c).

The bonus payment for each segment and partial segment meeting the above requirements will be computed as follows:

$$\text{Bonus} = 0.006 \times (5.0 - \text{PI}) \times \text{Quantity} \times \text{Unit Price}$$

PI = Average of the two profile indexes in the segment or partial segment (inches per mile)
Quantity = The quantity (square yards) represented by the segment or partial segment
Unit Price = The unit price for the concrete pavement as shown in the Contract Schedule of Items

Section 00756 - Plain Concrete Pavement

Description

00756.00 Scope - This work consists of constructing portland cement concrete pavement as shown and specified.

00756.01 Abbreviations:

GPT - Graphic Profile Test

LSL - Lower Specification Limit

PI - Profile Index

~~**PCC** - Portland Cement Concrete~~

SSD - Saturated Surface-Dry

SSFC - Stationary Side Form Construction

SSTV - Sublot Strength Test Value

USL - Upper Specification Limit

00756.04 Aggregate Production and Prepaving Conference:

(a) Aggregate Production Conference - Supervisory personnel of the Contractor and any subcontractor's or supplier's who are to be involved in the aggregate production work shall meet with the Engineer, at a mutually agreed time, to discuss methods of accomplishing aggregate production.

(b) Prepaving Conference - Supervisory personnel of the Contractor and any subcontractor's who are to be involved in the concrete paving work shall meet with the Engineer, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

Materials

00756.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement	02510
Concrete Materials	02001
Curing Materials	02050
Epoxy and Nonepoxy Bonding Agents	02070
Epoxy and Nonepoxy Grouts	02080
Galvanizing	02530.70
Poured Joint Fillers	02440.30
Preformed Expansion Joint Filler	02440.10
Structural Steel	02530
Welded Wire Fabric	02510.40

00756.11 Classes of Concrete - Furnish Class 4000 - 1 1/2 paving concrete unless otherwise shown or indicated in the Special Provisions.

00756.13 Concrete Mix Designs - Prepare and submit either new mix designs or current mix designs for each class of concrete required according to Section 02001.

00756.15 Quality Control - Provide quality control according to Section 00165, Section 02001, and the following:

(a) Concrete Mixture - If the results of any test are outside of the specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the specification limits. If the load cannot be corrected, reject it and do not incorporate it into the work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the specification limits.

(b) Records - Deliver all batch tickets, water-cement ration calculations, and all other records required to the Engineer upon availability but no later than the morning of the next day.

00756.16 Acceptance of Concrete:

(a) General - Acceptance of concrete will be based on the results of the Contractor's quality control testing according to Section 00165.

(b) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified by the Agency according to Section 00165.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level indicated in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165-2 for a 1.00 PF.

(c) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits of Section 02001.

(d) Hardened Concrete - Cast and cure the test specimens according to AASHTO T 23 in 6 inch x 12 inch single-use plastic molds and test at 28 days according to AASHTO T 22.

(1) General - For all classes of concrete, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test the cylinders at an ODOT certified laboratory.

(2) Actual Strength Test Value ~~(28 day)~~ - The ASTV at 28 days is the average compressive strength of the three cylinders tested. If the compressive strength of a single test specimen varies by more than 10~~%~~ percent from the average of the other two specimens, that compressive strength value will be discarded. The average compressive strength test of the two remaining specimens will be the ASTV.

(3) Sampling and Testing - Sampling and testing shall be according to the MFTP.

(4) Acceptance - The ASTV shall exceed the $f'c$ (specified strength) for the mix design. If a set of cylinders has an ASTV less than $f'c$, the Engineer will review the results to determine if the concrete represented by the cylinders shall be removed. In any case, concrete that has an ASTV of less than 85~~%~~ percent of the specified strength shall be removed unless otherwise authorized, in writing, by the Engineer. The cost of removal, replacement and all related work

shall be the Contractor's responsibility, subject, if the concrete is allowed to remain in place, to a price adjustment according to 00150.25.

If an ASTV falls below the f'c, the Contractor may submit a written plan within ~~three~~3 days of the test for review by the Engineer. The plan shall outline a proposed alternate method of evaluating compressive strength. The plan shall provide evidence that a reasonable f'cr (over~~-~~design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. If the Engineer determines that the compressive strength test results are suspect from definable external factors, the Engineer may allow an alternate method of acceptance.

Equipment

00756.20 Batch Plant - Provide batch plants according to Section 02001.

00756.21 Mixers - Provide mixers according to Section 02001 except mix concrete in the batch plant mixer. Truck mixers may be used only as allowed in 00756.45.

00756.22 Hauling Equipment - Transport concrete in non-agitating equipment. Truck mixers may be used to transport concrete only as allowed in 00756.45. Hauling equipment shall conform to AASHTO M 157.12 or AASHTO M 157.11.6 when allowed.

00756.23 Paving Equipment - ~~Place the PCC with either a slip form paving machine, a paving machine riding on stationary side forms, or both as the Contractor elects.~~ Provide self-propelled paving machines that conform to the following:

(a) Placer/Spreader - Provide a ~~Placer/Spreader~~placer/spreader that will:

- Receive the concrete mixture in its hopper on the shoulder area.
- Deliver the concrete mixture to the slipform paver and uniformly spread at the proper thickness for the full width of the area being paved.
- Not segregate the concrete mixture or displace the reinforcing steel.

(b) Slipform Paver - Provide a ~~Slipform Paver~~slipform paver that is:

- Equipped with electronic or hydraulic controls to automatically control line and grade from both sides.
- Able to vibrate, consolidate and finish the slab to proper grade and cross section for the full width and depth of the concrete being placed.
- Equipped with vibrating tubes or arms to work in the concrete.
- Equipped with sliding forms held together rigidly to prevent them from spreading.
- Equipped with sliding forms long enough so that slumping of the concrete does not exceed 1/4 inch, according to 00756.49(a).
- Equipped with a positive interlock system to stop all vibration and tamping elements when the forward motion of the machine is interrupted.
- For projects that have more than 1,000 feet of concrete paving, equipped with an electronic monitoring device that:
  - Is near the operator's controls visible to the paver operator and Engineer.
  - Operates continuously while paving.
  - Displays the operating frequency of each individual internal vibrator for both manual and automatic sequencing.

- Records the time of day, station location, paver track speed and the operating frequencies.

(c) Paving Machine - If a paving machine riding on stationary side forms is used, conform to the following:

- The machine used for initial strike-off and consolidation of PCC shall be self-propelled, screening type and shall ride on and be guided by steel side forms or the edge of contiguous PCC pavement. The machine shall be designed and operated to strike-off, consolidate and compact the PCC to prescribed line, grade and cross section. Make provision to prevent chipping or marring previously placed PCC.
- Vibratory equipment shall be of the surface pan type or internal type with immersed tube or multiple spuds. The vibrator shall provide full slab width vibration to the concrete ~~at frequencies~~. The rate of vibration shall be not less than 3,500 ~~impulses~~ cycles per minute for surface vibrators and shall be not less than 7,000 cycles per minute for internal vibrators and as necessary for proper consolidation and compaction.
- Floating and finishing machines shall be self-propelled and shall ride on and be guided by steel side forms or the edge of contiguous PCC pavement. The machine shall provide floating action to the PCC surface by means of screeds, floats, rollers or combinations of them. Screed type machines shall have at least two oscillating type transverse screeds. The machines shall have sufficient wheel base length, weight, float surface and adjustments to true up the PCC surface to accurate cross section and grade without dragging, marking or defacing the surface.

00756.24 Concrete Saws - Provide power driven concrete saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. Also provide a standby saw on the jobsite.

00756.25 Smoothness Testing Equipment - Provide all equipment and supplies for determining smoothness according to 00756.55.

(a) Straightedge - Provide two 12 foot straightedges.

(b) Profilograph - When required, provide a California type profilograph, computerized or not computerized, complete with recorder for determining the profile index of the pavement according to ODOT TM 770.

Have the profilograph on the Project, calibrated, in good working condition and ready for operation before construction of any concrete pavement begins. Provide a competent operator experienced in the operation of the equipment.

(c) Profilometer - Provide a profiling device that employs an accelerometer established inertial profiling reference and a laser height sensing instrument to produce a true profile of the pavement surface. The device shall be capable of reporting elevations with a resolution of 0.004 inch or finer at an interval of 6 inches or less. The unit shall also be able to generate the equivalent California-type profilograph plot and values according to ODOT TM 770 as well as the locations and heights of bumps and dips as required in this specification. The profilometer shall be calibrated, in good working condition, and ready for operation prior to performing smoothness measurements.

Provide competent and experienced ~~operator(s)~~operators for the equipment. The profilometer operator shall meet with the Engineer at a mutually agreed upon time prior to beginning smoothness measurements to discuss all aspects of smoothness measurement on the project.

Labor

00756.30 Quality Control Personnel - Provide ~~certified~~ technicians ~~in the following fields:~~having CAgT, CCT, CSTT, and QCT technical certifications.

~~• CAgT~~
~~• CCT~~
~~• CSTT~~
~~• QCT~~

Additional Contractor quality control responsibilities include the following:

- Provide and designate an individual who shall be present at the placement site at all times during concrete placements, and who is authorized and responsible for acceptance and rejection of materials.
- Reject loads which arrive at the jobsite without a batch ticket.
- Require the truck driver to record on the batch ticket and initial the amounts of water added in transit and at the jobsite.
- Reject plastic concrete that is outside of the specified limits.

Construction

00756.40 Weather Limitations - Coordinate all operations involved in constructing the pavement so the work will result in a finished pavement conforming to the Specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is allowed to proceed.

Do not place PCC during periods of rain. Do not place PCC on frozen bases, or when descending air temperature falls below 35 °F. Placement shall not resume until ascending air temperature reaches 35 °F. Measure air temperature in the shade and away from artificial heat.

Protect the pavement from weather damage. Protect unhardened PCC from precipitation with protective material. When PCC is being placed during cold weather, and the air temperature is forecast to drop below 33 °F, prevent the PCC from freezing for a minimum of ~~seven~~7 days after placing.

Remove and replace weather damaged pavement at no additional cost to the Agency.

00756.41 Preparation of Base - Before paving operations begin, bring the base to the finished condition required by the Specifications. If the equipment used by the Contractor requires additional width for support, provide the support necessary to assure the equipment maintains proper grade and cross section.

The base shall be moist before the concrete is placed. When the base is a treated base the surface shall be clean and free of all loose material. Place concrete on existing and new treated base only when the surface temperature is less than 90 °F. If water is used for cooling, remove all excess water standing in pools or flowing on the surface before placing concrete.

Manholes, inlets and other such structures shall be completed, adjusted, cured and otherwise prepared, as applicable. Make and ready to have concrete placed in contact with them. Prepare manhole frames and other independent metal structures in the pavement area with an approved bond-preventing agent.

00756.42 Construction Widths - When the pavement consists of two or more traffic lanes, construct at least two traffic lanes in one strip panel unless shown otherwise.

If the Contractor proposes a method of placement other than that shown or specified, the Contractor shall pay all costs to implement the change. Any changes require the Engineer's approval.

00756.43 Placing Dowel Bars and Tie Bars:

(a) Dowel Bars - Provide smooth, round, epoxy coated dowel bars. Coat with plastic, grease, heavy oil, or other approved material that will neither bond with nor be harmful to the PCC. ~~Place dowels in~~ Use a ~~supporting~~ framework to place dowels that is continuous across the entire lane width, holds the dowels parallel with each other, holds the dowels parallel with the surface of the pavement, and ~~perpendicular to the~~holds the dowels parallel to the roadway centerline. For dowels placed across an expansion joint~~.~~, use a dowel bar basket or other system of support that leaves no permanent incompressible members in place within the joint. Maximum alignment tolerance shall be 5 degrees or 3/16 inch in the length of the dowel. Place dowels within 3/8 inch of the center of the slab vertically.

Place dowel bars for joint contact at existing concrete pavement surfaces by drilling the existing concrete section and then inserting the dowel bars and grouting them in place. Drill the holes large and deep enough to insert the dowel bars with adequate epoxy or nonepoxy grout. Adjust hole locations to avoid damaging any existing reinforcement when drilling the holes. Blow the dowel bar holes clean with compressed air before grouting. Center the bar in the hole for the full length of embedment before grouting. Pump the grout into the hole around the bar so the back of the hole will be filled first. Do not allow blocking or shimming to impede the flow of the grout into the hole. If dams are needed, place them at the front of the holes to confine the grout. Place the dams to permit the escape of air without leaking grout. Do not remove dams until grout has cured in the hole.

(b) Tie Bars - Provide epoxy coated tie bars and place them for contact-type longitudinal joints by one of the following methods:

- By drilling the hardened concrete section and then inserting and grouting the tie bars into place. Drill the holes large and deep enough to insert the tie bars with adequate epoxy or nonepoxy grout. Take care not to damage the reinforcement when drilling the holes. Drill after the concrete attains enough strength so no damage to the concrete is caused by the drilling. Replace loose tie bars at no additional cost to the Agency.
- By inserting the tie bars into the plastic slipformed concrete before vibrating and finishing the concrete. The tie bars may be bent before insertion. Replace any loose tie bars by drilling and grouting, as described above, at no additional cost to the Agency.
- By using threaded mechanical splice couplers from the QPL. Submit splices for approval before using. Rebar splices shall be:
  - Accompanied by manufacturer's quality compliance certificate according to 00165.35.
  - Installed according to manufacturer's recommendations.

00756.44 Handling, Measuring, and Batching Materials - The plant site, layout, equipment and provisions for transporting material shall be adequate to assure a continuous supply of material to the worksite.

(a) Aggregates - Stockpile and remove the aggregate from stockpiles in a manner that holds segregation to a minimum.

Do not use aggregates that become segregated, mixed with earth or foreign material or contain lumps of hardened material. Thaw frozen aggregates or aggregates containing frozen lumps before use.

(b) Batching - Batch materials according to 02001.40.

00756.45 Mixing Concrete - Mix materials according to 02001.40. Mix the concrete in a batch plant mixer, except truck mixers may mix and deliver concrete only to areas inaccessible to paving equipment.

00756.46 Placing Concrete - Place the concrete ~~by either the slip form method~~pavement with a slipform paving machine as described in (a), (b), (c~~)~~), and (d) below~~, or by the~~. Concrete pavement may be constructed between stationary side ~~form method~~forms as described in (e) below~~.~~ only when:

- Areas of continuous concrete pavement are less than 1,000 square yards.
- Areas are inaccessible to slipform paving equipment.
- In areas of irregular geometry.
- In short sections of pavement which are necessary to facilitate traffic movement.

(a) Delivery To Spreader - Deliver the concrete from the hauling vehicles to the placer/spreader hopper on the shoulder area. Do not permit equipment hauling concrete on the subgrade or on the base, except for a minimum number of approved right angle or near right angle crossings. Correct damage to the subgrade or base due to the Contractor's operations, to the satisfaction of the Engineer, at no additional cost to the Agency. Keep the surface of the subgrade or base moist in front of the paving operation.

(b) One Lift - Place the concrete in final position by the slipform method in one lift, so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grade and cross section.

(c) ~~**Two Separate Machines** - Except for concrete pavement to be placed~~**Spreading** **and** ~~finished near obstructions, place~~**Finishing Construction** - Place the concrete with ~~two separate machines, one a placer/spreader and one a~~ slipform ~~paver. The machines shall operate in tandem and~~ paving equipment designed to spread, consolidate, screed, and float~~-~~-finish the ~~freshly placed~~plastic concrete in one complete pass of the machine to provide a dense and homogeneous pavement surface with a minimum of hand finishing. ~~Where impractical to use,~~ Use hand screeding and float finishing only on small irregular areas.

Consolidate the plastic concrete by internal vibration with transverse vibrating units located within the specified thickness of pavement sections for the full width of pavement. A series of equally spaced longitudinal vibrating units may be used to supplement or replace the transverse vibrating units.

Maintain the frequency of vibration of each vibrating unit above 7,500 cycles per minute. Maintain the frequency or amplitude of vibration to consolidate the plastic concrete along the entire length of the vibrating unit and for a distance of at least 1 foot. Vary the frequency or vibration of amplitude proportionately with the rate of travel to result in a ~~placer/spreader~~uniform density and air content.

Horizontally space vibrators according to the manufacturer's recommendations or not more than 18 inches, center-to-center, whichever is ~~not required~~less. Do not exceed a 9 inch space from the outer edge of the pavement to the outside vibrator.

(d) Continuous Forward Motion - Coordinate all operations of mixing, delivering and spreading concrete to provide uniform progress. Operate the slipform paver with as nearly continuous forward movement as possible. Hold stopping and starting the paver to an absolute minimum. If, for any reason, it is necessary to stop the forward motion of the paver, immediately stop the vibratory and tamping elements. Apply no external force to the paver.

(e) Stationary Side Form Method - Place the PCC between stationary side forms by means that will prevent segregation of constituents of the PCC, displacement or deformation of the forms or base, forming of piles, and unequal consolidation.

Spread and distribute the PCC with a mechanical concrete spreader which will fill all corners and spaces with PCC and leave it at such height that after consolidation and finishing it will be at specified grade and cross section. Spread and vibrate the PCC against and along the forms, and in the vicinity of joints comprising load transfer devices, with care to avoid displacement of the forms or devices.

Use shovels or muckrakes, not rakes, for hand spreading and distributing. Do not foul the PCC with foreign matter.

After being placed, strike-off, vibrate and consolidate the PCC with equipment conforming to the requirements of 00756.23. If more than one machine is required to properly handle production, the vibrating of PCC shall normally precede or accompany the first or leading machine only.

Perform the operations above within 15 minutes after the PCC is placed. The operations shall be continuous until the surface has been worked the equivalent of not less than two passes of a single screed machine. In each pass of the machine, maintain a roll of PCC ahead of the screed for the entire width of pavement being placed. The strike-off, vibrating and consolidating shall leave a surface of uniform texture, true to grade and cross section.

Equipment shall be in good mechanical condition at all times and be adjusted for wear at the direction of the Engineer. Keep forms and other controls of line and grade clean and true to line and grade.

(f) Provision for Joints and Other Devices - While placing concrete, make provision for constructing joints, placing dowels, tie bars, and other devices as shown and directed, and as provided in 00756.43 and 00756.48.

(g) Reject Concrete Material - Reject concrete if it:

- Is not in place within ~~one~~ 1 hour after being mixed (90 minutes when delivered in ready mix truck).
- Has begun to take an initial set before placement.
- Has been retempered with water.

(h) Protect Surface - Equip supports of the slipform paver, and other equipment which ride on previously placed pavement to meet the requirements of 00756.60, to prevent marring, edge breaking, or chipping of the previously placed pavement.

When concrete is placed adjacent to an existing pavement, equip that part of the equipment which is supported on the existing pavement with protective pads on crawler tracks or use rubber-tired wheels. Offset the track or wheels to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge

(i) Hand Operated Equipment - Use shovels and muckrakes, not rakes, for hand spreading and distributing. Do not foul the concrete with foreign matter, or disturb joint devices during such operations. Furnish hand operated mechanical vibrators satisfactory to the Engineer. Use these vibrators to consolidate the concrete pavement at least 6 feet on each side of construction and expansion joints and any other areas as directed.

(j) Illumination - During hours of darkness, adequately illuminate work areas at no additional cost to the Agency.

00756.47 Test Strip - At the beginning of paving operations, construct one initial test strip of concrete pavement at least 0.1 mile long at the specified paving width. Do not perform further paving until the test strip is evaluated according to 00756.55. An additional test strip will be required when:

- The Contractor proposes using different paving equipment.
- Any portion of a test strip fails to meet the smoothness requirements of 00756.55.

Change methods and/or equipment and construct additional test strips until a test strip meets smoothness requirements without grinding or other corrective work. Limit these additional test strips to 0.1 mile in length.

If three test strips fail to meet smoothness requirements before grinding, remove all three strips and construct additional test strips at no additional cost to the Agency.

00756.48 Joints:

(a) General - Construct joints of the kinds shown and where shown or directed. Joint types in the concrete pavement will be contraction, construction or expansion. They shall be transverse or longitudinal, as shown or directed. Extend all joints and joint filler to pavement edges or to each other.

Joints shall not vary from specified or indicated line by more than 1/4 inch. The tops of joint filler, when required, shall be slightly, but not more than 1/8 inch, below and paralleling finished pavement grade and cross section. Protect top edges of filler from damage by paving operations.

All joints which contain preformed filler are to be constructed before the final floating and surface finishing of the concrete, unless otherwise directed.

(b) Longitudinal Joints - If the Contractor elects to pour the entire width of pavement at one time, construct the longitudinal joint as shown. Longitudinal joints shall be the contact type or weakened plane type as shown:

(1) Longitudinal Contact Joints - Construct longitudinal contact joints when concrete is placed against hardened concrete regardless of age, between strips of pavement or between a strip of pavement and a concrete gutter.

(2) Longitudinal Weakened Plane Joints - Construct weakened plane joints by sawing to the depths and maximum width shown. ~~Perform sawing as soon as~~Saw longitudinal weakened plane joints at the earliest possible time following placement of the concrete ~~has set enough~~ to ~~permit sawing~~prevent uncontrolled cracking without ~~tearing~~damaging the pavement or ~~raveling~~joint. Saws may be single or tandem, as the Contractor elects, and be controlled by guides to true line. Restore curing agents broken or damaged by the sawing operations.

~~If the top width of sawed joints exceeds 1/4 inch, fill the joint with a poured joint filler.~~

(c) Construction Joints - Construct construction joints when there is an interruption of ~~20~~45 minutes in the concrete placing operations.

The new concrete placed against the joint shall conform closely to the proportions and consistency of the previously placed concrete except vibrate and consolidate it to a greater degree and with more care than normal. Unless otherwise shown, do not construct construction joints within 10 feet of a transverse expansion or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, remove the concrete back to the last joint and dispose of as directed.

(d) Transverse Contraction Joints - ~~Construct all~~Form transverse contraction joints by sawing~~. Create~~ to the required dimensions shown on the Plans. Saw transverse contraction joints at ~~intervals shown on drawings~~the earliest possible time following placement of the concrete to prevent uncontrolled cracking without damaging the pavement or joint. Repair any damage to the curing material during the sawing operations immediately after the sawing is completed.

(e) Sealing Sawed Joints - Fill sawed longitudinal weakened plane joints and transverse contraction joints with poured joint filler. Thoroughly clean joints at the time of sealing. Ensure the curing period for joints is complete before allowing construction equipment and vehicles on the pavement.

00756.49 Surface Finishing - After the concrete has been given a preliminary finish, check the surface of the fresh concrete in the longitudinal and transverse direction with a 12 foot straightedge. Correct surface deviations more than allowed by 00756.55(a). Check at interval as required. This longitudinal checking and correction on areas to be graphically profiled will be waived if it is successfully demonstrated that required pavement profile surface is otherwise produced which conforms to 00756.55(b-1-a).

Following hand floating, use a 12 foot proof (grout) rod. Each pass of the proof rod in the longitudinal direction, over the entire surface of the pavement placement, shall overlap the previous pass by half of its width. Check the transverse direction as required. Use of a proof rod on areas to be graphically profiled will be waived if it is successfully demonstrated that required pavement profile surface is otherwise produced which conforms to 00756.55(b-1-a).

(a) Edge Slump - Correct any edge slump of the concrete in excess of 1/4 inch before the concrete hardens.

(b) Textured Finish - Upon completion of the machine floating, straightedge testing, edge tooling and, if necessary, hand floating, and before initial set of the surface concrete, give the surface of the concrete a textured finish.

Accomplish the textured finish with ~~a~~at steel-tine tool with 1/8 inch wide tines spaced 3/4 inches apart that will mark the finished ~~concrete~~surface to a depth of 1/8 to 3/16 inch ~~to 1/8 inch. Randomly space~~without tearing the ~~markings from 1/2 inch to 1 1/4 inches as approved.~~surface. Avoid overlaps of the texturing. ~~Markings shall be transverse to~~Texture the surface parallel to the roadway centerline and full roadway width. ~~With approval of the engineer an astroturf or broom finish may be used in place of tining on roads with a posted speed limit of 35 mph or less.~~

00756.51 Modification of Strike-off, Consolidation, Final Floating, and Surface Finishing ~~-~~ - Where the width of pavement is narrow, tapering or of irregular pattern, not lending itself to being constructed by prescribed machine methods, the Contractor will be allowed to perform the strike off, consolidation, final floating, and surface finishing with equipment, tools, means, labor and methods other than those specified, provided the work meets with the approval of the Engineer and the following requirements:

- Without causing segregation, vibrate throughout the concrete being placed until it is uniformly consolidated.
- Strike-off the concrete with templates or screeds designed and manipulated to shape the concrete to specified cross section between the forms, carrying a slight excess of concrete in front of the leading edge of templates or screeds at all times.
- Following the vibrating and strike-off operations, float the concrete. Include transverse floating or other smoothing and finishing actions as necessary. Check and correct the surface according to 00756.49. Keep the surface free from laitance, soupy mortar, marks or irregularities.
- Finish the surface according to 00756.49.

00756.52 Edge Tooling and Filling - Tool edges at longitudinal contact joints and construction joints of new pavement and clean joints of previously placed concrete to remove laitance and mortar resulting from finishing operations, and to provide clean rounded edges without ridges on the surface. Perform tooling of the edges of concrete pavement so that a nominal 5/8 inch diameter radius is produced. Perform tooling of edges at construction joints so that no more than a 1/8 inch radius is produced.

Fill any areas of minor honeycomb or other minor defect in composition of the concrete along the exposed sides of concrete with a stiff mortar of cement and fine aggregate, and apply to the moistened concrete to the satisfaction of the Engineer. Remove and replace areas showing serious defects in composition of the concrete with specified quality concrete for full panel width between longitudinal joints or edges, and for a length not less than 10 feet. Low spots exceeding 1/4 inch in depth, if in hardened concrete, may be filled with an Epoxy Grout from the QPL provided the area is prepared according to grout manufacturer's directions and the filling is neat and blends inconspicuously with adjoining concrete.

00756.53 Curing Concrete - Immediately after the final floating, surface finishing and edging have been completed, and while the concrete surface is still moist, cover and cure the entire exposed surface of the newly placed concrete for at least 72 hours~~. If the Specifications require opening~~ according to ~~traffic in less than 72 hours, curing may be removed just prior to opening. Use~~ one of the following provisions:

(a) Liquid Membrane-Forming Compounds - Apply liquid membrane-forming compound uniformly to the concrete by pressure-spray methods at a rate of at least 1 gallon per 150 square feet. Mix the liquid membrane-forming compound thoroughly before and during use.

(b) Other Coverings - Apply ~~clear or white polyethylene film~~the covering to damp concrete as soon as it can be placed without marring the surface. Place the membrane in contact with the surface, extend beyond the sides or edges of the slabs or forms, and weight down as required to hold it in position as a waterproof and ~~moistureproof~~moisture-proof covering. Laps shall be sufficient to maintain tightness equivalent to the sheeting and use:

(1) Polyethylene Film - Sheeting shall be clear or white.

(2) Waterproof Paper - Transverse laps shall be at least 18 inches, and cement longitudinal seams.

(3) Cotton or Jute Mats - Before placing, saturate the mats with water and keep fully wetted during the curing period.

00756.54 Pavement Cracks - Within 28 days after concrete placement and before opening the pavement to public traffic, the Engineer will perform a pavement crack survey. Clean the pavement before the crack survey. Pavement with uncontrolled longitudinal or transverse cracks which are

visible without magnification will be considered unacceptable and be repaired or removed as determined by the Engineer. Perform all remedial work at no additional cost to the Agency.

00756.55 Surface Tolerance, Testing, and Correction - Perform straightedge testing according to 00756.55(a). Except as specified, when the Project exceeds ~~0.6 mile~~1,500 feet of continuous pavement construction or when specified in the Special Provisions, conduct graphic profile testing according to 00756.55(b). Furnish and operate the equipment as soon as the hardness of the concrete permits.

(a) Straightedge Testing and Tolerance - Perform longitudinal and transverse smoothness testing of the pavement surface with a 12 foot straightedge. The extent of the testing will be as the engineer determines necessary or expedient. The pavement surface shall not deviate from the straightedge at any point by more than 1/8 inch for all areas that are constructed by the prescribed machine methods and for all traffic lanes and ramps. Other areas shall not deviate by more than 1/4 inch. Longitudinal 12 foot straightedge testing will not be required for pavement accepted under 00756.55(b).

(b) Graphic Profile Testing (GPT) and Tolerance:

(1) General - Test the longitudinal surface of all traffic lanes, ramps shoulders and bridges for smoothness by the graphic profile method according to ODOT TM 770. Before paving commences on the Project, demonstrate the profilograph or profilometer operation by conducting a calibration test according to ODOT TM 770 and running the machine twice over a 0.1 mile section of pavement with repeating results.

a. Graphic Profile Tolerance - The pavement shall have a profile index of 7.0 inches per mile or less for each wheel path in each 0.1 mile segment or partial segment, and shall have no individual deviation of 0.3 inch or more. On ramps, shoulders and auxiliary lanes the profile index shall be 12.0 inches per mile subject to the above criteria. Bonus payment for smoothness will be made according to 00756.95.

b. Daily GPT - If the average profile index exceeds 7.0 inches per mile for all segments and partial segments of pavement constructed in any day's production, discontinue paving operations and construct one or more test strips as described in 00756.47. The test strip may be comprised of pavement placed during the shift that the shutdown is ordered, but in no case shall it be less than 0.1 mile in length.

(2) Surface Test - Run the profilograph or profilometer over the full length of the Project and 50 feet beyond the Project ends to provide a complete graphic profile. This includes all concrete traffic lanes and auxiliary lanes.

Obtain profiles on the pavement surface along lines parallel to and approximately 3 feet from each edge and longitudinal ~~joint(s)~~joints for 12 foot wide lanes and 4 feet from each edge and longitudinal ~~joint(s)~~joints for 14 foot wide lanes. The intent is to provide a profile in each vehicle wheel path. Take ~~profile(s)~~profiles on transition areas of entrance and exit ramps as close to the wheel path as practical.

Start the profiles that represent a day's production 50 feet before the beginning of that day's production and stop 50 feet before the end of that day's production.

Run the profiles for each day's production as soon as possible without damaging the surface. Analyze the daily GPT profiles according to 00756.55(b-3), and give the profiles and results to the Engineer within 24 hours of the conclusion of the day's production.

(3) Determining Profile Index:

a. General - Determine the profile index of pavement in 0.1 mile segments and partial segments. Segments shall begin 13 feet into the Project and run consecutively in either the direction of travel or the concrete placement, as determined by the Engineer. A segment will end as a partial segment and a new segment will begin when the segment sequence is interrupted by stage construction or by profiled areas excluded from the GPT smoothness requirements.

The following profiled areas of pavement are excluded from the GPT smoothness requirements:

- Profiles extending beyond the Project ends.
- Bridge decks and bridge panels.
- First and last 13 feet at the Project ends and bridge end panels.
- Pavement on horizontal curves with radii less than 1,000 feet.

Include and analyze separately those areas in the profile charts that are not subject to the GPT smoothness profile index requirements.

b. Method of Analysis - Determine the profile index and individual deviations of 0.3 inch or more by analyzing the profile charts according to ODOT TM 770 and provide the profile charts and results to the Engineer for review.

c. Profile Index - The profile index is the inches per mile in excess of the 0.2 inch blanking band. The formula for converting counts to profile index is:

$$\text{Profile Index} = \frac{\text{Total Count} \times 0.10}{\text{Length of Full 0.10 Mile Segment or of Partial } \underline{\ *\ } \text{ Mile Segment}}$$

* Report to the nearest 0.01 mile

(c) Correcting Deficiencies - Should testing described in 00756.49, 00756.51, and 00756.55 show the pavement does not conform to the prescribed limits of deviation, the following shall apply:

(1) Failure To Meet Straightedge Requirements:

a. Plastic Concrete - If the requirements of 00756.49 or 00756.51 are not met, stop the paving operations until revised methods, changes in equipment, or correction of procedures are made or proposed for trial, and are approved by the Engineer for trial. Also stop those revisions, changes and corrections if they do not produce a specified surface.

b. Hardened Concrete - If the requirements of 00756.51 or 00756.55(a) are not met, correct according to 00756.55(c-2-a) or 00756.55(c-2-b) and retest.

(2) Failure To Meet Graphic Profile Requirements - Correct any segment or partial segment that exceeds the requirements of 00756.55(b) in either wheel path by one of the methods listed below to the specified limits except correct deviations of 0.3 inch or more at least to the edge of the blanking band:

a. Remove the ~~nonspecification~~non-specification concrete pavement as determined by the Engineer and replace with specification concrete pavement.

b. Profile with abrasive ~~grinder(s),~~grinders, equipped with a cutting head comprised of multiple diamond blades. The Engineer will determine and mark the areas to be profiled. For all areas corrected by grinding, restore the required surface texture as specified in 00756.49(b) by transverse sawing with diamond blade saws.

Retest their entire length, according to 00756.55(b), all segments requiring corrective work with the profilograph or profilometer under the supervision of the Engineer. Perform all corrective work and graphic profiling, including traffic control, at no additional cost to the Agency.

00756.56 Pavement Thickness - Construct the pavement to the thickness shown. Pavement not so constructed will be subject to replacement according to 00756.57, or to payment at adjusted prices according to 00756.93.

(a) ~~Survey Method~~Sticking Measurements - Determine conformance with minimum thickness requirements by random ~~survey~~sticking measurements of the plastic concrete according to ODOT TM 775 under the Engineer's observation. Report thickness to the nearest 0.1 inch.

Divide the panel into units and partial units equivalent to a maximum of 200 lane feet. Normally, unit lengths will be 200 feet for one lane, 100 feet for two lanes, 70 feet for three lanes and as appropriate for transition areas. ~~Take survey measurements within 10 feet longitudinally and 1 foot transversely from the calculated random location as determined by the Engineer.~~ When directed, take one sticking measurement at a randomly selected location in each unit and partial unit. ~~Establish the horizontal location in such manner that it can be re-established in the same location to within 1 inch of the original location.~~ Record ~~vertical elevations~~ measurements to the nearest 0.1 inch. Take the measurements~~ as follows~~:

- ~~On the finished base course before paving and at the same location on the finished PCC pavement.~~
- After consolidation and screeding and before the float finish.
- No closer than 2 feet from the panel edges.
- ~~With survey instruments capable of producing repeatable accuracy within the required survey limits.~~
- ~~Determine the pavement thickness by subtracting the elevation of the finished base course from the elevation of the finished PCC pavement.~~ Within 10 feet longitudinally and 1 foot transversely from the calculated random location determined by the Engineer.

If ~~surveyed depth~~a sticking is not obtained for a unit or a partial unit, or is not available to represent the area of pavement remaining after the limits of pavement over 1.0 inch deficient is determined, the ~~depth~~measurement will be assumed to be the same as the preceding or following ~~surveyed depth~~sticking measurement, that is nearest in distance.

(b) Thickness 0.5 Inch Deficient - If a survey depth measurement indicates the pavement is 0.5 inch or more deficient in thickness, stop forward paving progress until appropriate adjustments are made or corrective action is taken.

(c) Coring Requirements - Perform required coring, or coring requested by the Engineer according to AASHTO T 24 and repair core holes as directed, at no additional cost to the Agency. Cores will be measured by the Engineer according to AASHTO T 148 and the measurements reported to the nearest 0.1 inch. Core measurements will replace survey methods.

(1) Corrective Grinding Areas - If corrective grinding required by 00756.55(c) is performed at a 00756.56(a) depth measurement site, a core shall be obtained at the surveyed measurement site according to the following:

a. Profile Indexes 7.0 Inches Per Mile or Less - If the original profile indexes for a segment or partial segment determined by 00756.55 is 7.0 inches per mile or less in each wheel path, a core is not required after corrective grinding is performed at a depth measurement site within the segment or partial segment represented by the profile indexes.

b. Profile Index Greater Than 7.0 Inches Per Mile - If an original graphic profile index for a segment or partial segment determined by 00756.55 is more than 7.0 inches per mile for a wheel path, obtain a core, after corrective grinding has been performed, at a depth measurement site within the segment or partial segment represented by the profile indexes if the depth measurement is the specified depth or less.

(2) Cores Requested By Contractor - If the Contractor believes that a depth measurement determined according to 00756.56(a), or a core obtained according to 00756.56(c), is not representative of the actual pavement thickness, the Contractor may take a replacement core. Take replacement cores at a location as directed, 10 feet from the depth measurement or core site in question and the same distance from centerline. The replacement core measurement will replace the original depth or core measurement.

(d) Thickness Over 1.0 Inch Deficient - If a depth measurement determined according to 00756.56(a) shows pavement over 1.0 inch deficient, obtain a core at the depth measurement site. If this core, or a core determined by 00756.56(c), shows pavement over 1.0 inch deficient, obtain additional cores. Take these additional cores at the same distance from the centerline and at 25 foot intervals each direction from the first core until a core in each direction shows pavement 1.0 inch deficient or less. These two core locations will be considered the limits of the pavement more than 1.0 inch deficient. The pavement panel between these two cores will represent the area of pavement subject to removal and replacement under 00756.57 or no payment under 00756.93.

When it is suspected by the Engineer that the pavement in the adjacent travel ~~lane(s)~~lanes in the panel may be more than 1.0 inch deficient for a greater distance than determined by the above procedure, core the pavement in the adjacent travel ~~lane(s)~~lanes in the nearest wheel track (3 feet from the nearest edge) opposite both limit cores. If these cores are more than 1.0 inch deficient, the above procedure shall be followed to determine the limits.

00756.57 Deficient Pavement - Remove and replace pavement deficient in thickness by more than 1.0 inch, according to 00756.56(d), at no additional cost to the Agency. If allowed by the Engineer, the pavement may be left in place without payment. Replacement pavement shall be of the specified design, quality and thickness as follows:

- Be the full width of the pavement panel involved.
- Extend far enough to replace at least a 20 foot length.
- Extend to the construction joint if closer than 20 feet to a construction joint.

Maintenance

00756.60 Protection of Concrete - ~~Erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the pavement is opened to traffic. If necessary provide watchmen.~~ Repair or replace any part of the pavement damaged by traffic or damaged from any other cause before its official acceptance, according to 00170.80.

~~**00756.61 Opening to Construction Equipment or Traffic** -~~ Do not operate construction equipment on newly placed concrete until the requirements of (a), (b), and (c) are met. Do not allow public traffic on newly placed concrete until all of the following requirements are met:

(a) The Contractor complies with 00150.60.

(b) The concrete attains a compressive strength of at least 70~~%~~ percent of the specified 28 day strength as determined by testing at least three cylinders cured according to AASHTO T 23 (field cure) and tested according to AASHTO T 22.

The maturity method, AASHTO T 325, may be used to estimate concrete strength for opening pavement to construction traffic. Install at least two maturity thermocouples for each day's placement in areas where the maturity method will be used for early opening. Install the thermocouples near the day's final placement for areas being evaluated for early opening.

When the maturity method is used, the Engineer may verify the maturity method with strength specimens. Establish a new strength-maturity relationship if strength specimens deviate more than 10 percent from the maturity-estimated strengths. Suspend use of the maturity method for opening pavements to traffic when the strength-maturity relationship deviates by more than 10 percent until a new strength maturity relationship is established.

(c) The surface of the concrete is protected from scarring or abrasion and kept free of stones, loose mortar and other matter apt to be deleterious to the concrete in the paths of equipment.

(d) The pavement meets all of the requirements of 00756.55.

Measurement

00756.80 Measurement - The quantities of concrete pavement will be measured on the area basis. The area will be determined by measuring the width and length of each separately constructed panel of pavement. The width is the design width or measured edge-to-edge width on the surface of the pavement whichever is less. The length is the horizontal measurement from end to end of pavement along the center line of the strip.

The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

Payment

00756.90 Payment - The accepted quantities of plain concrete pavement will be paid for at the Contract unit price, per unit of measurement for the following items:

Pay Item	Unit of Measurement
(a) Plain Concrete Pavement, Undowelled, ____ Inches Thick	Square Yard
(b) Plain Concrete Pavement, Dowelled, ____ Inches Thick	Square Yard

The thickness of pavement will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for construction joint reinforcement bars, tie bars, dowel bars, curing materials, and saw cutting.

00756.92 Price Adjustment for Strength - For each lot of concrete for which a PF is determined, the following will apply:

- In no case will the actual payment exceed the Contract Unit Price.
- When the PF is less than 1.00, the price adjustment will be determined as follows:

Price Adjustment = 0.3 x (PF - 1) x Unit Price

00756.93 Price Adjustment for Variation in Thickness - No additional payment over the Contract unit price will be made for pavement having a thickness greater than shown or ordered by the Engineer. When the pavement is found deficient in thickness by more than 0.2 inch, but not more than 1.0 inch, as determined according to 00756.56, payment will be made at an adjusted price according to the following table:

Deficiency in Thickness (inch)	Proportional Part of Contract Unit Price Allowed
0.00 to 0.20	100%
0.21 to 0.30	83%
0.31 to 0.40	76%
0.41 to 0.50	73%
0.51 to 0.75	63%
0.76 to 1.00	59%

No payment will be made for any area of pavement found deficient in thickness by more than 1.0 inch even though such pavement is allowed by the Engineer to remain in place under the provisions of 00756.57.

00756.95 Bonus Payment for Smoothness - If a profilograph or profilometer is used according to 00756.55 a bonus payment of up to 1.5~~%~~ percent will be made to the Contractor for each 0.1 mile segment or partial segment of pavement except shoulders, as determined in 00756.55(b) if:

- The profile index for each wheel path is 7.0 inches per mile or less.
- No individual deviation is 0.3 inch or more.
- The average of the two profile indexes is less than 5.0 inches per mile.
- These requirements are met without any corrective action specified in 00756.55(c).

The bonus payment for each segment and partial segment meeting the above requirements will be computed as follows:

Bonus = 0.006 x (5.0 - PI) x Quantity x Unit Price

PI = Average of the two profile indexes in the segment or partial segment (inches per mile)
Quantity = The quantity (square yards) represented by the segment or partial segment
Unit Price = The unit price for the concrete pavement as shown in the Contract Schedule of Items

Section 00758 - Reinforced Concrete Pavement Repair

Description

00758.00 Scope - This work consists of saw cutting and removing existing concrete pavement and constructing new reinforced and continuously reinforced portland concrete pavement repairs as shown and specified.

00758.01 Abbreviations:

SSD - Saturated Surface-Dry

SSFC - Stationary Side Form Construction

00758.04 Prepaving Conference - Supervisory personnel of the Contractor and any subcontractor's who are to be involved in the concrete paving work shall meet with the Project Manager, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

Materials

00758.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement	02510
Concrete Materials	02001
Curing Materials	02050
Epoxy and Nonepoxy Bonding Agents	02070
Epoxy and Nonepoxy Grouts	02080
Galvanizing	02530.70
Portland Cement Concrete Patching Materials	02015
Poured Joint Fillers	02440.30
Preformed Expansion Joint Filler	02440.10
Structural Steel	02530

00758.11 Classes of Concrete - Furnish Class 4000 - 3/4 or Class 4000 - 1 paving concrete. The use of high-early strength concrete may be necessary when early opening to traffic required.

00758.13 Concrete Mix Designs - Prepare and submit either new mix designs or current mix designs for each class of concrete required according to Section 02001.

00758.14 Concrete Mix Tolerances and Limits - Provide a workable concrete mixture that is uniform in composition and consistency and conforms to the properties and limits of Section 02001, and has a minimum compressive strength of 3,000 psi before opening to traffic.

00758.15 Quality Control - Perform quality control according to Section 00165 and the following:

(a) Aggregates - Provide a CAgT to perform sampling and testing of aggregates during production. Sample and test each stockpiled size according to the test procedures and at the frequencies shown in the Field Tested Materials Guide section of the MFTP. Record and evaluate test results according to Section 00165.

(b) Concrete Mixture - Provide a QCT to sample and test concrete for all classes of concrete and for trial batches when required. Provide a CCT to prepare new mix designs and to make adjustments in current mix designs for all paving concrete. Provide a CCT for all paving concrete during concrete placements who is authorized to control the production of concrete.

If the results of any test are outside of the specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the specification limits. If the load cannot be corrected, reject it and do not incorporate it into the work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the specification limits.

(c) Records - Deliver all batch tickets, water-cement ratio calculations, and all other records required in 00758.15(b) to the Engineer upon availability but no later than the morning of the next day.

00758.16 Acceptance of Concrete:

(a) General - Acceptance of concrete will be based on the results of the Contractor's quality control testing according to Section 00165 and the MFTP.

(b) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified by the Agency according to Section 00165 and the MFTP.

(1) Aggregate Gradation - A stockpile contains specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level indicated in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level indicated in Table 00165-2 yields a PF of less than 1.00 for any constituent, the material is non-specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165-2 for a 1.00 PF.

(c) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits of Section 02001.

(d) Hardened Concrete - Cast and cure the test cylinders according to AASHTO T 23 in single use plastic molds and test at 28 days according to AASHTO T 22.

(1) General - For all classes of concrete, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test cylinders at an ODOT certified laboratory.

(2) Actual Strength Test Value - The ASTV at 28 days is the average compressive strength of the three cylinders tested. If the compressive strength of a single test specimen varies by more than 10 percent from the average of the other two specimens, that compressive strength value will be discarded. The average compressive strength test of the two remaining specimens will be the ASTV.

(3) Sampling and Testing - Sample and test according to Section 00165 and the MFTP.

(4) Acceptance - The ASTV shall exceed the $f'c$ (specified strength) for the mix design. If a set of cylinders has an ASTV less than $f'c$, the Engineer will review the results to determine if the concrete represented by the cylinders shall be removed. In any case, concrete that has an ASTV of less than 85 percent of the specified strength shall be removed unless otherwise authorized, in writing, by the Engineer. The cost of removal, replacement, and all related work

shall be the Contractor's responsibility, subject, if the concrete is allowed to remain in place, to a price adjustment according to 00150.25.

If an ASTV falls below the *f*'c, the Contractor may submit a written plan within 3 days of the test for review by the Engineer. The plan shall outline a proposed alternate method of evaluating compressive strength. The plan shall provide evidence that a reasonable *f*'cr (over design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. If the Engineer determines that the compressive strength test results are suspect from definable external factors, the Engineer may allow an alternate method of acceptance.

00758.17 Spall Repair Material - For spall repair, furnish a PCC repair material meeting the requirements of Section 02015 except do not use products that contain magnesium phosphate. Use either "Rapid Set" or "Very Rapid Set" material.

Equipment

00758.20 Batch Plant - Provide batch plants according to 02001.40.

00758.21 Mixers - Provide mixers according to 02001.40.

For projects requiring high early strength concrete, mobile mixers may be used if the mixers conform to the following:

- The mixer is self-propelled and carries sufficient unmixed dry bulk cement, sand, coarse aggregate, admixtures, and water to produce a minimum of 6 cubic yards of concrete on site.
- The mixer provides positive measurement of cement being introduced into the mix by meter or counter.
- The mixer provides positive control of the flow of water into the mixing chamber. Water flow is readily adjustable to provide for minor variations in aggregate moisture.
- Each mixer is calibrated to automatically proportion and blend all components according to the mix design on a continuous or intermittent basis as required by the placing operation.

Perform a calibration and yield test on each mixer prior to the first placement to accurately proportion the specified mix. Use a written calibration procedure from the mixer manufacturer, a procedure provided by the agency or other written procedure acceptable to the agency. The calibration process may be witnessed by the Engineer. Provide the Engineer with information about the scheduled date, time and place for the calibration. Perform a new calibration when the source of materials changes, when the mixer undergoes a major repair, or when requested by the Engineer.

00758.22 Hauling Equipment - Use truck mixers to transport concrete. Provide hauling equipment conforming to AASHTO M 157.12 or AASHTO M 157.11.6.

00758.23 Paving Equipment - Provide paving equipment conforming to the following:

- Able to vibrate, consolidate, and finish the slab to proper grade and cross section for the full width and depth of the concrete being placed.
- Capable of meeting the smoothness requirements.
- Approved by the Engineer.

00758.24 Concrete Saws - Provide power driven concrete saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. Also provide a standby saw on the jobsite.

00758.25 Smoothness Testing Equipment - Provide one 12 foot straightedge.

Labor

00758.30 Quality Control Personnel - In addition to the certified technicians required in 02001.50 provide and designate an individual to be present at the placement site at all times during concrete placements and who is authorized and responsible for acceptance and rejection of materials.

Construction

00758.40 Weather Limitations - Coordinate all operations involved in repairing the pavement so the work will result in a finished pavement conforming to the Specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is permitted to proceed.

Do not place PCC during periods of rain. Do not place PCC on frozen bases. Stop placement when descending air temperature falls below 35 °F. Do not begin placement until the air temperature is 35 °F in the shade and rising and is forecast to remain above 35 °F.

Protect the pavement from weather damage. Protect unhardened PCC from precipitation with protective material. When PCC is placed during cold weather and the air temperature is forecast to drop below 33 °F, prevent the concrete from freezing for a minimum of 7 days after placement.

Remove and replace weather-damaged pavement at no additional cost to the Agency.

00758.41 Preparation:

(a) Removal of Existing Pavement - Remove existing reinforced concrete pavement full depth as shown or directed. Cut the reinforced concrete full depth with a concrete saw prior to removal. Remove concrete pavement with equipment approved by the Engineer in a manner that does not damage remaining pavement and allows for specified connections. Repair damage to the existing pavement due to the Contractor's operations, at the Contractor's expense, by extending the full depth repair to the satisfaction of the Engineer.

(b) Removal of Terminal Expansion Joint Steel W-Beam Flange and Web - Remove the existing terminal expansion joint steel W-beam top flange and web as shown or as directed. Cut the steel web to facilitate removal. Cut the steel web so that no more than 1/4 inch remains above the existing sleeper slab. Perform the removal in a manner that does not damage remaining pavement and sleeper slab. Repair any damage to the existing pavement or sleeper slab due to the Contractor's operations, at the Contractor's expense, to the satisfaction of the Engineer.

(c) Preparation of Base - If the existing base requires removal, replace it with plain concrete conforming to the applicable parts of this Specification and to the depth shown. Place a 6 mil polyethylene bond breaker between the new plain concrete base and the new reinforced concrete pavement as shown or directed.

(d) Reinforced Bar Lap Area - Saw cut the existing reinforced concrete pavement to a nominal depth of 2 inches. Do not damage the existing reinforcing steel or concrete pavement and base. Remove existing concrete with jack hammers and chipping hammers that will not damage reinforced concrete pavement to remain in place as directed. Do not use jackhammers heavier than nominal 30 pounds class. Do not use chipping hammers heavier than nominal 15 pounds class to remove concrete within 3/4 inch of reinforcing steel. Do not operate hammers at an angle greater than 45 degrees measured from the surface of the pavement. Repair all damage to

the existing pavement due to the Contractor's operations, at the Contractor's expense by extending the full depth repair full width to the satisfaction of the Engineer. Use hand tools such as hammers and chisels to remove final particles of unsound concrete or to achieve the required depth.

Protect and keep reinforcing steel clean of grease, oil, dirt, grout, or other contaminants at all times. Do not bend reinforcing steel that remains in place.

(e) Preparation of Existing Concrete - After pavement in repair areas is removed, sandblast all vertical surfaces of adjoining concrete. Before placement of concrete, blow clean the area with compressed air and apply a coat of epoxy grout or bonding agent to all vertical surfaces. If grouted surfaces become dry before new concrete is placed, sandblast clean and apply a new coat of grout.

00758.43 Placing Reinforcement:

(a) General - Place reinforcement as shown and specified. Lap splices according to Section 00530. The Contractor's equipment hauling reinforcement to the site will not be permitted on the subgrade or the base material.

Use reinforcement that is straight, clean, and free of scale or other matter which would interfere with its bonding to the concrete.

Place the reinforcement on support devices that maintain it in specified position during concrete placement.

On areas where traffic is operating adjacent to concrete paving operations, do not lift reinforcement from the surface nor place on supporting devices more than 2 hours before placing the concrete, unless otherwise approved by the Engineer.

(b) Deformed Bar Reinforcement - Tie or clip at every other transverse bar intersection, as a minimum, in a manner that does not allow for displacement. Tie or clip every lap splice as shown.

(c) Support Devices - Support devices used to hold reinforcement in proper position in the concrete shall:

- Hold the reinforcement within 1/2 inch of the vertical position shown.
- Not displace more than 2 cubic inches of concrete when embedded in the slab.

Obtain approval of the proposed support devices before use.

(d) Tie Bars - Place tie bars required for contact-type longitudinal joints by drilling the hardened concrete section and then inserting and grouting the tie bars into place. Drill the holes large and deep enough to insert the tie bars with adequate epoxy or nonepoxy grout. Do not damage the existing reinforcement when drilling the holes. Replace any loose tie bars at the Contractor's expense.

(e) Dowel Bars - Provide smooth, round dowel bars. Coat with plastic, grease, heavy oil, or other approved material that will not bond with or be harmful to the PCC. Place dowels in supporting framework or support devices that hold dowels parallel with each other, parallel with the surface of the pavement, and perpendicular to the joint. Obtain approval of the proposed method of support prior to use. Maximum alignment tolerance shall be 5 degrees or 3/16 inch in the length of the dowel. Place dowels within 3/8 inch of the center of the slab vertically.

00758.44 Handling, Measuring, and Batching Materials - The plant site, layout, equipment and provisions for transporting material shall be adequate to assure a continuous supply of material to the worksite.

(a) Aggregates - Stockpile and remove the aggregate from stockpiles in a manner that holds segregation to a minimum.

Do not use aggregates that become segregated, mixed with earth or foreign material, or contain lumps of hardened material. Thaw frozen aggregates or aggregates containing frozen lumps before use.

(b) Batching - Separately weigh into the hoppers the fine aggregate, each separated size of coarse aggregate, cement and fly ash in the respective proportions set by the mix design. Provide a device to indicate positively that the full amount of cement and fly ash was discharged into the batch box or container. Measure water and admixtures either by volume or by weight.

Conduct batching so that the individual weights of each material required are within the following tolerances:

Aggregates	± 2%
Cement	- 1% to + 4%
Fly Ash	- 1% to + 4%

00758.45 Mixing Concrete:

(a) General - Mix the concrete in a batch plant mixer, truck mixer, or mobile mixer and the following:

- Charge the batch into the receiving drum so some water enters before the solids and continues to flow uniformly for a portion of the mixing time.
- Keep the skip and the throats of drums free of accumulations.
- Mix the concrete only in the quantity required for immediate use.
- Do not intermix batches.
- Do not retemper concrete by adding water or by other means.

(b) Batch Plant Mixers - The mixing time for batch plant mixers shall be at least 60 seconds unless the Contractor's CCT documents meeting "Concrete Uniformity", according to AASHTO M 157, Annex A1 for concrete produced at the batch plant mixer set up for this Project, to the satisfaction of the Engineer. The mixing time may then be reduced to the extent the test permits but not less than 45 seconds.

(c) Truck Mixers - The mixing time for truck mixers shall be 70 to 100 revolutions at a mixing speed recommended by the manufacturer of the truck mixer.

00758.46 Placing Concrete:

(a) General - Perform the strike-off, consolidation, final floating and surface finishing according to the following:

- Vibrate throughout the concrete until it is uniformly consolidated. Do not segregate.
- Strike off the concrete with templates or screeds designed and manipulated to shape the concrete to the specified cross section between the forms, carrying a slight excess of concrete in front of the leading edge of templates or screeds at all times.

- Following the vibrating and strike-off operations, float the concrete. Include transverse floating or other smoothing and finishing actions as necessary. Check and correct the surface according to 00758.49. Keep the surface free from laitance, soupy mortar, marks or irregularities.
- Finish the surface according to 00758.49.

Correct all damage to the subgrade or base due to the Contractor's operations, at no additional cost to the Agency, to the satisfaction of the Engineer.

(b) One Lift - Place the concrete in final position in one lift so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grades and cross sections.

(c) Provision for Joints and Other Devices - While placing concrete, make provision for constructing joints, placing dowels, tie bars, and other devices, as shown and directed, and as provided in 00758.43 and 00758.48.

(d) Reject Concrete Material - Reject concrete if it:

- Is not in place within 90 minutes after being mixed.
- Has begun to take an initial set before placement.

(e) Hand Operated Equipment - Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not foul the concrete with foreign matter, or disturb joint devices during such operations. Furnish hand operated mechanical vibrators satisfactory to the Engineer. Use the vibrators to consolidate the concrete pavement at least 6 feet each side of construction and expansion joints and all other areas as directed.

(f) Illumination - During hours of darkness, adequately illuminate work areas at the Contractor's expense.

00758.48 Joints:

(a) General - Provide and construct contraction, expansion, or construction joints transverse or longitudinal as shown or directed. Extend all joints and joint filler to pavement edges or to each other as applicable.

Construct all joints at right angles to the surface of the pavement. Joints shall not vary from the specified or indicated line by more than 1/4 inch. The tops of joint filler, when required, shall be slightly, but not more than 1/8 inch, below and paralleling finished pavement grade and cross section. Protect top edges of filler from damage by paving operations.

Construct all joints which contain preformed filler before the final floating and surface finishing of the concrete, unless otherwise directed.

(b) Longitudinal Joints - Construct contact type or weakened plane type longitudinal joints as shown.

(1) Longitudinal Contact Joints - Construct longitudinal contact joints when concrete is placed against hardened concrete, between strips of pavement, or between a strip of pavement and a concrete gutter.

(2) Longitudinal Weakened Plane Joints - Construct weakened plane joints by sawing to the depths and maximum width shown. Perform sawing as soon as the concrete has set

enough to permit sawing without tearing or raveling. Saws may be single or tandem, as the Contractor elects, and be controlled by guides to true line. Restore curing agents broken or damaged by the sawing operations.

If the top width of sawed joints exceeds 1/4 inch, fill the joint with a poured joint filler.

(c) Construction Joints - Construct construction joints when there is an interruption of 30 minutes in the concrete placing operations. Place construction joints no closer than 150 feet from the end of a repair or from an adjacent construction joint.

New concrete placed against construction joints shall conform to the proportions and consistency of the previously placed concrete.

(1) Continuously Reinforced Pavement - Furnish a self-supported working platform at each construction joint. The working platform shall be at least 4 feet wide and long enough to span the entire width of the pavement panel being constructed. Construct and support the platform so it does not rest upon or touch the reinforcing steel. Have the workers use this platform when working in the area around the construction joints. Do not walk on the reinforcing steel. Remove all debris and spilled concrete at and beyond the joint. Support the reinforcement as shown.

(2) Other Pavements - Unless otherwise shown, do not construct construction joints within 10 feet of a transverse joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, remove the concrete back to the last joint and dispose of as directed.

00758.49 Surface Finishing - After the concrete has been given a preliminary finish, check the surface of the fresh concrete in the longitudinal and transverse direction with a 12 foot straightedge. Correct surface deviations more than allowed by 00758.56(a). Lap each successive check with the previous check path by at least half the length of the straightedge.

(a) Textured Finish - Upon completion of the machine floating, straightedge testing, edge tooling and, if necessary, hand floating, and before initial set of the surface concrete, give the surface of the concrete a textured finish.

Accomplish the textured finish with a steel-tine tool with 1/8 inch tines that will mark the finished concrete to a depth of 1/8 inch to 3/16 inch. Randomly space the markings from 1/2 inch to 1 1/4 inches as approved. Avoid overlaps of the texturing. Construct markings transversely to the roadway centerline and full roadway width.

With approval of the Engineer, an astroturf or broom finish may be used in place of tining on roads to receive an overlay.

(b) Transverse Profile - Match the surface of the fresh concrete in the transverse direction to the surface of the existing concrete at the ends of the patch. Taper into existing pavement ruts in the first and last 10 feet to 20 feet to provide a transverse surface finish for the remainder of the patch meeting the requirements of this section.

00758.52 Edge Tooling and Filling - Tool edges at transverse joints and longitudinal joints of new pavement and clean joints of previously placed concrete to remove laitance and mortar resulting from finishing operations, and to provide clean rounded edges without ridges on the surface.

Fill all areas of minor honeycomb or other minor defect in composition of the concrete along the exposed sides of concrete with a stiff mortar of cement and fine aggregate, and apply to the moistened concrete to the satisfaction of the Engineer. Remove and replace areas showing serious

defects in composition of the concrete with specified quality concrete for full panel width between longitudinal joints or edges, and for a length not less than 10 feet. Low spots exceeding 1/4 inch in depth, if in hardened concrete, may be filled with an epoxy grout, provided the filling is neat and blends inconspicuously with adjoining concrete. Prepare the area according to the grout manufacturer's recommendations.

00758.53 Curing Concrete - Immediately after the final floating, surface finishing and edging have been completed, and while the concrete surface is still moist, cover and cure the entire exposed surface of the newly placed concrete for at least 72 hours. If the specifications require opening the lanes to traffic in less than 72 hours, remove curing covers just prior to opening to traffic. Use one of the following provisions:

(a) Liquid Membrane-Forming Compounds - Apply liquid membrane-forming compound uniformly to the concrete by pressure-spray methods at a rate of at least 1 gallon per 150 square feet. Mix the liquid membrane-forming compound thoroughly before and during use. Liquid membrane-forming compounds are not allowed when an asphalt concrete layer will be placed on the new concrete.

(b) Other Coverings - Apply clear or white polyethylene film or insulated curing blankets as a waterproof and moisture-proof covering. Place the film or blankets beyond the edge of the repaired areas and weight to hold in position. Do not mar the concrete with the covering.

00758.54 Longitudinal Pavement Cracks - Remove and replace all patches that show longitudinal cracking or do not bond at no additional cost to the Agency.

00758.55 Spall Repair - In spalled areas, remove the existing pavement according to 00758.41(d). Prepare the repair area according to 00758.41(e) and the PCC repair material manufacturer's recommendations. Mix and place PCC repair material according to the manufacturer's recommendation. Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not contaminate the concrete with foreign matter.

00758.56 Surface Tolerance, Testing, and Correction - The surface of finished pavement shall not deviate from longitudinal and transverse smoothness more than the limits identified below. Perform straightedge testing under the supervision of the Engineer as soon as the hardness of the concrete permits.

(a) Straightedge Testing and Tolerance - Test pavement surface longitudinal and transverse smoothness with a 12 foot straightedge. The extent of the testing will be determined by the Engineer. The pavement surface shall not deviate from the straightedge at any point by more than 1/8 inch, except the transverse surface at the patch ends may vary as required in 00758.49(b).

(b) Correcting Deficiencies - Correct all segments that exceed the requirements of 00758.56(a) by one of the following methods:

(1) Remove the non-specification concrete pavement as determined by the Engineer and replace with specification concrete pavement.

(2) Profile with an abrasive grinder equipped with a cutting head comprised of multiple diamond blades. Take care not to unnecessarily sacrifice concrete cover over the reinforcing steel.

Retest according to 00758.56(a). Perform all corrective work at no additional cost to the Agency, including traffic control.

Maintenance

00758.60 Protection of Concrete - Repair or replace any part of the pavement damaged by traffic or damaged from any other causes before its official acceptance, according to 00170.80. Do not operate construction equipment or allow public traffic on newly placed concrete until all of the following requirements are met:

(a) The Contractor complies with 00150.60.

(b) The concrete attains a compressive strength of at least 3,000 psi as determined by testing at least two cylinders cured according to AASHTO T 23 (field cure) and tested according to AASHTO T 22.

(c) Approval is given by the Engineer before opening to traffic.

(d) The surface of the concrete is protected from scarring or abrasion and kept free of stones, loose mortar and other matter apt to be deleterious to the concrete in the paths of equipment.

Measurement

00758.80 Measurement - The quantities of work performed under this Section will be measured according to the following:

(a) Pavement Repair - Reinforced concrete pavement repair will be measured on the area basis and will be determined by measuring the width and length of each separately constructed panel of pavement. The width is the measured edge-to-edge width on the surface of the pavement, perpendicular to centerline. The length is the measurement from end-to-end of pavement along the center line of the roadway, including the length of the bar lap splices.

The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

(b) Bar Lap - Reinforced bar lap areas will be measured on the unit basis. The reinforced bar lap area consists of an area of one 12 foot lane width and from 24 inches to 30 inches long.

Where the bar lap areas consist of an area less than one lane width, the quantity of bar lap area will be adjusted by converting to a proportionate quantity based on a 12 foot lane width. A 6 foot wide pavement repair will be counted as one-half of a bar lap area.

(c) Spall Repair - Spall repair will be measured on the area basis and will be determined by measuring the width and length of each separate repair. The width is the measured edge-to-edge width on the surface of the pavement. The length is the measurement from end-to-end of pavement along the center line of the roadway.

The measurement of extra thickness beyond the depth shown in the plans or as ordered by the Engineer, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of the specified thickness.

(d) Pavement Repair at Joints - Pavement repairs at joints will be measured on the length basis.

(e) Plain Concrete Pavement - Plain concrete pavement used to replace the existing base will be measured on the area basis and will be determined by measuring the width and length of the plain concrete pavement placed.

The measurement of extra thickness of pavement, as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

Payment

00758.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Continuously Reinforced Concrete Pavement Repair	Square Yard
(b) Reinforced Concrete Pavement Repair	Square Yard
(c) Extra for Reinforced Bar Lap Areas	Each
(d) Concrete Pavement Spall Repair	Square Yard
(e) Extra for Expansion Joint Repair	Foot
(f) Extra for Terminal Expansion Joint Repair	Foot
(g) Extra for Terminal Expansion Joint Repair (Steel Beam)	Foot
(h) Concrete Pavement Base, _____ Inches Thick	Square Yard

Items (a) and (b) include saw cutting, removing concrete pavement including the PCC in the bar lap splice area, and preparing the cut edges.

Item (c) includes providing bar lap areas as specified using tied laps.

Item (d) includes sawing and removing concrete.

Items (e), (f), and (g) include removing existing joints and removing all or portions of existing steel beams.

In item (h), the thickness of pavement base will be inserted in the blank.

Item (h) includes removing existing base material and furnishing the bond breaker.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for intermediate bar lap splices necessary to accommodate staging or reopen the roadway to traffic.

Section 00759 - Miscellaneous Portland Cement Concrete Structures

Description

00759.00 Scope - This work consists of furnishing, placing and finishing commercial grade concrete curbs, islands, traffic separators, driveways, walks, monolithic curb and sidewalks, miscellaneous surfaces, and stairs ~~with~~and furnishing and installing metal handrail in close conformity to the lines, grades and dimensions shown or established. ~~These~~The commercial grade concrete items in this Section will be collectively referred to as "structures".

Materials

00759.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement	02510
Commercial Grade Concrete	00440
Dowels	02510.50
Epoxy Bonding Agent	02070
Metal ~~Pipe~~ Handrail	02830
Preformed Expansion Joint Filler	02440.10
Welded Wire Fabric	02510.40

00759.11 Aggregate Base - Furnish aggregate base materials for base, foundation courses, leveling courses, or bedding meeting the requirements of Section 02630. If a designated size is not shown or given, furnish either 1" - 0 or 3/4" - 0, as the Contractor elects.

00759.12 Sidewalk Ramp Treatment - Furnish truncated dome detectable warning surfaces for sidewalk ramps and accessible route islands from the QPL.

Use only adhesives recommended or supplied by the manufacturer.

Equipment

00759.21 Concrete Extruding Machine - Concrete extruding machines shall operate under sufficient restraint to forward motion to produce a well consolidated mass of concrete.

Construction

00759.41 Earthwork - Make excavations and backfills for the structures according to Section 00330 and to the depths, widths, and cross-sections shown, specified, or directed.

00759.42 Foundations - Construct foundations or other bedding using selected granular backfill material according to Section 00330 or using aggregate base when shown or directed.

For aggregate base, do one of the following:

- When existing aggregate base materials of the kind specified in 00759.11 are already in place, salvage and reuse.
- Use new aggregate base materials conforming to 00759.11.

00759.43 Foundation Preparation - Bring areas on which structures are to be constructed to established line, and make firm, dry and free of all unsuitable material before placing concrete. Existing concrete surfaces shall be clean and moist at the time of placing new concrete.

When placing concrete by the extrusion method, vertical dowel fastening to underlying concrete may be eliminated if the bond between surfaces is developed by applying epoxy bonding agent. Apply epoxy bonding agent according to the manufacturer's recommendations.

00759.44 Joining New ~~To~~to Existing Concrete - Construct suitable connections between new and existing concrete where existing driveways, walks, and other structures are cut back to permit the new construction or where the new construction abuts the existing concrete. Unless shown or directed otherwise, furnish and place minimum ~~1/2~~3/4 inch thick preformed expansion joint filler between new and existing concrete.

00759.45 Reinforcement, Dowels, and Tie Bars - Furnish and place reinforcement, dowels, and tie bars according to 00755.43 and as shown or directed.

Provide dowels with "slip sleeves" and place as load transfer devices where shown. Place dowels without "slip sleeves" as fastenings or ties between new and existing underlying concrete when shown.

00759.46 Concrete - Construct the structures between suitable forms or by the extrusion method. Place concrete according to Section 00440 subject to this Section.

00759.48 Expansion Joints - Construct expansion joints of the preformed filler type in concrete structures as shown and the following:

- Not less than 1/2 inch wide, except where abutting or underlying concrete joints are larger, then the width shall match those joints.
- At right angles to the structure alignment and normal to the structure surface.
- Which completely separate the concrete segments.
- Placed flush or no more than 1/8 inch below the concrete surface.

(a) Curbs, Islands, and Traffic Separators - Provide expansion joints:

- Opposite abutting expansion joints in abutting concrete.
- Over existing expansion joints in concrete underlying the new concrete structure.
- At each point of tangency in the structure alignment.
- Not over 200 foot spacing.

(b) Driveways, Walks, Monolithic Curbs and Sidewalks, and Surfacings - Provide expansion joints:

- Between driveways and concrete pavement.
- Transversely in walks opposite expansion joints in adjoining curbs and elsewhere so the distance between joints does not exceed 45 feet.
- Transversely in walks at a distance of 16 feet to 8 feet from ends of walks which abut curbs.
- Around poles, posts, boxes, and other fixtures which protrude through or against the structures.

(c) Stairs - Provide expansion joints for stairs at the top and bottom landings as shown.

00759.49 Contraction Joints - Construct transverse contraction joints of the weakened plane or dummy type in the exposed surfaces of the concrete structures as shown and the following:

(a) Locations - Locate contraction joints:

- Over contraction joints in concrete underlying the new concrete structure.
- Opposite contraction joints in abutting concrete.
- At locations to confine joint spacing to a maximum of 15 feet.

(b) Methods - Construct contraction joints by:

- Inserting and removing plates, or other devices.
- Inserting and leaving in place preformed expansion joint filler even and flush with the concrete surface.
- Sawing as soon as practical after concrete placement but before any uncontrolled cracking occurs.
- Tooling.
- Other approved methods.

(c) Requirements - Contraction joints shall:

- Be not less than 1/8 inch or more than 1/4 inch wide.
- Be a depth of one-third the thickness of the concrete.
- Have clean, unfilled grooves (if preformed expansion joint filler is not used).

00759.50 Surface Finishing:

(a) General - Remove forms, if any, from structures after the concrete has taken its initial set and while the concrete is still green. Repair minor defects with mortar containing one part portland cement and two parts sand. Do not plaster exposed surfaces.

The top and face of structures shall be true and straight, free from humps, sags, or other irregularities. The surface shall not vary more than 1/4 inch from the edge of 12 foot long straightedge laid on the top or face of the structure, except in curves. Furnish the straightedge and operate it as directed. Unless otherwise shown or directed, tool edges to 1/4 inch radius.

(b) Curbs, Islands, and Stairs - While the concrete is still green, finish the exposed surfaces as required to produce a smooth surface and uniform texture.

(c) Driveways, Walks, and Surfacings - Finish concrete surfaces to smooth and uniform texture by troweling, floating and cross brooming. Lightly groove or mark surfaces into squares or other shapes to match markings on similar existing surfaces in the vicinity, as directed.

On all sidewalk ramps and accessible route islands, install truncated domes as shown. Place according to the manufacturer's recommendation.

00759.51 Curing - Cure and protect concrete after placing and finishing according to Section 00440.

Keep the concrete structure free from contact, strain and public traffic for at least ~~seven~~7 calendar days or longer as directed. Do not apply curing compounds to the designated truncated dome areas of sidewalk ramps and accessible route islands.

00759.52 Metal Handrail - Fabricate and assemble free standing and bolted down metal handrail as shown.

00759.53 Welding - Welding, welder qualifications, prequalification of weld details and inspection of welds shall conform to AWS D1.1. Submit all welding procedure specifications to the Engineer for approval.

00759.54 Bolt Holes:

(a) Punched Holes - Use a die with a diameter not exceeding the diameter of the punch by more than 1/16 inch. Ream any holes that are required to be enlarged to admit the anchor bolts. Make clean cut holes without torn or ragged edges.

(b) Accuracy of Punched Holes - Locate all holes punched full size so accurately that when multiple anchor plates are stacked with the edges even, a cylindrical pin 1/8 inch smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the plate without drifting in each of the connecting holes in the same plane. Non-conforming pieces will be rejected.

Measurement

00759.80 Measurement - The quantities of structures constructed under this Section will be measured according to the following:

- **Volume Basis** - Measurement will be limited to the neat lines of the finished structure as shown or directed.
- **Area Basis** - Measurement will be the finished surface, limited the neat lines ~~of the structure~~shown or directed.
- **Length Basis** - Measurement of concrete items will be along the face of the structure, from end to end including curb tapers or depressed lengths at driveways and ramps. Measurement of metal handrail will be along the top rail member, from center of end post to center of end post.
- **Each Basis** - Measurement will be by actual count.

Payment

00759.90 Payment - The accepted quantities of structures will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Concrete Curbs, _____	Foot or Cubic Yard
(b)	Concrete Islands	Square Foot
(c)	Concrete Driveways	Square Foot
(d)	Concrete Driveways, Reinforced	Square Foot
(e)	Concrete Walks	Square Foot
(f)	Monolithic Curb and Sidewalks	Square Foot or Foot
(g)	_____ Concrete Surfacing	Square Foot
(h)	Concrete Stairs	Cubic Yard
(i)	Concrete Bus Shelter Pads	Each
(j)	Concrete Mowing Strip	Foot
(k)	Metal Handrail, ____ Rails	Foot

In item (a) the type of curb will be inserted in the blank, if appropriate.

Item (b) includes traffic separators.

Items (c) and (d) include monolithic curb at driveway locations.

Items (e) and (f) include sidewalk ramps.

In item (g~~)~~), the specified thickness, or type, of concrete surfacings will be inserted in the blank, if appropriate.

Item (h) includes pipe handrail.

In item (k), the number of rails will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

When earthwork is included as separate pay items, payment will be made according to 00330.90 through 00330.94 as appropriate.

When earthwork is not included as separate pay items, no separate or additional payment will be made for earthwork.

Aggregate will be paid for according to 00640.90 or 00641.90 as appropriate.

PART 00800 - PERMANENT TRAFFIC SAFETY AND GUIDANCE DEVICES

Section 00810 - Metal Guardrail

Description

00810.00 Scope - This work consists of constructing metal guardrail and metal median barrier to the lines and grades shown or established and includes the assembly and erection of all components, parts and materials complete at the locations shown or directed.

Metal guardrail and metal median barrier will be referred to in this Section as "guardrail". The types of guardrail will be shown.

Materials

00810.10 Materials - Furnish materials meeting the following requirements:

Guardrail Anchor Hardware	02820.40
Guardrail Hardware	02820.30
Metal Beam Rail	02820.10
Metal Posts	02820.20
Wood Guardrail Blocks	02110.20
Wood Guardrail Posts	02110.10

Use guardrail terminals from the QPL conforming to the National Cooperative Highway Research Program (NCHRP) Report 350.

00810.11 Posts - Posts, except as specified for use on bridges or otherwise shown or directed, may be of steel or wood, as the Contractor elects. Once a type has been selected, use it throughout the continuous run of guardrail except in the transitions and terminals.

00810.12 Median Barrier on Bridges - Metal median barrier on bridge decks shall be comprised of metal beam rail, metal posts, and hardware~~,~~ conforming to 00810.10.

At expansion joints on bridge decks, the slots in the rail member for post bolt and rail joint bolts shall be of special dimensions as shown.

00810.13 Guardrail Anchors - Guardrail anchors shall be steel.

00810.14 Condition of Materials - All materials will be subject to inspection of condition at the latest practical time available before or during incorporation of materials in the work.

00810.15 Salvaged Materials - Materials salvaged as part of removal work on the Project may be reused in new construction, if the Engineer determines the materials conform to current design, 00810.10, and the following:

(a) Wood Posts - Wood posts shall be structurally sound, treated and free from damage that would affect their strength and durability. Do not incorporate into the work any post damaged to the extent that untreated wood is exposed.

(b) Metal Beam Rail Members - Metal beam rail members shall be unpainted, straight and free of breaks, kinks, dents, damage to galvanized coating, or any other damage that would affect the integrity of the member. If paint is removed from metal beam rail members salvaged from the Project, remove the paint at a location outside of the highway right of way, and in a manner

that will not damage the galvanizing. Repair minor damage to galvanizing according to 00810.43.

Construction

00810.40 Timing and Coordination of Work - Time and coordinate construction of guardrail to hold disturbance of bases, surfacings and pavements to a minimum.

Place all salvaged metal guardrail or metal median barrier materials in continuous runs.

Do not leave posts installed for guardrail and median barrier exposed to traffic for more than 24 hours before installing the rail members, rail end pieces and anchors and tightening all bolts, except replacement rail shall be installed according to 00310.40(a).

00810.41 Excavation and Backfill - Subject to 00810.42, excavate to the lines, grades and depths shown or established. Make cuts through pavement by mechanical means, such as knife-edge cutters or rotary drills. Make cuts below the pavement by auger or other means that will prevent undue disturbance of abutting areas. Avoid fouling existing bases and pavements. Repair or replace, as directed, all materials that become fouled, at no additional cost to the Agency. Remove water and unsuitable material that would impair stability of the backfill, from areas to be backfilled.

In areas occupied by aggregates, bituminous material and pavements, backfill with like materials to the same thickness and density as the adjacent materials. In other areas, backfill with granular backfill materials meeting the requirements of 00330.14. Place all backfill in layers not exceeding 6 inches and compact each layer to a firm, dense condition.

Remove, replace, repair, or restore, as directed, adjoining areas that become misshapen or disturbed during excavating and backfilling operations at no additional cost to the Agency. Dispose of excess materials according to 00330.41(a-4).

00810.42 Installation of Posts and Anchors - Place posts and anchors as shown. If directed, install 8 foot guardrail posts. Set posts in excavated holes or drive them in place. If posts are driven through the bases, surfacings, or pavement, repair all damage as directed. Remove and replace posts, anchors or other components damaged during installation with sound components. Firmly set all posts at proper line, grade and spacing within a tolerance of 1/2 inch. Rigidly attach anchors, terminals and connections to other structures as shown.

When metal posts are required over box culverts, cattle passes, equipment passes or other concrete structures, place steel posts, base plates, or base plate concrete anchors as shown or directed.

00810.43 Erection of Rails and Other Components - Normally, all fabrication of metal beam rail members and other components shall be done in the shop or by the manufacturer. Limit field cutting, drilling and other field fabrication to the minimum and perform in a manner that will not impair the appearance or structural quality of the material. Burning new holes in metal beam rail members will not be allowed.

Restore to specified condition, surface finishes and protections that are damaged before or during erection. Repair the cut ends of galvanized bolts, rail elements and back-up plates, and any holes drilled or punched after galvanizing according to ASTM A 780. Minimum zinc content for Method A2 is 94~~%~~ percent on the dry film.

Toe nail blocks to post with two ~~10d~~16d, galvanized, flat head nails to prevent rotation.

Draw tight all bolts. Bolts shall be of sufficient length to extend slightly beyond the nuts.

00810.45 Painted Guardrail - Projects that include the removal and dismantling of painted metal guardrail require that environmental protection and worker safety precautions be established. If painted guardrail is reused in any application, comply with DEQ/EPA and OSHA regulations pertaining to paint removal.

Measurement

00810.80 Measurement - The quantities of guardrail items constructed under this Section will be determined as follows:

- **Length** - Measurement will be on the length basis, measured by one of the following methods:

  - **Count Method** - The number of standard sections will be counted and multiplied by 12 1/2 feet. For purposes of this subsection, a "standard section" is defined as 12 1/2 feet of complete guardrail or median barrier, without regard to the number of posts or rail elements used. Non-standard sections will be measured from center of post to center of post, and added to the total calculated length of the standard sections for each run.

  - **Length Method** - Measurement will be from center to center of end posts, or as otherwise shown, along the line and grade of each run of each type.

- **Unit** - Measurement will be by actual count.

Payment

00810.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Guardrail, Type ____	Foot
(b)	Metal Median Barrier	Foot
(c)	Guardrail Anchors, Type ____	Each
(d)	Guardrail End Pieces, Type ____	Each
(e)	Guardrail Transition	Each
(f)	Guardrail Connections	Each
(g)	Guardrail Terminals, ____	Each
(h)	Extra for ____ Foot Posts	Each
(i)	Guardrail Posts	Each

In item (a), the type of guardrail will be inserted in the blank . Item (a) includes all posts including steel, base plates, and base plate concrete anchors.

Items (a) and (b) include constructing the respective items except for:

- end pieces
- anchors
- transitions
- extra costs involved in constructing guardrail connections to existing bridges
- terminals

In item (c), the type of anchor will be inserted in the blank.

In item (d), the type of guardrail end piece will be inserted in the blank.

Item (e) includes preparing the bridge rail or concrete barrier for the transition and includes posts, rail elements, terminal connectors, connection plates, anchor bolts, and all necessary appurtenances and hardware.

Item (f) includes preparing the bridge rail or concrete barrier for the connection and installing the terminal connectors when there is no guardrail transition item and includes connection plates, anchor bolts, and all necessary appurtenances and hardware.

In item (g) the type of terminal will be inserted in the blank. Item (g) includes guardrail terminals, posts, anchors, rails, guards, end pieces, struts, soil tubes, and all necessary appurtenances and hardware.

In item (h) the length of post will be inserted in the blank. Item (h) includes installing 8 foot long or longer posts instead of standard 6 foot long posts, The extra costs for the longer posts are costs that are not covered and included in the unit price for one or more of the other listed pay items.

Item (i) includes only installing posts when upgrading or repairing existing guardrail installations.

Payment will be payment in full for furnishing and placing all materials, and furnishing all equipment, labor and incidentals necessary to complete the work, as specified.

No separate or additional payment will be made for excavation and backfill.

Section 00811 - Cable Barrier

Description

00811.00 Scope - This work consists of furnishing and installing cable barrier to the lines, grades, and at the locations shown or directed.

Materials

00811.10 Cable Barrier - Furnish cable barrier from the QPL. Provide all cable barriers on the Project from the same manufacturer regardless of the number of runs of cable barrier required and regardless of the types of cable barrier required.

Use pre-cast or cast-in-place concrete ~~docketed~~socketed foundation line posts. Furnish and place concrete meeting the requirements of Section 00440.

00811.11 Cable Barrier Terminals - Use the following options as specified:

- **Option 1** - Use cable barrier terminals from the QPL that matches the system used.
- **Option 2A** - Tie the cable barrier to new guardrail as approved by the cable barrier manufacturer.
- **Option 2B** - Tie the cable barrier to existing guardrail as approved by the cable barrier manufacturer.

Equipment

00811.20 Tension Measuring Device - Measure the cable barrier tension with a manufacturer supplied measuring device. At the completion of the Project, the measuring device becomes the property of the Agency at no additional cost to the Agency.

Labor

00811.30 Manufacturer's Representative - If it is a requirement of the manufacturer to have a manufacturer's representative on-site during installation, provide the services of a manufacturer's representative at no additional cost to the Agency.

Construction

00811.40 Cable Barrier - Install cable barrier according to the manufacturer's directions at the locations shown. Cable anchors and cable overlap as shown are approximate. Locate and overlap the actual anchor according to manufacturer's instructions.

Keep a tension log and give it to the Engineer upon completion of installation. The tension log shall show the time, date, location, ambient temperature, and the final tension readings, and be signed by the person performing the tension readings. Provide a copy of the manufacturer's recommended tension chart along with the tension log.

Perform all tension checks or adjustments required by the manufacturer within a 30 day period of installation.

00811.41 Cable Barrier Terminals - Place terminals according to the manufacturer's directions, at locations shown, and as required by the cable barrier manufacturer to meet their minimum

requirements. Ensure that there is compatibility between terminals and the cable barrier system installed.

00811.42 Placement - Place the concrete anchors and footings, and backfill them at least ~~two~~ 2 weeks prior to tensioning the cables. Set the concrete anchors into the excavation as shown. Set the bottom of the anchor so it has full and even bearing in the surface under it. Excavate and backfill according to 00810.41.

Maintenance

00811.60 Training - After installation, provide at least one 4 hour manufacturer presented training session to Agency maintenance personnel at no additional cost to the Agency.

Measurement

00811.80 Measurement - The quantities of cable barrier will be measured on the length basis, from center of end post to center of end post along the line and grade of each separate run. Measurement will be made through the ends of the terminals and guardrail connections.

The quantities of cable barrier terminals and cable barrier guardrail connections will be measured on the unit basis.

Payment

00811.90 Payment - The accepted quantities of cable barrier will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Cable Barrier, Test Level 3	Foot
(b)	Cable Barrier, Test Level 4	Foot
(c)	Cable Barrier Terminals	Each
(d)	Cable Barrier Guardrail Connections	Each

Items (c) and (d) include all special rail elements, brackets, posts, and all necessary appurtenances and hardware.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00812 - Adjusting and Repairing Guardrail

Description

00812.00 Scope - This work consists of adjusting and repairing existing guardrail ~~by raising it to the proper height to conform to the applicable standard drawings~~as shown or directed.

Materials

00812.10 Materials - ~~Replace rail members~~Furnish replacement metal beam rails, posts, ~~or other materials that are damaged with material~~blocks, and hardware meeting the requirements of 00810.10.~~ Replace materials damaged by the Contractor's operations at no additional cost to the Agency.~~

Construction

00812.40 General - ~~Reinstall adjusted~~Install all guardrail components during the same day they are removed. Repair minor damage to galvanizing according to ASTM A 780. Minimum zinc content for Method A2 is 94~~%~~ percent on the dry film.

00812.41 Adjusting Guardrail - Adjust ~~the~~ existing guardrail by one or both of the following methods:

(a) Posts Remain in Place~~ -~~:

- Remove the existing ~~rail members~~metal beam rails and blocks in a manner that will not damage galvanizing~~;~~.
- If required, drill new bolt holes in posts~~ (if needed); treat~~.
- Treat all existing and all new holes with a preservative from the QPL~~; reinstall~~.
- Reinstall the ~~rail members~~metal beam rails and blocks~~; and perform such~~.
- Perform all other required work as ~~may be required and~~ shown.

(b) Raise Posts - Remove and reinstall posts ~~at~~to the ~~proper~~required height, or raise ~~posts~~them to the ~~proper~~required height and ~~set firmly by working~~work grout or other materials under ~~the post~~them in a manner satisfactory to the Engineer.

Adjust existing terminal ends by raising the soil tubes and ground struts to the required height and placing and compacting matching material under the ground struts.

00812.43 Repairing Guardrail - Repair existing guardrail by replacing metal beam rails, posts, blocks, and hardware. Install new metal beam rails, posts, blocks, and hardware according to 00810.42 and 00810.43.

Measurement

00812.80 Measurement - The quantities of ~~adjusted~~work performed under this Section will be determined as follows:

- **Adjusting Guardrail** - Adjusted guardrail will be measured on the length basis, of existing guardrail adjusted. Measurement will be by one of the following methods:
  - **Count Method** - The number of standard sections will be counted and multiplied by 12 1/2 feet. For purposes of this subsection, a ~~"~~standard section~~"~~ is defined as 12

1/2 feet of complete guardrail, without regard to the number of existing posts or existing rail elements used. Non-standard sections will be measured from center of post to center of post, to the nearest foot, and added to the total calculated length of the standard sections for each run.

- **Length Method** - Measurement will be from center to center of terminal end posts, or as otherwise shown, along the line and grade of each run of each type to the nearest foot.

- **Repairing Guardrail** - Repaired guardrail metal beam rails, posts, and blocks will be measured on the unit basis. For purposes of this subsection, a metal beam rail is defined as 12 1/2 feet long.

Payment

00812.90 Payment - The accepted quantities of adjusted guardrailwork performed under this Section will be paid for at the Contract unit price, per footunit of measurement, for the item "following items:

Pay Item	Unit of Measurement
(a) Adjusting Guardrail".	Foot
(b) Metal Beam Rails	Each
(c) Guardrail Posts	Each
(d) Guardrail Blocks	Each

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- hardware
- adjusting terminal ends
- replacement metal beam rails, posts, and blocks that are damaged by Contractor equipment or operation

Section 00815 - Bollards

Description

00815.00 Scope - This work consists of furnishing and installing bollards at locations shown or as directed.

Materials

00815.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete.....00440
Granular Drain Backfill 00430.11
Reflective Sheeting~~..... 02910.30~~ (Type III and Type IV) From QPL

00815.11 Posts and Sleeves - Use Schedule 40 steel posts and sleeves conforming to ASTM A 53.

00815.12 Plates, Shapes, Fasteners, and Hardware - Use plates and shapes conforming to ASTM A 36. Use fasteners and hardware conforming to ASTM A 449.

00815.13 Galvanizing - Hot-dip galvanize all metal components after fabrication according to AASHTO M 111 (ASTM A 123) or AASHTO M 232 (ASTM A 153), as applicable.

00815.14 PVC Pipe - Use Schedule 40 PVC pipe.

Construction

00815.40 Bollards - Install bollards as shown or as directed.

Measurement

00815.80 Measurement - The quantities of bollards will be measured on a unit basis.

Payment

00815.90 Payment - The accepted quantities of bollards will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Bollards	Each
(b) Removable Bollards	Each

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavation work.

Section 00820 - Concrete Barrier

Description

00820.00 Scope - This work consists of constructing precast and fixed form cast-in-place portland cement concrete barrier, to the lines and grades shown or established.

Materials

00820.10 Materials - Furnish materials meeting the following requirements:

Commercial Grade Concrete.....00440, except as provided in this Section
Concrete Coating 02210
Deformed Bar Reinforcement.....02510.10
Portland Cement Grout 02080.40
Preformed Joint Filler 02440.10

00820.11 Other Materials:

(a) Concrete - Concrete shall meet the requirements of Section 00440, except that aggregates shall be modified as follows:

(1) Fine Aggregate - Fine aggregate shall meet the test requirements of 02690.30(d) and 02690.30(e). Test results shall be no more than ~~one~~ 1 year old.

(2) Coarse Aggregate - Coarse aggregate shall meet the test requirements of 02690.20(c) and 02690.20(d). Test results shall be no more than ~~one~~ 1 year old.

(b) Hardware - Pins, bolts, and dowels shall conform to ASTM A 449 and shall be hot-dip galvanized according to AASHTO M 232 (ASTM A 153).

(c) Loop Bars - Fabricate loop bars from ASTM A 36, hot-rolled round bar and hot-dip galvanize according to AASHTO M 232 (ASTM A 153) and ASTM A 143.

(d) C-shape Connectors - Furnish perforated C-shape connectors fabricated from ASTM A 36 channel, hot-dip galvanized after fabrication according to AASHTO M 232 (ASTM A 153) and ASTM A 143.

(e) Identification - Permanently cast into the top surface or into the side lower vertical face of each precast concrete barrier piece an identifying code consisting of the initials of the barrier manufacturer, the date of casting and the form number. Barrier pieces without identifying code will not be accepted.

00820.12 Re-use of Concrete Barriers - Used precast concrete barriers may be placed in permanent installations according to the following:

(a) New Barrier Used for Temporary Application - New precast concrete barriers used in temporary applications on the Project may be reused in permanent installations, provided they:

- Are in good condition, without visible cracks, chips or spalls.
- Present a surface of uniform texture and appearance.
- Are free of markings, except as required by 00820.11(e).
- Are given two coats of a water-based coating material meeting the requirements of 02210.30~~(c)~~ after installation in final position.

(b) Barrier Used on Previous Projects - Precast concrete barriers used on previous projects may be reused in permanent installations, provided they meet all the requirements of this Section and, prior to delivery to the Project Site:

- The Contractor furnishes documentation required by 00165.10(b).
- Barriers are restored to like-new condition, without visible cracks, chips, spalls or corroded loops.
- Barriers present a surface of uniform texture and appearance.
- Barriers are free of markings, except as required by 00820.11(e).

Apply two coats of a water-based coating material meeting the requirements of 02210.30~~(c)~~ after installation in final position.

(c) Repair of Damage - If any concrete barrier segment is damaged by the Contractor during or after installation, immediately repair it to the Engineer's satisfaction or replace it with an undamaged section, at no additional cost to the Agency.

00820.15 Quality Control - Provide quality control according to Section 00165.

Labor

00820.30 Quality Control Personnel - Provide a ~~certified Quality Control Technician (QCT).~~technician having a QCT technical certification.

Construction

00820.40 General - Construct cast-in-place barrier using fixed forms unless specifically directed otherwise. Use the same barrier design in any continuous run of barrier.

00820.41 Line and Grade - Place precast barrier sections on the pavement surface. New pavement surfaces placed as a part of this Project shall meet the appropriate smoothness requirement prior to placing the barrier. If corrective work is required for existing surfaces to receive concrete barrier, it will be paid ~~for separately as Extra Work~~according to 00195.20.

Place the barrier sections so that the joints offset no more than 1/4 inch transversely and no more than 1/2 inch vertically.

Construct the top and face of finished barriers true and straight. The top surface of the barriers shall be uniform width and free from humps, sags, or other irregularities. When a 12 foot straightedge is laid on the top or face of the barrier, the surface shall not vary more than 1/4 inch from the edge of the straightedge, except at grade breaks or curves. To compensate for variations in the roadway grade and cross slope, adjust the height of the barrier at no additional cost to the Agency.

00820.42 Concrete Construction - Construct concrete barrier according to Section 00440 except as provided in this Section.

00820.43 Curing - Cure barriers as follows:

(a) Cast-In-Place Barriers - Cure cast-in-place concrete surfaces by one of the following methods:

(1) Water Cure - Cover with burlap, canvas or other satisfactory material and keep moist for at least ~~seven~~ 7 calendar days.

(2) Latex Paint Cure - If approved, barrier may be cured with latex paint, using the following procedures:

- Allow free moisture to flash off, but only until the concrete surface does not glisten, and never for more than ~~one~~ 1 hour.
- Apply latex paint from the QPL as follows:
  - Apply first coat at an application rate of 150 square feet per gallon.
  - Allow first coat to air dry for ~~one~~ 1 hour.
  - Apply second coat at the same rate as above, with application direction transverse to the direction that the first coat was applied.

Barriers cured in this manner will be considered to have met the surface finishing requirements of 00820.45 except that additional coats may be necessary to provide uniform coverage and appearance to correct construction damage.

(b) Precast Barriers - Cure precast concrete surfaces by one of the following methods:

(1) Water Cure - Water cure concrete surfaces by covering with burlap, canvas or other satisfactory material and keep moist for at least ~~seven~~ 7 calendar days.

(2) Steam Cure - Steam curing can be substituted for water curing if done under a suitable enclosure constructed to contain live steam and to minimize moisture and heat loss. The steam shall be at 100~~%~~ percent relative humidity to prevent loss of moisture and to provide excess moisture for proper hydration of cement. Do not apply the steam directly to the concrete.

Equip the steam supply line to the enclosure with a motor-operated, modulating steam control valve operated by a temperature-sensing element that measures the temperature within the enclosure. Distribute the steam within the enclosure through suitable ports located on each side of the enclosure at not more than 30 foot centers, or closer if necessary, to keep the units being cured completely and uniformly surrounded with live steam.

Equip the enclosure with a 24-hour recording thermometer, and record the temperature on a single chart for each 24-hour period.

Apply the steam after the initial set of the concrete as determined by ASTM C 403. Continue steam curing until the barrier concrete reaches a minimum compressive strength of 2,000 psi as determined by Contractor test cylinders or as approved.

00820.44 Joints for Cast-in-Place Concrete Barriers:

(a) Construction Joints - Make construction joints at an expansion or contraction joint location. If the placement of the barrier is stopped at a normal contraction joint location, construct an expansion joint at that location, before proceeding with the placement of the barrier, as shown.

(b) Contraction Joints - Score or saw contraction joints before initial set to the depth and width shown.

(c) Expansion Joints - Fill expansion joints with a preformed joint filler. Place the filler in correct position on one side of the joint before placing concrete on the other side.

00820.45 Surface Finishing - After stripping forms and while the concrete is still green, remove all fins and form marks, and repair all rock pockets and holes having a surface opening over 3/8 inch in

diameter with portland cement grout conforming to 02080.40. Prevent grout from drying prematurely. Additional finishing after precast concrete barrier is set in its permanent position may be required to present a surface of uniform texture and appearance.

Coat the top and sides of all permanent barriers with a minimum of two coats of a latex paint from the QPL. Use additional coats as necessary to provide uniform coverage and appearance. Clean and thoroughly saturate with water the surfaces to be coated. Coat while damp. The second coat may be applied when the previous coat does not adhere to the fingers when touched lightly.

00820.47 Replacement or Price Reduction - Remove and replace barrier represented by cylinders that fail to meet the minimum strength requirement, at no additional cost to the Agency. If the Engineer determines the low-strength barrier is suitable for the purpose intended, the barrier may be accepted according to 00150.25.

00820.48 Inspection - Fabrication of barrier outside of the State of Oregon creates additional inspection costs to the Agency. The Contractor's payment for barrier will be reduced according to 00165.91.

Measurement

00820.80 Measurement - The quantities of concrete barrier will be measured on the length basis, according to the following:

- **Cast-In-Place Barriers** - Cast-in-place barrier will be measured along the line and grade of each separate run, including terminal sections and transition sections.

- **Precast Barriers** - Precast barrier will be the laying length of a standard section, as shown on the applicable standard drawing, multiplied by the number of standard sections installed in each separate run. Non-standard sections, terminal sections and transition sections will be measured separately and added to the total length of standard sections.

Payment

00820.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Concrete Barrier	Foot
(b) Concrete Barrier, Tall	Foot

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavating and backfilling concrete barrier buried ends.

Section 00822 - Glare Shields

Description

00822.00 Scope - This work consists of furnishing and installing glare shields on concrete median barrier.

Materials

00822.10 Materials - The Contractor has the option of providing modular glare shields or individual glare shields as specified.

- Furnish glare shields from the QPL.
- Furnish steel base plate brackets fabricated from ASTM A 304 stainless steel or merchant quality mild carbon steel. Mild carbon steel brackets shall be hot-dip galvanized after fabrication according to AASHTO M 111 (ASTM A 123).
- Furnish bolts, nuts, inserts, washers and other necessary assembly hardware made from ASTM A 304 stainless steel or mild carbon steel. Equip exposed hardware with vandal-resistant lock nuts or similar. Furnish mechanical inserts, if used, suitable for dynamic application. Galvanize carbon steel assembly hardware according to AASHTO M 111 (ASTM A 123).

All base plate brackets and necessary assembly hardware installed in a continuous run shall be of the same material.

Construction

00822.40 Construction - Install the glare shields according to the following:

- Recess inserts at least 1/4 inch below the concrete barrier surface.
- Install all glare shield blades vertical and true to line.
- Place glare shields according to the manufacturer's recommendation.
- Install so that the angle of light coming through from the other side does not exceed 22°.
- Firmly attach the base plate anchor bolts to the concrete barrier to withstand a 1,000 pounds vertical pull and to prevent horizontal and rotational displacement. Space modular unit anchor bolts as recommended by the manufacturer.
- Modular or single element glare shields that are installed in a continuous run shall be of the same manufacture and of like appearance throughout the entire installation.

Measurement

00822.80 Measurement - The quantities of glare shields will be measured on the length basis, along the line and grade of each run.

Payment

00822.90 Payment - The accepted quantities of glare shields will be paid for at the Contract unit price, per foot, for the item "____ inch Glare Shields".

The length of the blades will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00830 - Impact Attenuators

Description

00830.00 Scope - This work consists of furnishing and installing impact attenuators for permanent installations.

00830.02 Required Submittals - If placement or method of installation of impact attenuators is different than the manufacturer's recommendations, submit stamped shop drawings, including concrete components, according to 00150.35.

Materials

00830.10 Materials - Furnish impact attenuators from the QPL and as specified.

The following types of impact attenuators are allowed:

Type A: Gating device, Test Level 3, for Shoulder use only, Narrow Width, Regular Maintenance

Type B: Gating device, Test Level 3, for Shoulder, Gore and Median use, Narrow Width, Regular Maintenance

Type C: Non-Gating device, Test Level 2, for Shoulder, Gore and Median uses, Narrow Width, Regular Maintenance

Type D: Non-Gating device, Test Level 2, for Shoulder, Gore and Median use, Wide Width, Regular Maintenance

Type E: Non-Gating device, Test Level 3, for Shoulder, Gore and Median use, Narrow Width, Regular Maintenance

Type F: Non-Gating device, Test Level 3, for Shoulder, Gore and Median use, Wide Width, Regular Maintenance

Type G: Non-Gating device, Test Level 2, for Shoulder, Gore and Median use, Narrow Width, Low Maintenance

Type H: Non-Gating device, Test Level 2, for Shoulder, Gore and Median use, Wide Width, Low Maintenance

Type J: Non-Gating device, Test Level 3, for Shoulder, Gore and Median use, Narrow Width, Low Maintenance

Type K: Non-Gating device, Test Level 3, for Shoulder, Gore and Median use, Wide Width, Low Maintenance

~~Concrete shall meet the~~ **Type L:** Non-Gating device, Test Level 3, High Speed, for Shoulder, Gore and Median use, Narrow Width, Low Maintenance

Type M: Non-Gating device, Test Level 3, High Speed, for Shoulder, Gore and Median use, Narrow Width, Regular Maintenance

Furnish concrete meeting the manufacturer's requirements~~ of the manufacturer~~, or if the manufacturer makes no recommendations, furnish concrete ~~shall met~~meeting the requirements of Section 00440. ~~Reinforcement shall conform to~~Furnish reinforcement meeting the requirements of Section 00530.

~~All~~Furnish all hardware, epoxy resin, and miscellaneous items ~~shall be~~ according to the manufacturer's recommendations.

Construction

00830.40 General - Construct and surface finish concrete according to Section 00440.

Prepare surfaces, mix, and place epoxy grout for epoxy grout pad construction according to the manufacturer's recommendations.

Assemble and install impact attenuator systems according to the manufacturer's recommendations and shop drawings.

Install fixed object markers on the head of the impact attenuator.

Measurement

00830.80 Measurement - The quantities of impact attenuators will be measured on the unit basis, by actual count at each location a system is installed.

Payment

00830.90 Payment - The accepted quantities of impact attenuators will be paid for at the Contract unit price, per each, for the item "Impact Attenuator, Type _____ ".

The type of impact attenuator will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for transitions, concrete bases, and object markers.

Section 00840 - Delineators and Milepost Marker Posts

Description

00840.00 Scope - This work consists of furnishing and installing delineators and milepost marker posts at locations shown or established.

Materials

00840.10 Materials - Furnish materials meeting the following requirements:

Barrier Markers ..... From QPL
Delineator Reflective Sheeting (Type III and Type IV)..... From QPL
Flexible Delineators..... From QPL

00840.11 Galvanized ~~Support~~**Milepost Marker Posts**..... ~~From QPL~~
~~Reflective Sheeting for Delineators ..... From QPL~~

~~**00840.11 Target Members:**~~ - Furnish milepost marker posts meeting the following requirements:

(a) General - ~~The target members shall be of aluminum alloy conforming to the~~ Fabricate milepost marker posts from steel sections meeting either of the following requirements ~~of ASTM B 209, "3xxx" or "5xxx" series with "Hxx" approximately half-hard temper, suitable for enameling by continuous roller or~~ :

Metal Properties

Grade	Minimum Yield Strength, ksi	Minimum Ultimate Strength, ksi
Hot-rolled carbon steel - min. carbon content 0.32%	40	70
Hot-rolled rail steel *	50	80

* As defined in U.S. Department of Commerce Commercial Standard 1CS 150-48, rail steel products shall be rolled from standard tee-section steel rails. No other ~~acceptable method. The aluminum sheet from which targets are fabricated shall have a~~ materials, such as those known by the terms "rerolled", "rail steel equivalent", and "rail steel quality", shall be substituted.

Fabricate milepost marker posts using channel sections of the nominal ~~thickness of 0.050 inch~~dimensions as shown, subject to ~~standard~~the manufacturer's tolerances~~. Provide well finished targets, free of burrs, irregularities and turned edges. When resting on a~~ in dimensions, and a tolerance in weight of 3.5 percent in any one shipment and 5 percent under for any one post, and a tolerance in length of 1 inch under and 2 inches over. Ensure the milepost marker posts are straight and free of sharp corners and rough or burred edges or surfaces.

(b) Multiple Punching - Milepost marker posts with holes in addition to those called for on the plans will be acceptable provided that the critical net width of the section measured on the frontal plane ~~surface,~~projection of the ~~targets shall~~post is not ~~show warp, twist or variation from the surface in excess of 1/4 inch~~less than 2 1/2 inches.

~~**(b) Surface Preparation and Enameling** - Clean and prepare each surface of each target member for enameling according to one of the following procedures:~~

~~**(1) Cleaning** - Type A Solvent Cleaning or Type B, Method 1 Alkaline Cleaner Chemical Treatment, ASTM D 1730, with water rinsing. During rinsing, as evidence of proper cleaning, the cleaned surface shall retain a continuous film of water.~~

~~**(2) Chemical Treating** - Type B, or Methods 5, 6, or 7 chemical conversion coating, or Method 8 Acid-Bound Resinous Treatment, ASTM D 1730.~~

~~**(3) Anodic Treating** - Type C, Method 1 Sulfuric Acid Anodic or Method 2 Chromium Trioxide Anodic, ASTM D 1730.~~

~~**(4) Enameling** - Give each surface of each target member that has been cleaned and treated as specified above, and is ready for enameling either:~~

- ~~Two coats of enamel of the kind given in (c) below, each coat being properly baked and with the final coat baked to hard finish, or~~
- ~~A first coat of an inhibitive and compatible primer having a dry film thickness of about 0.3 mil, followed with one heavy coat of specified enamel baked to a hard finish. The baked enamel shall be uniform in color, commercially smooth and free from flow lines, streaks, blisters or other surface imperfections.~~

~~**(c) Enamel** - Enamel for the surface finish of the prepared aluminum target members shall be Class B baking enamel conforming to the requirements of Federal Specification TT-E-489, or equivalent.~~

~~The baked enamel finish is to be white or standard interstate yellow as applicable. The 3 1/2 inch x 13 3/4 inch target member may be furnished with a white finish on one side and a yellow finish on the other side, if the Contractor so elects.~~

(c) Galvanizing - Galvanize milepost marker posts after fabrication according to AASHTO M 111 (ASTM A 123).

(d) ~~**Testing Baked Enamel:**~~

~~**(1) Adhesion Test** - The adhesion test shall conform to ASTM D 3359, Method B. The enamel shall meet or exceed "4B" adhesion rating. One test is to be made on each face of each test specimen.~~

~~**(2) Pencil Hardness Test** - The pencil hardness test shall conform to ASTM D 3363. The enamel shall have a gouge hardness rating of not less than "H". One test is to be made on each face of each test specimen.~~

~~**(e)** **Acceptance** - Acceptance of target members~~milepost marker posts will be according to 00165.35~~, 02850.20 and the following:~~

~~**(1) Pretested Stock** - A supplier may qualify an identified lot of target members for use by the Agency by complying with the requirements of 00840.11(a) through 00840.11(d). This lot may then be subdivided for shipment to several projects. The sublots may be accepted on the basis of certification by the supplier that the identified lot of target members had been qualified by the Agency's Materials Laboratory.~~

~~**(2) Target Members** - If target members are not from a qualified lot, furnish target members for testing as follows:~~

- ~~For acceptance testing, a lot shall consist of target members of the same color from a single production run.~~
- ~~Test specimens will be sampled at random by the Engineer as follows:~~

~~Lot Size~~	~~Number of Target Test Specimens~~
~~Up to 1,000~~	~~1 per 100 or fraction of 100~~
~~1,000 to 10,000~~	~~10 plus 1 per 500 or fraction of 500~~
~~More than 10,000~~	~~30 plus 1 per 1,000 or fraction of 1,000~~

- ~~Allow the Engineer to sample the target members for test specimens, at no additional cost to the Agency for the specimens.~~
- ~~If a test specimen fails any test, the lot will be resampled for the same number of test specimens and retested. If a specimen of the second sample fails any test, the lot will be rejected.~~

. Accompany each shipment of ~~target members~~support posts with a quality compliance certificate~~, as described in 00165.35, verifying that the materials furnished are represented by a lot that has been sampled and tested by ODOT and met the Contract requirements. The certification shall include the ODOT inspection report number~~.

Construction

00840.40 Lines, Grades, and Preparation Work:

(a) Delineator Posts - Install delineator posts to the lines, grades and spacings shown and as established. To avoid difficult installation at any individual post site, the spacing may be varied 5~~%~~ percent in either direction and may deviate from line by 6 inches in either direction. Remove vegetative growth, litter and debris from the post sites.

(b) Milepost Marker Posts - Locate and install milepost marker posts as shown.

00840.41 Installation of Posts - Set posts firmly into the ground and vertical. Remove and discard posts that become split, cracked, twisted, or bent, or whose tops become badly misshapen during installation.

(a) Embedment Depth - Field verify post length. Posts set in sandy, gravelly or other unconsolidated material may require an anchor system or need to be longer to provide adequate anchorage. Posts may be shortened to avoid unnecessary penetration in solid rock or in large rock fragments. If set in rock, drill a 9 inch deep hole, 1 inch greater in diameter than the large dimension of the post, and grout in place with a fine mortar grout.

(b) Guardrail Locations - At wood guardrail post installations, attach Type 4 delineators (alternate 1, plastic or alternate 2, steel) to the wood guardrail posts as shown on the standard drawings . At metal guardrail post installations, Install full length Type 1, 1U, or 2 ground mounted delineators behind the rail, adjacent to metal guardrail posts.

(c) Concrete Barrier Locations - At concrete barrier installations, attach Type 5 delineators to the concrete barrier according to the manufacturer's recommendations and as shown on the standard drawings.

00840.42 Target Members for Delineator Posts - Assemble, fasten, set and align target members and reflective material appropriate to the type and color of delineators as shown. Attach reflective sheeting to the targets as recommended by the manufacturer.

00840.43 Signs For Milepost Marker Posts - Assemble, fasten, set, and align ~~signs~~ milepost marker signs and object marker signs according to Section 00940 and as shown.

Finishing and ~~Clean~~Cleaning Up

00840.70 General - Remove and dispose of excess excavated materials, litter, and debris resulting from the operations according to 00290.20. Finish the surface around the support to match the surrounding surface or as shown.

Measurement

00840.80 Measurement - The quantities of delineators and milepost marker posts will be measured on the unit basis.

Payment

00840.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Delineators, Type ___	Each
(b) Milepost Marker Posts	Each

In item (a) the type of delineator will be inserted in the blank regardless of the color or number of reflectors and targets.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for preparation work, earthwork, grouting, backfilling, and cleaning up.

~~Milepost~~Signs mounted on milepost marker ~~signs~~posts will be paid for according to 00940.90.

Section 00842 - Facility Identification Markers

Description

00842.00 Scope - This work consists of furnishing and installing facility identification markers as shown.

Materials

00842.10 Materials:

(a) Stormwater Control Field Facility Markers:

(1) Type S1 Markers - Furnish green and red Type 2 flexible delineator meeting the requirements of 00840.10 except do not include the reflective sheeting. Provide green #24190 and red #11350 meeting Federal Standard 595C.

(2) Type S2 Markers - Furnish white markers made of aluminum alloy meeting the requirements of ASTM B 209 approximately half-hard temper, suitable for enameling by continuous roller or other acceptable method. Fabricate the aluminum sheet having a nominal thickness of 0.050 inch, subject to standard manufacturer's tolerances and free of burrs, irregularities, and turned edges. When resting on a plane surface, the markers shall not show warp, twist, or variation from the surface in excess of 1/4 inch. Finish the markers as follows:

- Top band of non-reflective blue tape.
- Bottom band of non-reflective black tape.
- Non-reflective black type "C" font text and numbers.

Furnish galvanized Type IU support posts meeting the requirements of 00840.11.

(3) Type S3 Markers - Furnish manhole covers meeting the requirements of 2450.30 and permanently stamped with Type S3 markers as shown.

(b) Culvert Drainage Facility Markers:

(1) Type 1 Drainage Markers - Furnish 6 to 12 inch long by 4 inch wide green color Type B preformed fused thermoplastic film meeting the requirements of 00850.10.

(2) Type 2 Drainage Markers - Furnish white markers made of aluminum alloy meeting the requirements of ASTM B 209 approximately half-hard temper, suitable for enameling by continuous roller or other acceptable method. Fabricate the aluminum sheet having a nominal thickness of 0.050 inch, subject to standard manufacturer's tolerances and free of burrs, irregularities, and turned edges. When resting on a plane surface, the markers shall not show warp, twist, or variation from the surface in excess of 1/4 inch. Finish the markers as follows:

- Top band of non-reflective green tape.
- Non-reflective black type "C" font text and numbers.

Furnish galvanized Type 1U support posts meeting the requirements of 00840.11.

(c) Bridge Facility Markers - Furnish markers meeting the requirements of Section 02910. Furnish galvanized Type 1 support posts meeting the requirements of 00840.11. Furnish 1/4 inch x 1 3/4 inch stainless steel mechanical anchors for concrete surfaces from the QPL.

Construction

00842.40 General:

(a) Stormwater Control Field Facility Markers - Install field markers for each facility according to the following:

- **Posts** - Locate and install the Type S1 and S2 marker posts as shown and according to 00840.40 and 00840.41.

- **Markers** - Attach the Type S2 markers to the Type 1U posts as shown. Install the Type S3 markers as shown.

(b) Culvert Drainage Facility Markers:

(1) Type 1 Drainage Markers - Install the Type B preformed fused thermoplastic film to clean dry pavement surfaces and as shown.

(2) Type 2 Drainage Markers - Install Type 1U posts as shown. Twisted, bent, or damaged posts will not be accepted. If posts are set in rock or large rock fragments, shorten posts, drill 9 inch deep holes 1 inch greater in diameter than the large dimension of the post then grout the post in place with fine mortar grout.

Attach the markers to the Type 1U posts, wood guardrail posts, concrete barrier, and culvert headwalls as shown.

(c) Bridge Facility Markers - At bridge rail transition areas where wood guardrail posts are installed, install the bridge identification marker on a Type 1 post and attach it to a wood guardrail post according to the "Type 4, Alternate 2" detail shown on the standard drawings. At bridge rail transition areas where metal guardrail posts are installed, install the bridge identification marker on a Type 1 post behind and adjacent to the metal guardrail post as shown and according to 00840.41. Install bridge identification markers on vertical or near vertical structure surfaces as shown.

Measurement

00842.80 Measurement - The quantities of work performed under this Section will be measured on the unit basis.

Payment

00842.90 Payment - The accepted quantities for work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Field Facility Markers, Type ____	Each
(b) Culvert Drainage Markers, Type ____	Each
(c) Bridge Identification Markers	Each

In item (a), the type of field facility marker will be inserted in the blank.

In item (b), the type of culvert drainage marker will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00850 - Common Provisions for Pavement Markings

Description

00850.00 Scope - This work consists of furnishing, preparing, and installing all forms of pavement markings.

Materials

00850.10 Materials - Furnish the following materials from the QPL:

- Adhesive for Pavement Markers
- High Performance Pavement Markings
- Methyl Methacrylate
- Pavement Markers
- Reflective Elements*
- Marking Paint
- Marking Tape
- Thermoplastic

* Reflective elements used with materials other than marking paint are not required to be from the QPL. Use reflective elements according to the manufacturer's recommendations.

00850.11 Flexible Bituminous Adhesive - At least 2 weeks before using, submit for Agency testing and approval a 15 pound brick sample of flexible bituminous adhesive for each manufacturer lot number, including previously tested and approved lot numbers that are over 1 year old, that will be used on the Project. All previously rejected lot number samples will not be retested. Agency testing and approval is only for acceptance of use of the adhesive.

Equipment

00850.20 Equipment - Use equipment acceptable by the marking material manufacturer for the method specified and the following:

(a) Equipment for Pavement Legends and Bars - Use manual or automatic application equipment.

(b) Equipment for Longitudinal Lines - Use applicators, sprayers or extruders made specifically for applying the specified pavement marking material at a uniform width and thickness on the roadway surface.

Except for tape applications, use automatic bead applicators that place a uniform layer of beads on the line.

~~Use~~ Provide equipment ~~capable of placing~~that can:

- Place two parallel lines simultaneously with ~~variable spacing~~4 inch minimum to 12 inch maximum spacings between the two lines ~~and capable of placing~~.
- Place the entire width of a line in one pass.

Use a three-gun system for applying sprayed markings.

Hand units are allowed for tape applications only.

(c) Equipment for Inlaid/Grooved Markings - ~~Use grinding equipment~~ For thermoplastic and methyl methacrylate inlaid markings on dense graded asphalt concrete pavement, provide grinders with either diamond ~~grinding~~cutting heads ~~and shot-blasting equipment to~~that create ~~a~~ smooth, flat~~-~~-bottomed ~~cut~~cuts of uniform depth or carbide cutting heads that create smooth uniform depths and uniform patterned striations as the Contractor elects.

For all other operations, provide grinders with diamond cutting heads that create smooth, flat-bottomed cuts of uniform depth or sloped cuts as shown.

Labor

00850.30 Manufacture's Representative - For Sections referencing 00850.30, provide the services of a manufacturer's representative on-site during the installation, authorized to sign a warranty on behalf of the manufacturer.

00850.31 Manufacturer-Certified Installers - For Sections referencing 00850.31, provide installers certified by the marking materials manufacturer for the specified marking material and method. Do not begin installation ~~prior to~~before receiving the Engineer's approval.

Construction

~~**00850.40 Projects Without Striping Plans** - For projects without striping Supplemental Drawings, replace striping to match existing pavement markings in-kind. Document existing striping by survey according to Special Provision 00305. Submit survey documentation to the Engineer seven calendar days prior to loss of existing pavement markings.~~

~~**00850.41**~~**00850.40 Plans:**

(a) Projects With Complete Striping Plans~~ - For projects with~~ - When striping Supplemental Drawings are included in the Project, install striping as shown.

(b) Projects With Partial Striping Plans - When partial Supplemental Drawings are included in a Project, install striping according to the following:

- In areas where striping details are shown on the Supplemental Drawings, install striping as shown.
- In areas where striping details are not shown on the Supplemental Drawings, install striping to match the original striping configuration with the appropriate striping items listed in the Contract Schedule of Items.

(c) Projects Without Striping Plans - When striping Supplemental Drawings are not included in the Project, install striping to match the original striping configuration with the appropriate striping items listed in the Contract Schedule of Items.

For Projects with partial striping plans or Projects without striping plans, document all existing striping that is not shown in the Supplemental Drawings. Submit documentation to the Engineer 7 calendar days before the loss of existing pavement markings.

00850.42 Pre-Striping Conference - Meet with the Engineer and striping subcontractor, if striping is done by a subcontractor, ~~two~~ 2 weeks prior to beginning striping work to discuss methods and practices of accomplishing all required striping work. Submit the following in writing ~~five~~ 5 calendar days before the pre-striping conference for approval:

- A striping schedule showing areas and timing of work, and placing of material.

- A list of materials proposed for use and the application method.
- A copy of the manufacturer's installation instructions and Material Safety Data Sheets (MSDS).
- Proof of installer's certification for those Sections referencing 00850.31.
- Equipment specifications.
- A spill recovery plan including:
  - Name, address, and phone number of the Contractor's contact with the DEQ.
  - Name, address, and phone number of the persons certified and on-call to do clean-up.

00850.43 Prepare and Prime Pavement - Prepare pavement surfaces according to the following:

- **Existing Pavement Surfaces** - When required by the pavement marking manufacturer, remove pavement markings from existing pavement surfaces that will adversely affect the bond of new pavement marking material to the roadway surface according to Section 00851.

  Remove all other contaminants from existing pavement surfaces that may adversely affect the installation of new pavement markings by sandblasting, shot-blasting, or sweeping. Air blast the pavement with a high-pressure system to remove extraneous or loose material.

- **New Asphalt Concrete Surfaces** - Remove contaminants from new AC surfaces that may adversely affect the installation of the pavement markings by sandblasting, shot-blasting, or sweeping. Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply materials to new asphalt concrete that is sufficiently cured according to the manufacturer's recommendations.

- **New Portland Cement Concrete Surfaces** - Remove curing compounds and laitance by an approved mechanical means. Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply materials to concrete that has reached a minimum compressive strength of 3,000 psi and that is sufficiently cured according to the manufacturer's recommendations.

After the pavement surface is clean and dry, apply primer as recommended by the manufacturer to the area receiving the pavement markings. Apply the primer in a continuous, solid film according to the recommendations of the primer manufacturer and the pavement markings manufacturer.

00850.44 Alignment Layout - Place control points for lines every 50 feet on tangent and every 25 feet on a curve. Using these control points, layout a continuous narrow guideline for each line, along one edge of, or uniformly offset from the intended permanent line location. Do not proceed with installation until the guidelines are approved by the Engineer.

For inlaid/grooved markings, indicate the exact grind-out location with a 4 inch wide line as the guideline. For broken lines, lane drop lines, and dotted lines, use 10 feet, 3 feet, and 2 feet long sections respectively, at the cycle length shown. For solid lines, use a continuous line. Use marking paint from the QPL applied at a thickness of 6 mils. Reflective elements are not required.

00850.45 Installation - Apply pavement marking materials to clean dry pavement surfaces and according the following:

- Place material according to the manufacture's recommendations.
- Place parallel double lines in one pass.
- Place the specified width of lines in one pass.
- The pavement surface shall not be visible in the striped areas.
- The top of pavement marking shall be smooth and uniform.
- Skip line ends shall be square and clean.

- Place pavement marking lines parallel and true to line.
- Place skip lines so that they are in cycle with at least one end of any adjacent project.
- Place markings in proper alignment with existing markings.
- Immediately clean up marking material dribbled beyond the cutoff.

For inlaid/grooved markings, grind the slot as shown. For each grinder operator and piece of equipment, obtain the Engineer's and manufacturer representative's approval of the slot within the first 150 feet for solid lines and within the first 300 feet for skip lines. Do not proceed with grinding until the slot is approved. Repeat this process for each new grinder operator or new piece of equipment used.

After grinding, obtain the Engineer's and manufacturer representative's approval before placing marking material. ~~Clean the slot by shot blasting. Remove metal shot-blasting residue by magnetic sweeping, and clean~~Clean the area with high pressure air immediately before placing the marking material.

00850.46 Placement Tolerance - Allowable tolerances for installation are:

- **Lateral location on roadway:** 1/2 inch on tangents; 1 inch on curves
- **40 foot skip cycle length:** ± 2 inches for skip length, ± 2 inches for gap length
- **12 foot skip cycle length:** ± 3/4 inch for skip length, ± 1 inches for gap length
- **8 foot skip cycle length:** ± 1/2 inch for skip length, ± 3/4 inches for gap length
- **Skip Cycle:** A tolerance of 1/10 of the skip line length on the first skip line of a run, but it shall be on cycle within one skip
- **Double lines:** Parallel, with a gap tolerance of ± 1/2 inch
- **Width of lines:** + 3/8 inch, - 1/16 inch
- **Thickness of flat, surface applied lines:** +~~ 5 mils, –~~ 1/3 ~~mils~~of the specified thickness, – 1/10 of the specified thickness
- **Divergence of parallel double lines:** ± 3/8 inch

00850.47 Quality Control - Record the following readings for each type and color of marking material and the locations where they were taken. Submit the results to the Agency within ~~one~~ 1 day of taking the readings.

(a) Placement Tolerances - Measure the following at the time of installation or application:

- For inlaid/grooved markings, measure the depth of the slot every 300 feet.
- For surface applied markings, except paint and tape applications, measure the thickness of the lines, at 300 foot intervals. Thickness is measured from the top of the pavement marking to the top of the wearing surface. Marking material placed in a depression left by pavement line removal will not be included in measuring the thickness of the line.

(b) Curing of Material - ~~Rate the line, markings, and pavement marker adhesive at~~ At the time of installation, note and ~~14 calendar days after placement~~report to ~~determine if~~ the ~~material has properly cured. Note any~~Engineer all soft spots~~, abnormally~~ and darkened areas~~, or other indications~~ that ~~the line has not properly cured~~may result in poor bonding and durability of the pavement markings.

(c) Retroreflectivity - ~~Use a retroreflectometer to measure the retroreflectivity within 48 hours of curing and 14 calendar days after placement, except~~Except for paint applications~~:~~

- ~~At 300 foot intervals for~~, evaluate longitudinal ~~lines.~~

~~At each pavement legend/bar. Take ten individual readings per pavement legend/bar. If the Project has more than ten pavement legend/bars, measure a minimum of ten legends/bars or 10% of the total number of legends/bars, whichever is greater. The legends~~and transverse marking retroreflectivity according to ODOT TM 777. Acceptance will be according to ~~be measured will be selected by the Engineer.~~the following:

~~Estimate the bead embedment depth for~~

- **Longitudinal Markings** - Each longitudinal ~~lines~~marking sublot will be accepted if the average of the measurements and ~~pavement legends/bars~~ at ~~the same location as~~least 90 percent of the individual measurements within the sublot meet or exceed the required minimum initial retroreflectivity ~~reading~~.

  If more than 10 percent but no more than 25 percent of the individual measurements in a sublot fail, take additional measurements within the sublot according to ODOT TM 777, Section 7.2.1 halfway between the measurements taken during initial evaluation. Combine these additional measurements with the initial measurements and re-evaluate the sublot. If the combined sublot measurements do not meet the 90 percent criteria, remove and replace the entire longitudinal marking sublot at no additional cost to the Agency.

  If more than 25 percent of the individual measurements in a sublot fail remove and replace the entire longitudinal marking sublot at no additional cost to the Agency.

- **Transverse Markings** - Each transverse marking sublot will be accepted if the average of the measurements and at least 90 percent of the individual measurements within the sublot meet or exceed the required minimum initial retroreflectivity.

  If more than 10 percent but not more than 25 percent of the individual measurements in a sublot fail, take additional measurements within the sublot according to ODOT TM 777, Section 7.2.2. The Engineer will randomly select an equal number of untested transverse markings to test. Combine these additional measurements with the initial measurements and re-evaluate the sublot. If the combined sublot measurements do not meet the 90 percent criteria, remove and replace the entire transverse marking sublot at no additional cost to the Agency

  If more than 25 percent of the individual measurements in a sublot fail remove and replace the entire transverse marking sublot at no additional cost to the Agency.

Temporary

00850.50 General - Protect all applied markings from traffic until sufficiently cured so as not to be damaged or tracked by traffic movements.

Finishing and ~~Clean-up~~Cleaning Up

00850.70 Disposal of Waste - ~~Waste material becomes the property of the Contractor at the point or origin. This includes all grindings and all removed marking material.~~ Dispose of ~~waste~~all materials according to 00290.20.

00850.71 Removal and Repair of Unacceptable Work - Remove unacceptable materials according to Section 00851. If more than one repair is required in a single 300 foot section, grind and repair the entire 300 foot section.

00850.75 Manufacturer's Warranty - For Sections referencing 00850.75, furnish a ~~Warranty from the manufacture signed by the manufacture's representative~~manufacturer's warranty according to 00170.85(c-1) on Agency supplied warranty forms. The forms are available from the Engineer.

~~The Warranty period will start on the date the Engineer accepts the work and authorizes final payment.~~

~~The Warranty~~The warranty shall recite that the manufacturer will repair or replace, at the discretion of the Engineer and at no additional cost to the Agency, all pavement markings that drop below the minimum required retroreflectivity, show insufficient color stability, or fail to bond, within 6 months of the Agency's request to do so.

Perform ~~Warranty~~warranty repair work when weather permits. At the discretion of the Agency, temporary pavement markings may be required, at the manufacturer's expense, to protect traffic until repairs can be made.

~~When the Agency makes a written request to the manufacturer for repair or replacement, the Warranty period will stop until the required repairs or replacements are made and accepted.~~

Section 00851 - Pavement Marking Removal

Description

00851.00 Scope - This work consists of removing markings from the pavement surface.

Construction

00851.40 General - Remove durable and non-durable pavement markings by hydroblasting, steel shot blasting, or grinding so that the pavement surface is not damaged below a depth or 1/8 inch. Remove durable marking by steel shot blasting or grinding the pavement surface to a depth no greater than 1/8 inch, creating a smooth, flat slot of uniform depth.

Remove pavement markings the same day permanent markings are applied. Use vacuum shrouded equipment or other equally effective containment procedures. Dispose of all waste materials according to 00290.20.

Measurement

00851.80 Measurement - The quantities of pavement line removed will be measured on the length basis~~, to the nearest foot.~~. Pavement line removed will be based on a nominal width of 4 inches. If the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4 inch line on a proportionate area basis. Measurement will be the actual stripe removed. Gaps between broken and dotted stripes will not be measured.

The quantities of pavement bars removed will be measured in the area basis~~, to the nearest square foot~~, for each stop bar and crosswalk bar removed.

The quantities of pavement legends removed will be measured on the unit basis, by actual count. One legend is considered to include all letters, characters, and all markings associated with the particular pavement legend.

Payment

00851.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item		Unit of Measurement
(a)	Pavement Line Removal	Foot
(b)	Pavement Bar Removal	Square Foot
(c)	Pavement Legend Removal	Each

Payment will be payment in full for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for removing existing pavement markings when directed by the pavement marking manufacturer, for the preparation of applying new pavement markings.

Section 00855 - Pavement Markers

Description

00855.00 Scope - In addition to the requirements of Section 00850, install reflective and non-reflective pavement markers according to the following Specifications.

Construction

00855.40 Pavement Markers:

(a) General - Install reflective (Type I) and nonreflective (Type II) markers as shown.

(b) Surface Preparation - Remove contaminants from the wearing course surface which would adversely affect the bond of the adhesive.

Sandblast or steel shot blast the pavement surface to remove all surface contaminants. Use a blast of clean air to remove all loose particles from the surface.

(c) Installation - Apply pavement markers to a clean, dry surface.

Do not install markers spanning a pavement joint or crack. ~~Adjust spacing between the markers to avoid installation of markers across a joint or crack~~To avoid longitudinal cracks and joints, adjust pavement markers up to one half the width of the marker. To avoid transverse cracks and joints, adjust pavement markers ahead or back on line ± 5 inches.

Place the adhesive uniformly on the prepared pavement surface or on the bottom of the marker in a quantity sufficient to result in a complete coverage of the area of contact of the marker with no voids present and a slight excess of material after the marker has been pressed in place.

Place the marker in position and apply pressure until firm contact is made with the pavement. Visually inspect the installation to ensure that a small bead approximately 1/8 inch thick forms around all edges and corners and the marker is fully supported on a pad of adhesive. Immediately remove excessive adhesive on the pavement, and adhesive on the exposed surfaces of the markers.

Completely remove adhesive from the surfaces of pavement markers using an approved adhesive remover.

00855.41 Recessed Pavement Markers:

(a) Surface Preparation - Construct grooves in the pavement to neat lines conforming to width, length and depth shown, and prepare the surface according to 00855.40(b).

(b) Installation - Install the pavement markers in the grove as shown and according to 00855.40(c).

Measurement

00855.80 Measurement - The quantities of pavement markers and recessed pavement markers will be measured on the unit basis, for each type of marker.

Payment

00855.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Mono-Directional White Type I Markers	Each
(b) Mono-Directional White Type IAR Markers	Each
(c) Bi-Directional Yellow Type I Markers	Each
(d) Bi-Directional Yellow Type IAR Markers	Each
(e) White Type II Markers	Each
(f) Yellow Type II Markers	Each
(g) Mono-Directional White Type IAR Markers, Recessed	Each
(h) Bi-Directional Yellow Type IAR Markers, Recessed	Each

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work.

No separate or additional payment will be made for constructing pavement grooves, pavement preparation, adhesive, and clean-up.

Section 00856 - Surface Mounted Tubular Markers

Description

00856.00 Scope - This work consists of furnishing and installing permanent surface mounted tubular markers as shown or directed.

Materials

00856.10 Materials - Furnish surface mounted tubular markers from the QPL.

Construction

00856.40 General - Install surface mounted tubular markers straight and true to line at the spacings shown. In addition to bolting the base of the surface mounted tubular marker to the surface, bond the surface mounted tubular marker to the surface using an adhesive recommended by the manufacturer according to the manufacturer's recommendations.

Measurement

00856.80 Measurement - The quantities of permanent surface mounted tubular markers will be measured on the unit basis.

Payment

00856.90 Payment - The accepted quantities of permanent surface mounted tubular markers will be paid for at the Contract unit price, per each, for the item "Permanent Surface Mounted Tubular Markers".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00857 - Rumble Strips

Description

00857.00 Scope - This work consists of ~~forming~~milling rumble strips by constructing indentations in ~~the pavement surfacing~~ asphalt concrete surfaces as shown or directed.

Equipment

00857.20 Equipment:

(a) ~~Continuous~~Longitudinal Rumble Strips - ~~Form~~ Construct continuous or gap pattern longitudinal shoulder, edge line, and centerline rumble strips as shown using a rotary type cutting head with a maximum outside diameter of 24 inches. Provide a cutting head length that matches the rumble strip width as shown ~~(8 inches and 16 inches as appropriate).~~. Arrange the cutting head cutting tips in a pattern that provides a relatively smooth cut ~~(~~with approximately 1/16 inch between peaks and valleys~~).~~. Attach the cutting heads to the power unit in a manner that allows the tool to self-align with the ~~slope~~slopes of the pavement and shoulder and any irregularities in the pavement and shoulder ~~surface~~surfaces. The cutting equipment shall be capable of cutting rumble strips of the required width in a single pass while moving in the same direction as the flow of traffic.

(b) Transverse Rumble Strips - Form transverse rumble strips using a rotary type cutting head 5 1/2 inches long. Arrange the cutting head cutting tips in a pattern that provides a relatively smooth cut (approximately 1/16 inch between peaks and valleys). Attach the cutting heads to the power unit in a manner that allows the tool to self-align with the slope of the travel lane and any irregularities in the travel lane surface. The cutting equipment shall be capable of cutting rumble strips perpendicular to the travel lane.

Construction

00857.40 Construction - ~~All cuttings and other debris resulting from the rumble strip operation becomes the property of the Contractor. Dispose of cutting debris according to 00330.41(a-5). After removal of the debris, thoroughly clean the pavement by sweeping to remove dust and other foreign matter~~Where rumble strips will be constructed at the same locations where permanent pavement markings will be installed, construct rumble strips within 3 weeks after temporary pavement markings have been placed for the final roadway configuration, but before installing permanent pavement markings.

After constructing the rumble strips, clean the pavement by sweeping to remove dust and other foreign matter. Dispose of all materials according to 00290.20.

Measurement

00857.80 Measurement - The quantities of ~~continuous~~longitudinal rumble strips will be measured on the length basis, at least to the nearest 0.01 mile. Measurement will be made along each ~~shoulder on which the~~rumble strip run, regardless of location or width of strip with no deductions made for gaps in gap pattern rumble strips ~~are constructed.~~ . Breaks in the rumble strips at intersections, interchange ramps, or other locations shown will not be measured for payment.

The quantities of transverse rumble strips will be measured on the unit basis, by actual count of rumble strip clusters.

Payment

00857.90 Payment - The accepted quantities of rumble strips will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Continuous Rumble Strips	Mile
(b) Gap Pattern Rumble Strips	Mile
(c) Transverse Rumble Strips	Each

Payment will be payment in full for furnishing all materials, equipment, labor, and incidentals necessary to complete the work as specified.

Section 00860 - Longitudinal Pavement Markings - Paint

Description

00860.00 Scope - In addition to the requirements of Section 00850, install painted longitudinal pavement markings according the following Specifications.

Construction

00860.45 Installation - Apply painted longitudinal pavement markings as follows:

- Apply two separate applications of painted longitudinal pavement markings. Retrace the second application directly over the first application, within 1/16 inch as follows:
  - Apply the second application after 2 hours but within 48 hours of the first application.
  - For yellow colored markings that delineate two-way traffic, apply the second application in the opposite direction of the first application. For yellow colored markings on one-way roadways, apply the second application in the same direction of the first application. For white colored markings, apply the second application in the same direction of the first application.
- Apply each painted marking application at a thickness of 15 mils wet, equivalent to 17 gallons per mile for a 4 inch wide solid stripe.
- Apply reflective elements for each application at a minimum rate of 5 pounds per gallon of paint. Embed, by means of paint wicking, a minimum of 80~~%~~ percent of the reflective elements in the paint to a minimum depth of 50~~%~~ percent of their diameter.

Minimum initial retroreflectivity shall be the following:

- White - 250 mcd/m^2/lx
- Yellow - 200 mcd/m^2/lx

Measurement

00860.80 Measurement - The quantities of painted longitudinal pavement markings will be measured on the length basis~~, to the nearest foot.~~. Painted longitudinal pavement markings will be based on a nominal line width of 4 inches. If the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4 inch line on a proportionate area basis. Measurement will be the actual stripe. Gaps between skip stripes will not be measured.

Payment

00860.90 Payment - The accepted quantities of painted longitudinal pavement markings will be paid for at the Contract unit price, per foot, for the item "Longitudinal Pavement Markings - Paint".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00865 - Longitudinal Pavement Markings - Durable

Description

00865.00 Scope - In addition to the requirements of Section 00850, install durable longitudinal pavement markings according to the following Specifications.

Labor

00865.30 Manufacture's Representative - Provide a manufacturer's representative according to 00850.30.

00865.31 Manufacturer-Certified Installers - Provide certified installer's according to 00850.31.

Construction

00865.40 General - Before installing, and in the presence if the Engineer, conduct a performance test by applying a 150 foot test section on roofing felt. Do not place permanent material without the Engineer's approval of the performance test. Additional performance tests may be required. Conduct performance tests at no additional cost to the Agency.

00865.45 Installation - Place ~~permanent~~durable markings only when the ~~manufacture's~~manufacturer's representative determines that the pavement is ready for the pavement marking material.

Apply reflective elements at a rate to obtain the following minimum initial ~~reflectivity~~retroreflectivity readings:

- White - 250 mcd/m^2/lx
- Yellow - 200 mcd/m^2/lx

Apply marking materials by one or more of the following methods:

- **Method A:** ~~**Profiled Markings** - Place~~ **Extruded Markings** - Apply markings with an extrusion or ribbon type process and according to the following:
  - For grooved markings, grind the slot depth as shown. Apply the specified marking material into the slot so the slot is filled from edge to edge as shown. The top of the marking shall be flat or slightly convex.
  - For profiled markings, place lines and bumps straight and square.
- **Method** ~~**B: Non-Profiled Markings** - Apply with extrusion process. Sprayers, or ribbon type applications will not be allowed.~~
- ~~**Method C: Protected Inlaid Markings** - Place the specified marking material so the slot is filled from edge to edge, with the thickness of the marking material as specified. Make the marking flat or slightly convex on top.~~
- ~~**Method D: Profile Wet Weather Markings** - Place lines and bumps straight and square.~~
- ~~**Method E: Non-Profile Wet Weather Markings** - Install non-profile wet weather markings as shown.~~

- ~~Method F~~ B: **Spray Markings** - Apply two separate applications of spray markings with each application being one half the total specified thickness ~~per application.~~. Retrace the second application directly over the first application within 1/16 ~~inch~~ inch. For white colored markings, apply the second application in the same direction of the first application. For yellow colored markings that delineate two-way traffic, apply the second application in the opposite direction of the first application. For yellow colored markings on one-way roadways, apply the second application in the same direction of the first application.

- **Method ~~G~~ C: Pavement Marking Tape** - ~~Apply~~ Do not place tape continuously on longitudinal pavement joints. Apply pavement marking tape as follows:

  - ~~Hot-Laid~~Rolled-In **Installation** - Apply the tape to the fresh asphalt concrete surface prior to the final rolling of the mat. Roll the tape into the fresh surface during the finishing ~~rolling~~ of the mat.

  - **Grooved Installation** - Grind slot depth to ~~110~~ 130 to 150 mils ~~to 125 mills~~ with a smooth, uniform, and flat bottom. Apply tape into slot.

  ~~Do not place tape continuously on longitudinal pavement joints.~~

- **Method AB: Non-Profiled Extruded or Sprayed Markings** - Install Method A surface, non-profiled markings or Method B markings.

00865.75 Manufacturer's Warranty - Furnish a ~~Warranty~~warranty according to 00850.75 and the following:

- **Warranty Period** - The ~~Warranty~~warranty period shall be ~~three~~ 3 years for surface mounted thermoplastic, and ~~four~~ 4 years all other methods and materials in this Section.

- **Retroreflectivity** - Markings shall maintain a minimum retroreflectivity of 150 mcd/m^2/lx for white and 125 mcd/m^2/lx for yellow.

- **Color Stability** - Use Federal Color Chart PR-1 to determine color stability. Yellow markings shall meet 33538 Federal yellow. White markings shall have a minimum daylight reflectance of 84.

- **Adhesion** - A cumulative 5~~%~~ percent or greater loss of line due to non-adhesion on any 300 foot segment of marking will constitute failure of the material in that segment.

Measurement

00865.80 Measurement - The quantity of durable longitudinal pavement markings will be measured on the length basis~~, to the nearest foot.~~. Durable longitudinal pavement markings will be based on a nominal line width of 4 inches. If the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4 inch line on a proportionate area basis. Measurement will be the actual stripe. Gaps between skip stripes will not be measured.

Payment

00865.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item **Unit of Measurement**

Method A (~~Profile~~Extruded)

(a) Methyl Methacrylate, ~~Profile, 90 mils,~~ Extruded, _____, _____ ..... Foot
(b) ~~Methyl Methacrylate, Profile, 120 mils, Extruded ..... Foot~~
~~(c)~~ Thermoplastic, ~~Profile, 90 mils,~~ Extruded, _____, _____ ..... Foot
~~(d) Thermoplastic, Profile, 120 mils, Extruded ..... Foot~~

Method B (~~Non-Profile)~~

~~(e) Methyl Methacrylate, Non-Profile, 90 mils, Extruded ..... Foot~~
~~(f) Methyl Methacrylate, Non-Profile, 120 mils, Extruded ..... Foot~~
~~(g) Thermoplastic, Non-Profile, 90 mils, Extruded ..... Foot~~
~~(h) Thermoplastic, Non-Profile, 120 mils, Extruded ..... Foot.....~~

~~**Method C (Inlaid)**~~

~~(i) Methyl Methacrylate, Protected Inlaid, Extruded ..... Foot~~
~~(j) Thermoplastic, Protected Inlaid, Extruded ..... Foot~~
~~(k) Methyl Methacrylate, Protected Inlaid, Wet Weather Pattern, Extruded Foot~~
~~(l) Thermoplastic, Protected Inlaid, Wet Weather Pattern, Extruded ..... Foot~~

~~**Method D (Profile Wet Weather)**~~

~~(m) Thermoplastic, Wet Weather Pattern w/ Bumps, Extruded ..... Foot~~
~~(n) Methyl Methacrylate, Wet Weather Pattern w/ Bumps, Extruded..... Foot~~

~~**Method E (Non-Profile Wet Weather)**~~

~~(o) Thermoplastic, Wet Weather Pattern, Extruded ..... Foot~~
~~(p) Methyl Methacrylate, Wet Weather Pattern, Extruded ..... Foot~~

~~**Method F (Spray)**~~

~~(q) Methyl Methacrylate, Non-Profile, 90 mils,~~ **Sprayed**~~Foot~~**)**
~~(r~~
(c) Methyl Methacrylate, ~~Non-Profile, 120 mils,~~ Sprayed, Surface, Non-Profiled Foot
(~~s~~d) Thermoplastic, ~~Non-Profile, 90 mils,~~ Sprayed, Surface, Non-Profiled... Foot
~~(t) Thermoplastic, Non-Profile, 120 mils, Sprayed ..... Foot~~

Method ~~G~~C (Pavement Marking Tape)

(~~u~~e) Pavement Marking Tape, ~~Hot-Laid~~ _____ ..... Foot
(~~v~~f) Pavement Marking Tape, Wet Weather ~~Pattern, Hot-Laid,~~ _____ ..... Foot
~~(w) Pavement Marking Tape, Grooved ..... Foot~~
~~(x) Pavement Marking Tape, Wet Weather Pattern, Grooved ..... Foot~~
~~(y) Pavement Marking Tape, Pattern, Hot-Laid ..... Foot~~
~~(z) Pavement Marking Tape, Pattern, Grooved ..... Foot~~

Method AB (Non-Profiled Extruded or Sprayed)

(g) Methyl Methacrylate, Extruded or Sprayed, Surface, Non-Profiled ..... Foot
(h) Thermoplastic, Extruded or Sprayed, Surface, Non-Profiled..... Foot

In items (a) and (b), the word "Surface" or "Grooved" will be inserted in the first blank and the word "Profiled" or "Non-Profiled" will be inserted in the second blank.

In items (e) and (f), the word "Rolled-In" or "Grooved" will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for work done under this Section will be limited to 75% percent of the amount due until the Agency has received the signed warranty.

Section 00866 - Longitudinal Pavement Markings - High Performance

Description

00866.00 Scope - In addition to the requirements of Section 00850, install high performance longitudinal pavement markings according to the following Specifications.

Labor

00866.30 Manufacturer's Representative - Provide a manufacturer's representative according to 00850.30.

00866.31 Manufacturer-Certified Installers - Provide certified installer's according to 00850.31.

Construction

00866.40 General - Before installing, and in the presence ~~if~~of the Engineer, conduct a performance test by applying a 150 foot test section on roofing felt. Do not place permanent material without the Engineer's approval of the performance test. Additional performance tests may be required. Conduct performance tests at no additional cost to the Agency.

00866.45 Installation - Place markings only when the ~~manufacture's~~manufacturer's representative determines that the pavement is ready for the pavement marking material.

Do not place the pavement markings on longitudinal pavement joints.

Apply reflective elements at a rate to obtain the following minimum initial reflectivity readings:

- White - 250 mcd/m^2/lx
- Yellow - 200 mcd/m^2/lx

Apply marking material by one or more of the following methods:

- **Method 1: Spray Markings** - If more than one application is required to obtain the thickness specified, place additional applications directly over previous applications, within 1/16 inch.

- **Method 2: Protected Inlaid Markings** - Grind the slot to the correct depth, and in proper alignment. Place the specified marking material such that the slot is filled from edge-to-edge with the thickness of the marking material as specified. Make the marking flat or slightly convex on top.

00866.75 Manufacturer's Warranty - Furnish a ~~Warranty~~warranty according to 00850.75 and the following:

- **Warranty Period** - The ~~Warranty~~warranty period shall be for ~~one~~ 1 year.

- **Retroreflectivity** - Marking shall maintain a minimum retroreflectivity of 150 mcd/m^2/lx for white and 125 mcd/m^2/lx for yellow.

- **Color Stability** - Use Federal Color Chart PR-1 to determine color stability. Yellow marking shall meet 33538 Federal Yellow. White marking shall have a minimum daylight reflectance of 84.

- **Adhesion** - A cumulative 5~~%~~ percent or greater loss of line due to non-adhesion on any 300 foot segment of marking will constitute failure of the material in that segment.

Measurement

00866.80 Measurement - The quantities of high performance pavement markings will be measured on the length basis~~, to the nearest foot~~. High performance pavement markings will be based on a nominal line width of 4 inches. If the width of the line is other than 4 inches, measurement will be adjusted by converting to an equivalent length of nominal 4 inch line on a proportionate area basis. Measurement will be the actual stripe. Gaps between skip stripes will not be measured.

Payment

00866.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Modified Urethane, 25 mil, Sprayed	Foot
(b) Modified Urethane, Protected Inlaid	Foot
(c) Hi-Build Paint, 25 mil, Sprayed	Foot
(d) Polyurea, 20 mil, Sprayed	Foot

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for work under this Section will be limited to 75~~%~~ percent of the amount due until the Agency has received the signed Warranty.

Section 00867 - Transverse Pavement Markings - Legends and Bars

Description

00867.00 Scope - In addition to the requirements of Section 00850, install pavement markings for legends and bars according to the following Specifications.

Labor

00867.30 Manufacturer's Representative - Provide a manufacturer's representative according to 00850.30.

~~Construction~~

00867.~~40 General~~31 Manufacturer-Certified Installers - ~~Install staggered continental crosswalks and bike lane stencils, as shown, using Type B-HS or Type C-HS marking material only~~Provide certified installer's according to 00850.31.

Construction

00867.45 Installation - Place permanent markings only when the ~~manufacture's~~manufacturer's representative determines that the pavement is ready for the pavement marking material.

Transverse joints will be allowed with no overlap or gap allowed at the joint.

Minimum initial retroreflectivity shall be 250 mcd/m^2/lx.

Apply one or more of the following marking material types:

- **Type A: Liquid, Hot-Laid Thermoplastic Material** - For pavement bars, apply the thermoplastic material to the pavement by a spray or extrusion method, to the full width shown, in a single application. For pavement legends, apply the thermoplastic material to the pavement by a spray method, to the full width shown, in a single application. Pavement markings shall be 90 mils to 120 mils in thickness, exclusive of projecting surface-applied reflective elements, with a continuous and uniform cross sectional configuration, and with the upper surface slightly arched.

  Separately apply reflective elements to the material as it is placed at a sufficient rate to obtain an initial reflectivity reading of 250 mcd/m^2/lx. Locate the dispenser behind the pavement marking extrusion die and uniformly distribute the reflective elements over the entire width of the thermoplastic material

- **Type B: Preformed, Fused Thermoplastic Film** - Install preformed, fused thermoplastic film as shown.

- **Type B-HS: Preformed, Fused Thermoplastic Film High Skid** - Install ~~Type B - HS,~~ preformed, fused thermoplastic film high skid, that has intermixed reflective elements with factory installed crushed glass or aggregate on the surface for all staggered continental crosswalks, bike lane stencils, bike path railroad crossings, and other transverse pavement markings as shown.

- **Type AB**: Install Type A, Type B or Type B-HS as the Contractor elects

- **Type C: Cold-Applied Plastic Film (Tape)** - On asphalt, apply the tape on the fresh asphalt concrete surface prior to final rolling of the mat. Roll the tape into the fresh surface during the

finish rolling of the mat. On concrete, install tape with primer as recommended by the manufacturer.

Apply Type C - HS, cold applied plastic film that has intermixed reflective elements with factory installed crushed glass or aggregate on the surface. On asphalt, apply the tape on the fresh asphalt concrete surface prior to final rolling of the mat. Roll the tape into the fresh surface during the finish rolling of the mat. On concrete, install tape with primer as recommended by the manufacturer.

- **Type D: Methyl Methacrylate** - Apply the methyl methacrylate material to the pavement by a gravity and extrusion method, to the full width shown, in a single application. Pavement markings shall be 90 mils to 120 mils in thickness, exclusive of projecting surface-applied reflective elements, with a continuous and uniform cross-sectional configuration, and with the upper surface slightly arched. Provide intermixed reflective elements.

Separately apply reflective elements to the material as it is placed at a sufficient rate to obtain an initial reflectivity reading of 250 mcd/m^2/lx. Locate the dispenser behind the pavement marking extrusion die and uniformly distribute the reflective elements over the entire width of the methyl methacrylate material.

00867.75 Manufacturer's Warranty - Furnish a warranty according 00850.75 and the following:

- **Warranty Period** - The warranty shall be for 18 months.
- **Retroreflectivity** - Markings shall maintain a retroreflectivity of 100 mcd/m^2/lx.
- **Color Stability** - White markings shall have a minimum daylight reflectance of 84.
- **Adhesion** - 5~~%~~ percent or greater loss of marking due to non-adhesion will constitute failure.

Measurement

00867.80 Measurement - The quantities of pavement legends will be measured on the unit basis, by actual count.

The quantities of pavement bars will be measured on the area basis, ~~to the nearest square foot,~~ for each stop bar and crosswalk bar.

Payment

00867.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Pavement Legend, Type ____ : Arrows	Each
(b)	Pavement Legend, Type ____ : "ONLY"	Each
(c)	Pavement Legend, Type ____ : "SCHOOL"	Each
(d)	Pavement Legend, Type ____ : "SCHOOL~~ CROSSING"~~" Large	Each
(e)	Pavement Legend, Type ____ : "~~SCHOOL XING~~"CROSSING" Large	Each
(f)	Pavement Legend, Type ____ : ~~Railroad Crossing Markings~~"X-ING"	Each
(g)	Pavement Legend, Type ____ : ~~Bicycle Lane Symbols~~"BUS"	Each
(h)	Pavement Legend, Type ____ : ~~Diamonds~~Railroad Crossing	Each
(i)	Pavement Legend, Type ____ : ~~_____~~Railroad Crossing, Narrow	Each
(j)	Pavement Legend, Type ____ : Railroad Crossing, Bike	Each

(k) Pavement Legend, Type ____ : HOV Diamond ..... Each
(l) Pavement Legend, Type ____ : Cattle Guard ..... Each
(m) Pavement Legend, Type ____ : Bicycle Lane Stencil ..... Each
(n) Pavement Legend, Type ____ : Disabled Parking ..... Each
(o) Pavement Legend, Type ____ : On-Street Parking ..... Each
(p) Pavement Legend, Type ____ : Yield Line Triangle ..... Each
(q) Pavement Legend, Type ____ : _____ ..... Each
(r) Pavement Bar, Type ____ ..... Square Foot

In items (a) through (~~j~~r), the type of pavement marking materials will be inserted in the first blank.

In item (~~i~~q), the name of the legend will be inserted in the second blank.

Item (a) includes single or multiple headed arrows as required.

~~Item (f) includes a R x R Symbol and three~~Items (h) and (i) include the R x R symbol, two 24 inch wide white pavement bars ~~as shown~~ placed directly above and directly below the R x R symbol, and one 24 inch wide white stop bar placed prior to the tracks.

Item (j) includes ~~the~~ a R x R Symbol and one 12 inch wide white pavement ~~bars~~bar placed above the R x R symbol.

Item (m) includes the bike lane stencil and arrow.

Item (n) includes the wheelchair stencil only. The 4 inch wide white lines used to mark the disabled parking space and access aisle will be paid for ~~stop bars and~~ according to 00860.90

Item (o) includes the cross style marking or the end marking.

Item (p) includes one 2 by 3 foot triangle used to form the yield line.

Item (r) includes all transverse pavement markings that are defined as a "BAR", including but not limited to, stop bars, crosswalk bars, chevron bars, transverse median bars, and transverse shoulder bars.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for work under this Section will be limited to 75~~%~~ percent of the amount due until the Agency has received the signed warranty.

PART 00900 - PERMANENT TRAFFIC CONTROL AND ILLUMINATION SYSTEMS

Section 00905 - Removal and Reinstallation of Existing Signs

Description

00905.00 Scope - This work consists of one or both of the following:

- Removing existing signs, specific service signs, and tourist-oriented directional signs (TODS) as shown or directed.
- Removing and moving existing signs, specific service signs, and tourist-oriented directional signs (TODS) from their existing locations and reinstalling them at new locations as shown or directed.

Construction

00905.40 General - Do not remove signs from existing supports until new supports are in place, ready to receive the signs. Install the signs on the new supports immediately after removing from existing supports. Provide temporary supports as required. Provide permanent supports according to Sections 00910, 00920, and 00930 as required.

Protect specific service signs (business logos) and TODS from damage, whether the signs are to remain in place or are placed on temporary supports, until reinstalled on permanent supports. Repair or replace damaged signs at no additional cost to the Agency. Liquidated damages will be assessed against the Contractor in the amount of $200 per day for each sign out of service for more than ~~five~~ 5 calendar days.

Install rigid, temporary vertical ties to the back of all extruded aluminum panel signs to prevent buckling of the sign panels and/or their legends during removal, moving and reinstallation of the signs. Repair any damage inflicted to the signs or their legends.

Remove to 1 foot below the ground line those installations with concrete or steel footings set in the ground unless indicated otherwise. Fill the resultant hole and finish the surface to correspond with the surrounding area. Do not remove the existing appurtenances until ordered. Dispose of all existing appurtenances removed and not used in reinstallation, according to 00290.20.

Measurement

00905.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00905.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Remove Existing Signs	Lump Sum
(b) Remove and Reinstall Existing Signs	Lump Sum

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00910 - Wood Sign Posts

Description

00910.00 Scope - This work consists of furnishing and installing preservative treated wood sign posts at the locations shown or as directed.

Materials

00910.10 Materials - Furnish ~~wood posts of either~~ Douglas fir ~~or Hem fir~~wood posts meeting the following requirements:

Posts 02110.40
Preservative Treatment of Posts 02190

Construction

00910.40 Post Holes - Excavate post holes to the lines and grades established and to the depth shown or to a depth necessary to achieve the required mounting height, whichever is greater. If necessary, obtain the required depth by blasting. Do not set the post until the location, lines and grades of the holes have been approved. Align the post to a vertical position in the hole and backfill the hole. Backfill with selected general backfill meeting the requirements of 00330.13. Place in layers not greater than 6 inches. Solidly ram and tamp the layers into the excavated area around the post. Dampen during placement if too dry to compact properly. On completion of the work, replace and finish the surface around the post to match the surrounding surface.

Measurement

00910.80 Measurement - The quantities of wood sign posts will be measured on the volume basis~~, to the nearest 0.01~~ in units of foot board measure (FBM~~), using nominal sizes and lengths of each wood post installed.~~). Post volume will be determined by multiplying the nominal post size by the commercially available length shown on the standard drawings. For calculation purposes, post length will be determined by rounding the installed length to the nearest higher commercial length.

The estimated wood post lengths will be indicated on the plans. Final lengths of wood posts will be determined or verified by the Engineer prior to fabrication.

Payment

00910.90 Payment - The accepted quantities of wood sign posts will be paid for at the Contract unit price, per foot board measure (FBM), for the item "Wood Sign Posts".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for route marker frames, wind bracing, or special sign brackets.

Section 00920 - Sign Support Footings

Description

00920.00 Scope - This work consists of constructing major and minor sign support footings of the dimensions and design shown and at the locations shown or directed.

Materials

00920.10 Materials - Furnish materials for constructing sign support footings meeting the following requirements:

Anchor Bolts.....02560.30
Backfill~~(~~, unless otherwise directed~~)~~.....00510.10 or 00510.11
Commercial Grade Concrete.....00440
Conduit.....02920.10 through 02920.12
Reinforcement.....00530

Construction

00920.40 Excavation and Backfill - Excavate and backfill footings according to Section 00510.

Finish the surface of backfill to match the existing surface. Where required, reinstall curbs and pavement markings.

00920.41 Concrete - Construct concrete sign foundations according to Section 00440 and the applicable portions of 00540.48(a).

Pour concrete spread footings and concrete shaft footings against undisturbed material or backfill with selected granular backfill material according to 00510.11. Compact to 95~~%~~ percent maximum density according to 00330.43 or as shown.

During concrete placement, accurately and securely hold in place all anchor bolts or post stubs until the concrete has set.

Remove forms and place subsequent loading according to Table 00540-1.

00920.42 Reinforcement - Fabricate and place steel reinforcement according to Section 00530.

00920.43 Conduit - Fabricate and install conduit according to Sections 00960, 00970, and 00990.

Measurement

00920.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Estimated quantities of concrete for minor sign supports and estimated quantities of excavation, backfill, concrete, reinforcement, and miscellaneous metal for major sign supports will be listed in the Special Provisions. Miscellaneous metal includes anchor rods and associated hardware, templates, and anchor plates.

Payment

00920.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract lump sum amount for the item "Sign Support Footings".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Section 00921 - Major Sign Support Drilled Shafts

Description

00921.00 Scope - This work consists of excavating and constructing drilled, cast-in-place, reinforced concrete shafts for sign supports according to these specifications and the plans.

00921.01 Definitions:

Drilled Shafts - Reinforced concrete sections, cast-in-place against in situ soil, rock, or a casing.

Temporary Casing - Casing installed to facilitate drilled shaft construction only and removed during or after concrete placement.

00921.02 Subsurface Investigation - The Soils and Geological Exploration Logs are available for review through the Engineer's office. The data shown for each test boring or test pit applies only to that particular boring or test pit. Subsurface conditions may vary between borings or test pits. Core samples and laboratory test results, if obtained and performed for the Project, are available for review by contacting the Engineer.

The Foundation Data shown in the plans is a compilation of pertinent information including, but not limited to, the Soils and Geological Exploration Logs.

Materials

00921.10 Materials - Furnish materials meeting the following requirements:

(a) Reinforcement - Use reinforcement complying with Section 00530 and Section 02510.

(b) Concrete - Use Class 4000 structural concrete according to Section 02001, except as modified in this Section.

00921.12 Concrete Mix Design - Design the drilled shaft concrete mix for minimum segregation. Use the mix design that the Engineer has reviewed and approved according to Section 02001.

- Add water to the concrete mix at the Project Site only if allowed by the approved mix design. Accurately measure water added at the site by water meters, buckets or other approved devices. Limit the addition of water at the jobsite to 1 gallon per cubic yard.
- Provide concrete having the appropriate initial slump according to Table 02001-3. Use chemical additives from the QPL to control and maintain slump and to facilitate temporary casing extraction.
- Design the concrete mix to maintain at least 4 inches of slump after placement and throughout the entire duration of the pour including during temporary casing extraction.
- Provide supporting documentation for the workability and slump retention requirement in the Drilled Shaft Installation Plan 00512.40 Submittals.

00921.13 Steel Casing - Furnish temporary casing meeting the requirements of ASTM A 252 or ASTM A 36. Use casing of sufficient strength to resist handling, transportation and installation stresses and the external stresses of the subsurface materials. Ensure that the casing is clean and watertight prior to placement in the drilled shaft excavation.

00921.14 Drilling Slurry - Furnish drilling slurry meeting one of the following requirements:

(a) Mineral Slurry - Use mineral slurry meeting the following requirements:

Property	Test	Requirement
Density	Mud Density API * 13B-1, Section 1	64 - 75 lb./cu. ft.
Viscosity	Marsh Funnel and Cup API * 13B-1, Section 2.2	26 - 50 sec./qt.
pH	Glass Electrode, pH Meter, or pH Paper	8 - 11
Sand Content	Sand API * 13B-1, Section 5	4.0 % max.

* American Petroleum Institute

Maintain slurry temperature at 40 °F or more during testing.

(b) Synthetic Slurries - Select synthetic slurries from the QPL. Use synthetic slurries according to the manufacturer's recommendations and the Contractor's quality control plan. The sand content of synthetic slurry shall be less than 2.0 percent (API 13B-1, Section 5) prior to final cleaning and immediately prior to concrete placement.

(c) Water Slurry - Water may be used as slurry when casing is used for the entire length of the drilled shaft. Use of water slurry without full-length casing will only be allowed with the Engineer's approval. Use water slurry meeting the following requirements:

Property	Test	Requirement (Maximum)
Density	Mud Density API * 13B-1, Section 1	70 lb./cu. ft.
Sand Content	Sand API * 13B-1, Section 5	2.0 %

* American Petroleum Institute

Do not use blended slurries.

00921.15 Crosshole Sonic Log Access Tubes - Furnish steel crosshole sonic log (CSL) access tubes meeting the following requirements:

- Steel access tubes shall be at least 1 1/2 inch inside diameter Schedule 40 pipe conforming to ASTM A 53, Grade A or B, Type E, F, or S.
- Use access tubes having a round, regular inside diameter free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of the source and receiver probes used for the testing. Ensure that access tubes are watertight, free from corrosion with clean internal and external faces to ensure good bonding between the drilled shaft concrete and the access tubes. Fit the access tubes with watertight caps on the top and bottom.
- Access tube acceptance will be based on manufacturer's certification that the furnished material meets the requirements of this specification.

00921.18 Crosshole Sonic Log Cement Grout - Furnish non-epoxy grout or tendon grout from the QPL or furnish a pumpable CSL cement grout consisting of neat cement and water that has a water cement ratio between 0.38 and 0.45. The portland cement for the pumpable CSL cement grout shall meet the requirements of Section 02010.

00921.19 Quality Control - Maintain and be responsible for quality control of the drilled shaft work throughout the construction operation. The Engineer will inspect all drilling operations and verify the suitability of all drilled shaft construction procedures. Provide lights, mirrors, weighted tape, weighted probe, personnel, and all assistance required for the Engineer to perform inspection during drilled shaft construction.

Labor

00921.30 Personnel Qualifications - Perform the drilled shaft construction work using a company and personnel experienced in drilled shaft construction work. Submit a list to the Engineer for approval identifying the on-site supervisors and drill rig operators assigned to the Project and the companies experience relevant to the Project. Experience shall be relevant to the anticipated subsurface materials, groundwater conditions, shaft size, depth and any special construction techniques required. Also provide the experience qualifications of the company performing the CSL testing. Before the preconstruction conference, provide the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the drilled shaft construction and CSL testing:

- Submit a project reference list of at least three separate foundation projects, successfully completed in the last 5 years, with drilled shafts of diameters and depths equal to or larger than those shown in the plans and in ground conditions similar to those indicated. Include a brief description of each project and the owner's contact person's name and current phone number for each project listed.
- On-site supervisors shall have at least 2 years experience in supervising construction of drilled shaft foundations of similar diameter and depth and scope to those shown in the plans and in similar geotechnical conditions to those described in the geotechnical report. Experience shall include the direct supervisory responsibility for the on-site construction operations.
- Drill operators shall have at least 1 year experience in the construction of drilled shaft foundations.
- Perform CSL testing using an independent testing organization retained by the Contractor and approved by the Agency. Furnish personnel experienced in operating the CSL testing equipment. Submit the CSL testing firm qualifications according to 00921.40(a). The CSL testing firm shall have successfully performed CSL testing on a minimum of five projects during the last 3 years. CSL testing personnel shall be trained in the operation of the CSL equipment and have at least 1 year of experience in operating CSL testing equipment on a minimum of 10 shafts.

The Engineer will respond within 21 calendar days after receipt of the submittal. Do not begin work on any drilled shafts until the qualifications have been approved. The Engineer may suspend the drilled shaft construction if the Contractor substitutes unapproved personnel during construction. Submit requests for substitution of either on-site supervisors, drill operators, or CSL testing personnel to the Engineer, who will have 7 calendar days to respond to each request. Additional costs resulting from the suspension of work due to the changing of personnel is the Contractor's responsibility, and no adjustment in Contract Time resulting from the suspension of work will be allowed.

Construction

00921.40 Submittals - Provide the following submittals to the Agency for review and approval:

(a) Drilled Shaft Installation Plan - At least 21 calendar days before beginning shaft construction, submit the following:

- The sequence of drilled shaft construction as it relates to the overall construction plan.
- A review of equipment suitability based on the Contractor's understanding of the site subsurface conditions. Include a project history of the drilling equipment that demonstrates the successful use of the equipment for drilled shafts of equal or greater size in similar subsurface conditions.
- Details of shaft excavation methods, including proposed drilling methods and a disposal plan for excavated material. Include details of methods used to perform final cleaning of the excavation. Include a disposal plan for any water or contaminated concrete expelled from the top of the shaft if applicable.
- Details of the proposed methods for ensuring drilled shaft stability during excavation and concrete placement.
- Details for the use of drilling slurry including mix design, slurry head requirements, mixing methods, maintaining, and disposing of the slurry if applicable. Include a discussion of the suitability of the proposed drilling slurry in relation to the anticipated subsurface conditions.
- A plan for quality control of all drilling slurries, if their use is proposed. In the quality control plan, include property requirements, required tests and test methods to ensure the slurry performs as intended. Submit to the Engineer the name and current phone number of synthetic slurry manufacturer's representatives who will provide technical assistance during construction. Provide the names of the Contractor's personnel assigned to the Project and trained by the synthetic slurry manufacturer in the proper use of synthetics slurries.
- Unstamped reinforcing steel shop drawings and details of reinforcement placement, including bracing, splicing, centering, lifting methods, and the method for supporting the reinforcement according to 00150.35. Include details on the type, number, and placement of spacers and other devices for ensuring the reinforcing cage position is maintained during construction. Include details for attaching the CSL test access tubes to the reinforcing cage if applicable.
- Evidence that the proposed materials and concrete mix design conform to all applicable Specifications.
- Provide documentation that assures that the concrete mix design will maintain the required slump retention properties specified in 00512.12.
- Details of concrete placement, including proposed operational procedures for pumping and tremie methods. Include details for grout placement in the crosshole sonic logging test access tubes after testing is completed if applicable.
- Detailed procedures for temporary casing installation and removal. Include casing diameters, dimensions, and depths and the methods and equipment for casing installation and removal.
- CSL testing company performing the CSL testing work, including documentation demonstrating that the company, and company personnel, meets the required qualifications.
- Confinement methods required to contain drilling fluids, spoils, waste concrete and other products from contacting sensitive environmental areas according to Section 00290 and all applicable regulatory permits.
- Methods for protecting existing structures according to 00170.82.

The Engineer will approve or reject the drilled shaft installation plan within 21 calendar days after receipt of all submissions. Provide any additional information and submit a revised plan, if requested, for review and approval. All procedural approvals given by the Engineer will be subject to trial in the field and will not relieve the Contractor of the responsibility to satisfactorily complete the work. Submit requests for modification of adopted procedures to the Engineer. Allow 21 calendar days for approval of modifications. Do not begin drilled shaft construction work until all drilled shaft submittals have been approved.

(b) Drilled Shaft Repair Plans - For any shaft determined to be unacceptable, submit a repair plan to the Engineer for approval. Furnish all materials and work, including engineering analysis and design, needed to correct unacceptable drilled shafts, at no additional cost to the Agency. Do not begin repair operations before remedial procedures or designs are approved. Any modifications to the dimensions or material of the drilled shafts shown on the plans that are proposed in the repair plan will require stamped calculations and working drawings according to 00150.35.

(c) Drilled Shaft Inspection Reports - Provide the Engineer with a completed Drilled Shaft Inspection Report for each drilled shaft, detailing the actual location, alignment, elevations, dimensions, and quantities of the shafts.

Submit the report within 21 calendar days after the completion and acceptance of each shaft. A "Drilled Shaft Inspection Report" form is available from the Engineer.

(d) Concrete Placement Logs and Volume Curves - Measure and record all concrete placed into drilled shafts using standard ODOT forms designated for this purpose or other forms approved by the Engineer. Provide the Engineer with a completed Drilled Shaft Concrete Placement Log and Concrete Volume Curve Form for each drilled shaft within 24 hours after completion of shaft concrete placement.

00921.41 Drill Shaft Coordination Meeting - Hold a drilled shaft coordination meeting at least 7 calendar days before beginning any shaft construction work at the site to discuss construction procedures, schedules, staging, personnel, equipment to be used, and other elements of the approved shaft installation plan as specified in 00921.40. If synthetic slurry is used to construct the shafts, the frequency of scheduled site visits to the project site by the synthetic slurry manufacturer's representative will be discussed. Those attending the meeting include:

- **Representing the Contractor** - The superintendent, on-site supervisors, and all supervisors in charge of excavating the shaft, placing the casing, mixing and installing slurry as applicable, placing the steel reinforcing bars, and placing the concrete. If synthetic slurry is used to construct the shafts, the slurry manufacturer's representative and a Contractor's employee trained in the use of the synthetic slurry shall also attend.

- **Representing the Contracting Agency** - The Project Engineer, key inspection personnel, and designers of record or their appointed representatives.

If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved shaft installation plan, hold an additional meeting before any additional shaft construction operations are performed.

00921.42 Construction Tolerances - Excavate drilled shafts as accurately as possible at the locations shown and within the specified tolerances listed below. Determine the drilled shaft dimensions and alignment with approved methods. The following construction tolerances apply to drilled shafts unless otherwise stated:

- **Horizontal Position (At the Plan Elevation of the Top of Shaft)** - 3 inch horizontal tolerance from the location shown.

- **Top Elevation of Shaft Concrete** - Plus 3 minus 0 inches from the plan top of shaft elevation.

- **Vertical Alignment in Soil** - May not vary from the plan alignment by more than 1.5 percent of the shaft length.

- **Vertical Alignment in Rock** - May not vary from the plan alignment by more than 2 percent of the shaft length.

- **Top of Steel Reinforcement** - Plus 3 minus 0 inches from the plan top of steel reinforcement elevation. Maintain 3 inch of cover.

Frequently check the plumbness, alignment, and dimensions of the shaft during construction. Correct all out-of-tolerance shaft excavations and completed shafts to the satisfaction of the Engineer. Materials and work necessary to complete corrections for out-of-tolerance drilled shafts will be at the Contractor's expense, and no extension of the Project completion date will be granted. Materials and work necessary to complete corrections for out-of-tolerance drilled shafts resulting from the removal of unexpected drilled shaft obstructions will be paid for according to 00195.20.

00921.43 Drilled Shaft Excavation - Perform drilled shaft excavation according to the following:

(a) General - Excavate drilled shafts to the dimensions and elevations shown or as directed. Provide and maintain stabilized drilled shaft sidewalls and bottoms for the full depth of the excavation, using approved materials, equipment and methods. If caving or other unstable conditions occur during any construction procedure, stop further construction, notify the Engineer, and stabilize the shaft excavation by approved methods and submit a revised installation plan which addresses the problem and prevents further instability. Do not continue with shaft construction until any damage which occurred has been repaired according to the Specifications and until receiving the Engineer's approval of the revised shaft installation plan.

If the Engineer has reason to believe that the drilled shaft excavation techniques or workmanship have been deficient, so that the integrity of any excavation is in question, work on that drilled shaft may be stopped. Drilled shaft excavation will not be allowed to resume until the deficient excavation techniques or workmanship have been changed to the Engineer's satisfaction.

Dispose of materials removed from the shaft excavations according to 00290.20.

Do not leave partially completed shaft excavations open overnight unless they are cased full depth or otherwise stabilized with approved methods. If approved by the Engineer, a partially excavated shaft may be left open overnight, provided that the excavation:

- Is stabilized at the bottom, sides and surface to prevent soil caving or swelling or a reduction of soil strength, and
- Is covered at the surface to protect the public.

Extend the drilled shaft excavation if the Engineer determines that the subsurface materials encountered are not capable of providing the required bearing resistance or differ from those anticipated in the design of the drilled shafts.

(b) Protection of Existing Structures - Control shaft construction operations to prevent damage to existing structures and utilities. Preventive measures include, but are not limited to, selecting construction methods and procedures that will prevent caving of the shaft excavation and monitoring and controlling the vibrations from construction activities such as the driving and

vibrating of casing or sheeting, drilling of the shaft, or from blasting, if blasting is allowed. Repair all damage caused to existing structures, utilities or other facilities, resulting from drilled shaft construction activities, at no additional cost to the Agency.

(c) Temporary Casing - Provide temporary casing according to the approved installation plan and of sufficient quantities to meet the needs of the anticipated construction method.

(d) Unexpected Drilled Shaft Obstructions - Remove any natural or manmade object encountered that was not revealed by the Agency's site investigation, and that would cause a significant decrease in the rate of advancement if removed using the techniques and equipment used successfully to excavate the shaft. The Engineer will be the sole judge of the significance of any reduced rate of shaft advancement and the classification of any unexpected obstructions. Removal of unexpected obstructions from the shaft excavation will be paid according to 00195.20.

(e) Lost Tools - Promptly remove drilling tools lost in the excavation. Lost tools will not be considered unexpected obstructions and shall be removed without additional compensation. Drilling tools lost during the course of removing unexpected drilled shaft obstructions will be paid according to 00195.20.

(f) Drilling Slurry Installation - If synthetic drilling slurry is selected, provide a manufacturer's representative to provide technical assistance at the site prior to use of the slurry, who shall remain at the site during construction and completion of a minimum of one drilled shaft to adjust the slurry mix for the specific site subsurface conditions. After the manufacturer's representative is no longer at the site, provide the approved personnel trained in the use of the synthetic slurry for the remainder of the shaft slurry operations to supervise the proper slurry mix design and quality control procedures.

All in-hole drilling slurry shall meet the required slurry specifications during excavation and prior to concrete placement. Clean, recirculate, de-sand or replace the slurry to maintain the required slurry properties.

Unless otherwise approved, maintain the level of slurry in the excavation at not less than 5 feet above the groundwater level for mineral slurries or 10 feet above the groundwater level for synthetic or water slurries. Maintain the slurry level a sufficient distance above all unstable zones to prevent bottom heave, caving or sloughing.

Maintain the required slurry properties and levels at all times during shaft construction, including work stoppages, unless other approved stabilization methods are applied.

Feed slurry continuously into the shaft excavation as drilling progresses so that a stable excavation is maintained. Use a self-priming pump to reclaim the slurry. Keep a standby pump available during the drilling operation.

(g) Drilling Slurry Inspection and Testing - Mix and thoroughly hydrate all drilling slurries in an appropriate storage facility. Collect sample sets from the storage facility and perform tests to ensure the slurry conforms to the specified material properties before introduction into the drilled shaft excavation. A sample set shall be composed of samples taken at mid-depth and within 24 inches of the bottom of the storage facility.

Sample and test all slurry in the presence of the Engineer, unless otherwise directed. The sample sets of slurry within the excavation shall consist of samples taken at mid-depth of the excavation and within 24 inches of the bottom of the excavation. Collect and test sample sets during the drilling operation as necessary to ensure the specified properties of the slurry are maintained. Clean, recirculate, de-sand, or replace the slurry as necessary to maintain the

specified slurry properties. Final cleaning of the excavation and placement of concrete will not be allowed until the test results indicate the slurry properties are as specified.

Perform a minimum of two sets of slurry tests per eight-hour work shift, the first test being done at the beginning of the shift. Field conditions may require more frequent testing to ensure acceptable slurry properties.

Make copies of all slurry test results available to the Engineer on request.

(h) Clean Out - Use appropriate means, such as a cleanout bucket, pump or air lift, to clean the bottom of the drilled shaft excavations. No more than 1 inch of loose or disturbed material will be allowed at the bottom of the excavation.

Notify the Engineer of completion of each drilled shaft excavation to permit inspection before proceeding with construction. Measure final shaft depths with a suitable weighted tape or other approved method after final cleaning to determine that the shaft bottom meets the requirements in the Contract. Do not proceed with shaft construction until the bottom cleanliness requirements have been met and the bottom (shaft tip) elevation is approved.

00921.45 Reinforcing Steel - Furnish and place reinforcing steel as shown and according to the following:

(a) Placement - Do not place reinforcing steel in the shaft excavation until the Engineer has approved the final elevation of the bottom of the shaft.

In each shaft, place reinforcing steel to the top elevation shown. Support the reinforcing cage to prevent distortion or settlement during concrete placement. Support the reinforcing cage such that the supporting mechanism does not obstruct the center of the shaft and allows concrete placement vertically down the center of the shaft. If concrete placement does not immediately follow cage placement, remove the reinforcing cage from the excavation and rectify the integrity of the excavation prior to reinstallation of the cage.

(b) Bracing - Rigidly brace the reinforcing cage to retain its shape for lifting. Lift the cage in a manner that does not cause permanent racking or distortion. Show bracing and any extra reinforcing steel required for fabrication of the cage on the submitted shop drawings. Remove cross bracing during cage placement unless otherwise approved.

(c) Splicing - Splice all drilled shaft reinforcement using approved mechanical splicer's unless otherwise shown or approved.

(d) Concrete Cover - Maintain the required concrete cover shown by placing concentric spacer bars or other approved devices around the reinforcing cage. Place spacing devices on minimum 10 foot vertical spacings the full length of the shaft. At each 10 foot level, place spacers on a minimum 30 inch circumferential spacing with at least three spaces per level. Do not use wood spacers or concrete dobies. Provide details of the proposed centering method on the shop drawings submitted according to 00921.40.

00921.46 Crosshole Sonic Log Test Access Tubes - Furnish and install access tubes for CSL testing as shown. Attach CSL access tubes securely to the interior of the reinforcement cage as near to parallel as possible in each drilled shaft and in the pattern shown. Extend the access tubes from the bottom of the reinforcement cage to at least 24 inches above the top of the shaft. Joints required to achieve full-length access tubes shall be watertight. Do not damage the access tubes during reinforcement cage installation and concrete placement. Fill the tubes with potable water, according to 02020.10(b), as soon as possible, but no more than 1 hour after concrete placement and reinstall the top watertight caps. Check water level and top off as needed.

Replace all access tubes that the test probe cannot pass through to the full depth of the shaft at no additional cost to the Agency. Replace all damaged access tubes with 1.5 to 2.0 inch diameter holes cored through the concrete for the entire length of the shaft. Unless otherwise directed, locate replacement core holes approximately 6 inches inside the reinforcement. Do not damage the shaft reinforcement during coring operations.

Fill the access tubes with grout only after all CSL testing has been completed and the shaft has been accepted.

00921.47 Concrete - Furnish and place concrete according to the following:

(a) Concrete Placement - Place concrete immediately after completion of the shaft excavation and with the approval of the Engineer. Prior to concrete placement, ensure the shaft clean-out requirements are met according to 00921.43(h) and the properties of the slurry, if used, conform to specifications. Shaft concrete may be placed without mechanical vibration in those areas of the drilled shaft that are not formed or are below the ground line or the water surface.

Place concrete continuously until concrete at the top of the shaft is free of water, soil, and debris, and uncontaminated concrete extends to the plan top-of-shaft elevation. Dispose of all contaminated concrete expelled from the top of the shaft in an approved manner. Remove waste concrete from the site. If a delay in concrete placement occurs because of a delay in concrete delivery or other factors, reduce the placement rate to maintain a flow of fresh concrete into the shaft excavation.

Unless otherwise approved by mix design, allow a maximum of 60 minutes between concrete placements and use no concrete older than 90 minutes from batch time. Use procedures for concrete placement which ensure that the concrete within the shaft becomes a monolithic, homogeneous unit.

Place concrete using hoses or pipes having watertight joints. For concrete placement by gravity tremie, use hose or pipe having an inside diameter of at least 8 inches. For placement by concrete pump, use hose with inside diameter of at least 4 inches. Provide an alternate delivery system that can be used in case of failure of the primary delivery system. Place concrete only against the bottom of the drilled shaft or into fresh concrete.

If caving occurs during concrete placement, the shaft may be rejected.

(b) Dry Shaft Concrete Placement - Concrete may be placed by free-fall if all of the following conditions are met:

- No more than 3 inches of water is present in the bottom of the excavation at the beginning of the pour.
- Groundwater seepage into the excavation is at a rate of no more than 12 inches per hour.
- Shaft diameter is greater than or equal to 3 feet.

Under free-fall placement, deposit concrete through the center of the reinforcement cage by a method which prevents segregation of aggregates and splashing of concrete on the reinforcement cage. Place concrete so that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars or steel cage bracing.

(c) Wet Shaft Concrete Placement - If the drilled shaft excavation does not meet the requirements for dry concrete placement, stabilize water inflow and place the concrete under water or slurry with a tremie pipe or pump hose according to 00540.48(e). Place concrete

continuously from the bottom of the shaft to the top-of-shaft elevation shown. Use a plug in the tremie pipe or pump hose to force water or slurry ahead of the advancing flow of fresh concrete. Dispose of all displaced water, slurry, or waste concrete according to 00290.20. When groundwater, the drilling water or slurry in the shaft excavation is to be removed by pumping during concrete placement, have a standby pump available.

Place concrete in a continuous operation so that the concrete always flows upward within the shaft. Withdraw the delivery hose or pipe slowly as the elevation of the fresh concrete rises in the shaft. Keep the discharge end of the pipe or hose at least 5 feet below the surface of the concrete after the concrete has reached a depth of 5 feet. Maintain sufficient concrete inside the hose or pipe to prevent drilling fluid from entering. During concrete placement, provide and maintain markings on the tremie pipe or pump hose, or a sounding device or other appropriate method to determine the relative elevations of the fresh concrete surface and the bottom end of the pipe or hose. Raise the bottom end of the pipe or hose only when the pipe or hose has a sufficient head of fresh concrete to prevent the formation of a void at the bottom.

(d) Concrete Curing and Cleaning - Allow the exposed top of concrete to cure a minimum of 7 calendar days by covering with wet burlap overlain with plastic sheets or by keeping top of concrete under water. Keep the burlap wet during the concrete cure.

Prior to placing any fresh concrete on top of a completed shaft, clean the upper surface of the concrete by removing all scum, laitance, loose gravel, and sediment and chip off any high spots on the upper surface that would prevent the steel reinforcing bar cage from being properly placed in the position shown on the plans. Remove all loose material and poor quality concrete at the top of the shaft down to sound concrete prior to performing any required CSL testing.

(e) Casing Removal - Remove all temporary casing during or after completion of concrete placement. Do not start temporary casing removal until the level of fresh concrete within the casing has reached a depth of at least 10 feet or the level necessary to adequately counteract the external hydrostatic pressure head. As the temporary casing is withdrawn, maintain a minimum 5 feet head of concrete above the bottom of the casing. A slight downward movement of the casing while exerting downward pressure, or hammering or vibrating the casing will be allowed to facilitate extraction. Extract the casing so that concrete is cast directly against the surrounding in-situ material. Check the elevation of the top of the reinforcing cage before and after temporary casing extraction for conformance with the construction tolerance criteria of 00921.42. Casing that cannot be extracted during, or immediately after, the concrete placement operation may be cause for rejection of the shaft.

00921.48 Drilled Shaft Testing and Acceptance - Acceptance of drilled shafts will be based on the Engineer's review of the results of CSL, or other, integrity testing if conducted, field inspection reports and visual observations during drilled shaft construction. The Engineer has final authority on the approval of drilled shafts. For shafts that are integrity tested, the Engineer will determine final acceptance of each tested shaft, based on the integrity test results and inspection reports and will provide a response to the Contractor within 5 calendar days after receiving the CSL test report.

(a) Crosshole Sonic Log Testing - Provide crosshole sonic log testing equipment and perform crosshole sonic log testing and analysis on the first drilled shaft completed at each foundation and subsequent shafts as specified or designated for testing by the Engineer. Provide CSL testing equipment conforming to the requirements of ASTM D 6760 and approved by the Engineer. Provide all necessary access and other support to the CSL testing firm necessary to do the CSL testing work.

Perform one CSL test on each shaft designated for testing. A single CSL test consists of all ultrasonic profile combinations in a given shaft. Test completed drilled shaft foundations using Ultrasonic Crosshole Testing methods ((CSL) Testing) according to ASTM D 6760. Inform the

Engineer of scheduled CSL testing at least 3 calendar days prior to the testing. Perform all CSL testing using the Contractor's CSL technician in the presence of the Engineer.

Allow at least 3 calendar days of curing time before testing unless otherwise approved. Additional curing time beyond 3 calendar days may be required if the shaft concrete contains admixtures such as set retarding admixture or water reducing admixture. Additional CSL testing required due to the CSL testing being conducted on concrete that has not cured sufficiently is at no additional cost to the Agency. Additional curing time required due to concrete admixtures will not be grounds for additional compensation or time extensions.

(b) Contractor's Crosshole Sonic Log Test Reports - Provide a brief summary report of the data, with interpretation of the test results, to the Engineer at the completion of each test. Provide copies, either hardcopies or electronic files, of the raw test data as requested. Mark the test data files to identify, as a minimum, the structure, bent and shaft number, the date of CSL testing, depths of testing and any other pertinent information.

Submit three copies of a final CSL Test Report for each shaft tested according to ASTM D 6760. Provide electronic file copies of the raw CSL data measurements compatible with the Cross Hole Ultrasonic Monitor (CHUM) program, if requested. The report shall summarize the CSL testing performed, data analysis, and interpretation of CSL data with special attention made to the identification and location of any anomalies or possible defects. Provide interpretation of the CSL test data in terms of overall shaft integrity and acceptance. Submit all reports to the Engineer within 5 calendar days of the performance of the tests.

(c) Additional Testing and Investigation - Conduct additional testing or investigation necessary to identify the location, extent and condition of possible shaft defects if requested by the Engineer. Additional testing and investigation may include, but is not limited to, additional CSL testing, excavation work or core drilling.

If requested by the Engineer, drill a core hole in any questionable quality shaft to explore the shaft condition. The number, location and depths of the core holes will be determined by the Engineer. Submit the method and equipment used to drill and remove cores from the shaft to the Engineer for review and approval prior to drilling. Use a coring method that provides complete core recovery and minimizes abrasion and erosion of the core. If a defect is confirmed, as determined by the Engineer, all investigation costs associated with identifying the defect will be at no additional cost to the Agency and no extension of the Project completion date will be granted, regardless of whether the identified defect is repaired or not.

If no defect is identified in the investigation work, and the CSL tubes were satisfactorily installed according to ASTM D 6760 and accepted, the Agency will pay for all coring and excavation costs associated with the additional investigation and grant an appropriate time extension, if required, according to Section 00190 and Section 00195. If it is determined by the Engineer that the CSL tubes were not installed properly thus invalidating the CSL test results, all coring, excavation, and other investigation and evaluation costs will be at no additional cost to the Agency and no extension of the Project completion date will be granted.

Fill all core holes with grout only after the evaluation process is completed and the shaft is accepted and approved.

(d) Drilled Shaft Repair - Repair all defects and rejected shafts according to 00921.40(b). Perform additional CSL testing, or other investigation required, as directed by the Engineer, to confirm the quality of the completed shaft repair work at no additional cost to the Agency with no time extension granted.

For temporary casing not extracted from the shaft excavation, submit a repair plan or a structural evaluation to the Engineer for approval according to 00921.40. If caving occurs during concrete placement submit a repair plan to the Engineer for approval.

00921.49 Scheduling and Restrictions - Unless otherwise approved, do not proceed with construction of subsequent shafts until the CSL testing has been completed on the first drilled shaft and the results have been approved and accepted, in writing by the Engineer. Approval to proceed with the construction of subsequent shafts, before receiving approval of the first shaft will be based on the Engineer's observations of the Contractor's workmanship during construction of the first shaft and the Engineer's review and assessment of the following:

- The Contractor's conformance with the approved shaft installation plan.
- The Contractor's daily reports and inspector's daily logs of excavation, rebar, and concrete placement.
- The concrete placement logs and volume curves.

Written notification will be provided to the Contractor on whether or not to proceed with subsequent shaft construction within 24 hours after completion of the first shaft. If the Engineer determines the first shaft to be of questionable quality, discontinue all shaft construction until the CSL test results of the first shaft are received and reviewed and the shaft accepted, in writing, by the Engineer.

Denial of permission to proceed with subsequent shaft construction will not be cause for contract time extension.

Do not proceed with the third drilled shaft until the final CSL test results from the first drilled shaft has been received and reviewed and the shaft accepted, in writing, by the Engineer.

After the first drilled shaft on the Project has been accepted, make no significant changes in construction methods, equipment, or materials used to construct subsequent shafts, unless otherwise approved.

Measurement

00921.80 Measurement - The quantities of work performed under this Section will be measured on the length basis, by the vertical excavated length from the bottom of the shaft to the ground surface. If directed to construct drilled shafts below the elevations shown, the drilled shaft will be measured from the revised bottom of shaft.

The estimated quantities of materials for the sign support drilled shaft foundations will be listed in the Special Provisions.

Payment

00921.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per foot for the item "_____ Inch Diameter Sign Support Drilled Shaft Foundation".

The diameter of the drilled shaft will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- furnishing drilling equipment
- temporary casings
- drilled shaft excavation
- drilled shaft concrete
- drilled shaft reinforcement
- CSL equipment mobilization
- CSL test access tubes
- CSL tests

Section 00930 - Metal Sign Supports

Description

00930.00 Scope - This work consists of furnishing, fabricating, galvanizing, and erecting metal sign supports.

00930.01 Definitions and Terms:

Multi-Post Breakaway Sign Supports - The complete structure is composed of post stubs, base plates, posts, hinges, sign support members, and fastenings, but does not include the sign support footings.

Triangular Base Breakaway Sign Supports, Pipe Breakaway Sign Supports, and Perforated Steel Square Tube ~~Breakaway~~Slip Base Sign Supports - The complete structure is composed of post stub, base plates, metal post, sign support members, and fasteners, but does not include the sign support footings.

90 Degree Rotational Sign Supports - The complete structure is composed of post stubs, base plates, posts, rotator connection, sign support members, and fastenings, but does not include the sign support footings.

Pipe Sign Supports and Perforated Steel Square Tube Anchor Sign Supports - The complete structure is composed of metal post, sign support members and fasteners, but does not include the sign support footings.

Truss Sign Bridges, Monotube Sign Bridges, Butterfly Sign Structures and Monotube Cantilever Sign Structures - The complete structure is composed of base plates, support columns, cantilever arms, trusses, horizontal beam, sign support arms, supporting brackets, ~~and~~ fasteners, and maintenance walkways, but does not include the sign illumination equipment~~, maintenance walkways~~ and sign support footings.

Bridge Structure Mounts - The W-shapes or special detailed attachments used for mounting signs to bridge structures and maintenance walkways, and includes all necessary support brackets, arms, and fasteners, but does not include sign illumination equipment~~ and maintenance walkways~~.

Exit Number Sign Mounts - The S-shape, spacers, special mounting brackets, and fasteners, necessary to install the exit number signs.

Signal Pole Mounts - The complete support including horizontal and vertical arms, supporting brackets, and fasteners.

Adjustable Sign Mounts - The complete support is adjustable horizontally and vertically to facilitate signal pole mast arm and pole mounting of flat sign sheets. The bracket consists of cast aluminum and galvanized steel elements, stainless steel straps, and fasteners.

Vertical Sign Mounts on Existing Structures - The additional or replacement vertical members and fasteners necessary to install a new sign onto an existing major sign support.

Secondary Sign Mounts - This group includes tubes, S-shapes, channels, plates, and fasteners necessary to install secondary signs.

Major Sign Supports - This group includes Truss Sign Bridges, Monotube Sign Bridges, Butterfly Sign Structures, and Monotube Cantilever Sign Structures.

Minor Sign Supports - This group includes Multi-Post Breakaway Sign Supports, Triangular Base Breakaway Sign Supports, Pipe Breakaway Sign Supports, Perforates Steel Square Tube ~~Breakaway~~Slip Base Sign Supports, 90 Degree Rotational Sign Supports, Pipe Sign Supports, and Perforated Steel Square Tube Anchor Sign Supports.

Mast Arm Street Name Sign Mounts - This group includes the frame members, attachment channel or bracket, steel bands or cables, and fasteners necessary to install a street name sign on a signal mast arm.

00930.02 Working Drawings - Submit six copies of unstamped working drawings according to 00150.35 for all structural metal work. Submit six copies of stamped designs, details, plans, and calculations according to 00150.35 for all engineered details and drawings that are not prepared by the Agency but are required by the Contract Documents and Specifications for the Project prior to fabrication. Include the Field Verification of Post Lengths form for Major Sign Supports, available from the Engineer. Material ordered or work done before the Engineer finishes and returns the documents will be at the Contractor's risk.

In addition to the working drawings, submit six copies of all available data including manufacturer's pamphlets and brochures, technical bulletins, working drawings and other technical information relative to products used on the Project. After installation, submit corrected working drawings that represent the material as installed and in operation. Include sufficient information to enable the Agency's maintenance forces to replace all or part of the commercially manufactured sign structures, under routine or emergency maintenance, by direct reference to the information furnished by the Contractor.

Working drawings are not required for the following types of steel supports:

- Multi-Post Breakaway Sign Supports
- Triangular Base Breakaway Sign Supports
- Signal Pole Mounts
- Exit Number Sign Mounts
- Secondary Sign Supports
- Route Marker Frames
- ~~Square Tube Sign Supports~~

Working drawings for these supports will be provided by the Agency's Engineer of Record. Use the Field Verification of Post Lengths form, available from the Engineer, to provide the necessary site data to the Engineer of Record for use in producing working drawings. All work done, or materials ordered, before receiving working drawings from the Engineer of Record will be at no additional cost to the Agency.

00930.09 Identifying Tags - Overhead and butterfly sign support structures, except structure mounts, shall have stainless steel or brass identifying tags attached to all posts, arms, and truss sections. The tags shall be at least 1/16 inch thick. Tag lettering shall be at least 1/4 inch in height, and shall be stamped into the tag. Tags shall be attached with stainless steel pop rivets of at least 3/16 inch nominal body diameter. Do not locate pop rivet holes within 6 inches of welds. Post tag shall be located approximately 5 feet above the baseplate. Holes for pop rivets shall be drilled prior to hot-dip galvanizing. Remove excess hot-dip galvanizing from holes and repair according to ASTM A 780.

Tags shall include the following information:

- Structure number

- Manufacturer
- Month and year of manufacture
- Highway number and mile point

Materials

00930.10 Materials - Furnish structural steel materials meeting the applicable portions of Section 02530, with weights and sizes as shown or specified.

Furnish galvanized bolts, nuts, hardened washers, and direct tension indicators meeting the requirements of Section 02560, except the rotational capacity test of 02560.60(a) does not need to be repeated at the job site for Minor Sign Supports.

~~All components of~~ Except for perforated steel square tube slip base sign ~~structures shall be galvanized after fabrication~~supports and ~~before assembly. Galvanizing~~for perforated steel square tube anchor sign supports, galvanizing shall conform to the requirements of Section 02530. Galvanize perforated steel square tube slip base sign supports and perforated steel square tube anchor sign supports according to ASTM A653 G140.

Labor

00930.30 Fabricators - Fabricators of metal sign supports shall have either a current AISC Simple Steel Bridge Structures (Sbr) certification or a current AISC Major Steel Bridges (Cbr) certification.

Construction

00930.40 Fabrication and Erection - Fabricate and erect according to the applicable portions of Section 00560, except where in conflict with the following:

(a) General - Erect breakaway sign posts, pipe sign posts and pipe support columns at a true vertical.

Where two or more posts are required to support a sign, orient and position both posts so that no twist or warp will be imparted to the sign panels.

(b) Assembly of Metal - Accurately assemble the parts as shown on the plans and follow any match marks. Handle the material carefully so that no parts will be bent, broken or otherwise damaged. Clean bearing surfaces and surfaces to be in permanent contact before the members are assembled. Roughen faying surfaces of slip-critical structural connections utilizing high strength bolts by means of hand wire brushing after galvanizing. Power wire brushing is not allowed.

Faying surfaces of plates shall be flat to within a tolerance of 1/32 inch in 12 inches and a tolerance of 1/16 inch overall. Base plates with leveling nuts shall be flat to within a tolerance of 1/8 inch in 12 inches and a tolerance of 3/16 inch overall.

(c) Welding - Weld steel sign structures according to AWS D1.1~~.~~ with the following exceptions:

AWS D1.1, Clause 3 prequalified welds for complete joint penetration (CJP) are not allowed. Qualify CJP welds according to AWS D1.1, Clause 4. Perform V-notch (CVN) testing at 70 °F meeting the requirements of the absorbed energy values of Table 4.14.

The fabricator shall inspect welds according to ~~with~~the details and requirements called out on the Contract Documents. This requirement will override all appropriate weld inspection requirements

called out in Section 5.15 ~~WELDING~~WELDED CONNECTIONS in AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals". Submit all Procedure Qualification Records, Welding Procedure Specifications, and testing procedures for Engineer's review prior to starting ~~inspection~~manufacturing. Submit certified copies of inspection reports to the Engineer for review.

If requested by the Engineer, additional weld inspection may be required upon arrival of the material at the job site. If defects are found by this additional inspection, the Contractor shall be responsible for the additional testing and repair costs. If no defects are found, the Engineer will be responsible for the additional inspection costs.

(d) Bolt Installation - Do not reuse galvanized high strength bolts. Other high strength bolts may be reused, if approved, but not more than once. Retightening previously tightened bolts that may have been loosened by the tightening of adjacent bolts will not be considered a reuse.

Provide all high strength bolts with hardened washers under the element (nut or bolt head) turned in tightening. If a high strength bolt is installed in an oversized or short slotted hole in an outer ply, use a hardened washer. If a high strength ~~bold~~bolt is installed in a long slotted hole in an outer ply, use a plate washer or a continuous bar made of structural grade steel at least 5/16 inch thick with standard holes. Make the washer or bar sufficiently large to completely cover the slot after installation.

Protect fasteners from dirt and moisture at the jobsite. Do not remove the lubricant that is present in as-delivered condition. Clean and relubricate fasteners that accumulate dirt according to 02560.70.

(1) ~~Bold~~Bolt Installation for Slip Bases (Breakaway) - Furnish, at no additional cost to the Agency, a calibrated torque wrench of a capacity appropriate to the size of the high-strength bolts installed and tightened. Confirm the accuracy of the calibrated torque wrench through calibration by an approved testing agency at least once a year.

Remove any dirt and moisture from the lubricated fasteners, and recoat the lubricated fasteners with a fresh, second coat of lubricant immediately before tightening. Tighten the bolts, in the presence of the Engineer, to the minimum torque or tension shown to seat the bolts in the base plate slots. After all the bolts in the slip base are tightened, loosen each bolt and retighten to the prescribed torque or tension shown in the same order as the initial tightening.

(2) Bolt Installation for Slip-Critical Connections - Tighten high strength bolts by direct tension indicator method unless noted otherwise. The calibrated torque wrench method of final tightening is not acceptable. Use of direct tension indicators is not allowed with Type 3 high-strength bolts in AASHTO M 270, Grade 50W (ASTM A 709, Grade 50W; ASTM A 588), unpainted weathering steel connections.

a. Direct Tension Indicator Tightening - Install new and unused direct tension indicator washers meeting the requirements of 02560.20(d) and 02560.40(b) at each bolt. Do not permit the surfaces contacting the protrusions of the direct tension indicator washer to turn during tightening. Bring each bolt to a snug-tight condition as indicated by partial compression of the direct tension indicator protrusions. Then tighten all fasteners in the connection, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic partial tightening before final tightening to deform the protrusion to nil gap or as specified.

A "nil gap" is defined as the condition that exists when at least half of the spaces between the direct tension indicator protrusions refuse entry to a 0.005 inch feeler gauge, and a visible gap exists in at least one space.

b. Turn-of-Nut Tightening - During all turn-of-nut tightening, proceed systematically from the most rigid part of the connection to the free edges. Tighten all bolts until they are simultaneously snug tight and the connection is fully compacted. Snug tight is defined as the tightness that exists when all plies of the joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a worker using a 12 inch long wrench. Following this initial operation, further tighten all bolts in the connection by the amount of rotation specified in Table 00560-3 in Section 00560. During the tightening operation do not permit rotation of the part not turned by the wrench.

(e) Bolt Inspection:

(1) General - The Engineer will observe the installation and tightening of bolts to determine that the selected tightening procedure is properly used and that all bolts are tightened, and in the case of direct tension indicators that the correct indication of tension has been achieved. Bolts may reach tensions substantially above the value given in Table 00560-1 in Section 00560, but this will not be cause for rejection.

(2) Direct Tension Indicator Method - Provide the Engineer full opportunity to witness installation of bolted connections. The Engineer will periodically observe the installation and tightening operations to ensure that proper procedures are being adhered to.

Upon completion of a bolted joint, the Engineer will determine that all bolts have been tightened. A minimum of 10~~%,~~ percent, but not less than two bolts in each joint, will be inspected. If all gaps checked are nil or as shown, the joint will be accepted as properly tightened. If gaps checked are in excess of the above, reinspect all bolts and retighten bolts in the joint, as required, then resubmit the joint for inspection.

Apply the feeler gauge to all of the openings between protrusions around the indicator circumference. To satisfy the nil gap requirement, the feeler gauge shall be refused by at least one-half of the applied places.

(3) Turn-of-Nut Method - When all turn-of-nut tightening activities have been witnessed and are acceptable by the inspector, no additional bolt tightening inspection is required. If turn-of-nut tightening has been performed without being witnessed by the inspector, use the following inspection procedure:

- In the presence of the Engineer, use an inspection wrench, which may be a calibrated torque wrench.
- Place three bolts of the same grade, diameter and condition as those under inspection individually in a calibration device capable of indicating bolt tension. Use a hardened washer under the part turned in tightening each bolt.
- Tighten each bolt specified in the paragraph above in the calibration device by any convenient means to an initial condition equal to 20~~%~~ percent of the required tension, and then to a tension not less than 5~~%~~ percent greater than specified for its size in Table 00560-1 in Section 00560. Tightening beyond the initial condition shall not produce greater nut rotation than 1.5 times that allowed in Table 00560-3 in Section 00560. Then apply the inspecting wrench to the tightened bolt and determine the torque necessary to turn the nut or head 5 degrees, approximately 1 inch at 12 inches radius, in the tightening direction. Take the average torque measured in the tests of

three bolts as the job inspecting torque to be used in the manner specified in the next paragraph.

- Test bolts that have been tightened in the structure and are represented by the sample prescribed above with the inspecting wrench. Apply the job inspecting torque to 10~~%~~ percent of the bolts, but not less than two bolts selected at random. If no nut or bolt head is turned by this application of the job inspecting torque, the connection will be accepted as properly tightened. If any nut or bolt head is turned by the application of the job inspecting torque, test all bolts in the connections. Retighten all bolts whose nut or head is turned by the job inspecting torque, and re-inspect. Retighten all of the bolts in the connection and then resubmit the connection for the specified inspection.

00930.41 Adjustable Sign Mounts - The mount shall allow vertical adjustment for positioning the sign and shall rotate to plumb the sign. Use galvanized or stainless steel nuts, bolts and washers for fasteners.

Measurement

00930.80 Measurement - No measurement of quantities will be made for metal sign supports.

Estimated quantities of structural steel will be listed in the Special Provisions. If field verified post lengths increase or decrease by more than 25~~%~~ percent of the length specified, adjustments to the Contract lump sum amount will be made according to 00190.10(h).

Payment

00930.90 Payment - The accepted quantities of metal sign supports will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
Major Sign Supports	
(a) Truss Sign Bridge	Lump Sum
(b) Monotube Sign Bridge	Lump Sum
(c) Butterfly Sign Structures	Lump Sum
(d) Monotube Cantilever Sign Structures	Lump Sum
Mounts	
(e) Bridge Structure Mounts	Lump Sum
(f) Exit Number Sign Mounts	Lump Sum
(g) Signal Pole Mounts	Lump Sum
(h) Adjustable Sign Mounts	Lump Sum
(i) Vertical Sign Mounts on Existing Structures	Lump Sum
(j) Secondary Sign Mounts	Lump Sum

Minor Sign Supports

(k) Multi-Post Breakaway Sign Supports ..... Lump Sum
(l) Triangular Base Breakaway Sign Supports..... Lump Sum
(m) Pipe Breakaway Sign Supports..... Lump Sum
(n) Perforated Steel Square Tube ~~Breakaway~~Slip Base Sign Supports Lump Sum
(o) 90 Degree Rotational Sign Supports..... Lump Sum
(p) Pipe Sign Supports ..... Lump Sum
(q) Perforated Steel Square Tube Anchor Sign Supports..... Lump Sum

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for route marker frames, wind bracing, pole clamps, stainless steel clamps, mast arm street name sign mounts, or special sign brackets.

Section 00940 - Signs

Description

00940.00 Scope - This work consists of furnishing, fabricating, and erecting traffic signs of the types shown.

00940.02 Types of Signs - Traffic signs are classified by sign type according to the descriptions in 02910.02. Use either retroreflective, reflective, or nonreflective sign sheeting as shown and according to 02910.02.

Use sign sheeting colors conforming to the Federal Highway Administration "Color Specifications for Retroreflective Sign and Pavement Marking Materials". In addition, specified color coordinates shall be subject to visual matching by the Engineer to determine that all panels in any one sign match.

00940.03 Drawings - Copies of working drawings for non-standard signs will be made available to the Contractor by the Engineer. Standard signs called for in the Contract Documents shall be constructed using drawings available in FHWA's "Standard Highway Signs" (FHWA English Version) or ODOT's "Sign Policy and Guidelines for the State Highway System". The ODOT sign policy is available ~~for purchase from~~on the ODOT ~~Procurement Office, Salem~~Traffic-Roadway Section web site.

Materials

00940.10 Materials - Furnish materials for signs meeting the requirements of Section 02910.

Construction

00940.40 General - Finished signs shall conform to the designs shown or specified.

Choose the substrate material from the following table:

Sign Size	Acceptable Substrate Materials
Up to 4 feet ~~x~~by 5 feet	Sheet aluminum Plywood Extruded aluminum panels
From 4 feet ~~x~~by 5 feet to 4 feet ~~x~~by 8 feet	Plywood Extruded aluminum panels
Over 4 feet ~~x~~by 8 feet	Extruded aluminum panels
Over 8 feet in any dimension	Extruded aluminum panels

Street name signs mounted on signal pole mast-arms, and EXIT ONLY panels riveted to extruded aluminum panels, may exceed the width limit of 4 feet for sheet aluminum substrate.

See Table 02910-1 in Section 02910 for sheet aluminum thicknesses for various sizes of signs.

Fabricate all components of each individual sign with sheeting from the same supplier, to ensure that all components are compatible, and are warrantable by the manufacturer. Removable legend does not have to be fabricated with sheeting from the same supplier as the background sheeting on the sign panels.

Construct standard signs as shown in the FHWA "Standard Highway Signs" manual or in ODOT's "Sign Policy and Guidelines for the State Highway System".

00940.41 Aluminum Panel Sign Fabrication:

(a) General - Fabricate aluminum panel signs as shown or specified. Do not round corners of panels outside the border. Reinforced sheet aluminum signs will not be allowed. All aluminum used for sign panels shall be new material.

(b) Extruded Aluminum - Each panel of extruded aluminum panel signs shall be a continuous section. Apply the sign sheeting to the extrusion a sufficient distance around the edge to ensure that no aluminum surface is visible on the face of the sign.

(c) Sheeting - The sign sheeting applied to the extrusions shall be the background color of the sign.

(d) Legend - Signs consisting of only one extrusion may use permanent legend.

(e) Transparent Paste - Do not use transparent paste background on extruded aluminum signs.

00940.42 Sheet Aluminum Sign Fabrication:

(a) General - Cut the sheet aluminum sign to size and shape as shown or specified. The sign shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

Before application of retroreflective, reflective, or nonreflective sheeting, treat the entire surface of the sign with a conversion film according to the sheeting manufacturer's recommendations.

(b) Mounting Holes:

(1) On Posts - Signs having a vertical dimension of less than 48 inches and mounted on wood or metal posts shall have at least two mounting holes. Signs having a vertical dimension of 48 inches or greater shall have three mounting holes. Place the third mounting hole near the center of the sign. Locate mounting holes so the mounting hardware will not cover any portion of the legend unless otherwise shown.

(2) On Extruded Aluminum Signs - Provide a minimum of eight mounting holes for sheet aluminum signs mounted on extruded aluminum signs.

00940.43 Plywood Sign Fabrication - Perform all fabrication with saw blades that do not tear plywood grain. Cut all holes clean and uniform. Splicing will not be allowed unless specified. Locate mounting holes so that the mounting hardware will not cover any portion of the legend. Provide mounting holes for signs according to 00940.42(b).

After fabrication and before the application of retroreflective, reflective, or nonreflective sheeting, seal all edges with plywood sealer tinted to match the color of the panel overlay material. Where retroreflective, reflective, or nonreflective sheeting is to be applied, prepare the surface of the sign according to the sheeting manufacturer's recommendations.

00940.44 Retroreflective, Reflective, or Nonreflective Sheeting Application - Apply the sheeting according to the sheeting manufacturer's recommendations on extruded aluminum panel signs. Up to 25~~%~~ percent of the extruded aluminum panel signs required in the plans will be allowed one manufacturer's splice for each sign. One patch will be allowed for each 50 square feet of sign to a maximum of three patches for each sign. Patches shall be between 3/4 inch and 3 3/8 inches in diameter. No Contractor splices will be allowed.

On all other signs, manufacturer's splices will not be allowed except as noted on approved shop drawings, or when sign dimensions exceed the sheeting manufacturer's capabilities. Make these splices horizontal with the upper section of sheeting overlapping the lower by a minimum of 3/8 inch on encapsulated lens sheeting, and butt splice prismatic lens sheeting with no appreciable substrate visible. The use of overlaid transparent paste or electronic cuttable film will not be allowed on overlapped splices. No Contractor splices will be allowed.

00940.45 Legend Installation:

(a) General - The word "legend" means the entire message and border for a sign. A group of words, numbers and/or symbols constitute the "message" for a sign. Install the type of legend for each traffic sign as shown and according to 00940.02.

Spacing between letters and/or numbers shall conform to the FHWA "Standard Alphabets for Highway Signs" manual.

Spacing between words for Series "E" (modified) legend shall be 1.5 times the upper case letter height. Spacing between words for other fonts shall be as tabulated below unless otherwise shown:

Legend Series	Word Spacing
B	(0.531) H
C	(0.625) H
D	(0.836) H
E	(1.000) H

H = height of upper case letter

Spacing between symbols shall conform to FHWA "Standard Highway Signs" unless otherwise shown.

Space all lines equally between side borders unless otherwise shown. Space the legend vertically as shown. For diamond shaped signs, space between lines in the legend a minimum of one half the average letter height and space between the message and the borders equally so the message is centered on the sign.

(b) Attachment - Attach removable legend to aluminum panels using aluminum, domed head, 1/8 inch diameter, self-plugging blind rivets. Remove aluminum shavings from the sign face before attaching the legend. The entire sign will be rejected if any shavings are left beneath the legend. Drill 0.128 inch diameter holes in the removable legend and sign panel as shown on the "Mounting Details for Removable Legend" standard drawings.

Apply screened legend according to the sheeting manufacturer's recommendations. Apply cut-out legend according to 00940.44.

Attach 1 inch retroreflective removable border sections by placing two rivets 1/2 inch from the end of each border section with additional rivets spaced at a maximum of 6 inches apart, centered in the section. Corner border sections shall be attached with a minimum of five rivets, two rivets 1/2 inch from each end, and the remaining rivet centered in the middle of the section.

Attach 2 inch retroreflective removable border sections by placing two rivets 1/2 inch from the end of each border section with additional rivets spaced at a maximum of 6 inch apart, along the top

and bottom edge of the section. Corner border sections shall be attached with a minimum of five rivets, two rivets 1/2 inch from each end, and the remaining rivet centered in the section.

(c) Border Sizes - Unless otherwise shown, the width of the sign borders shall be according to the following:

Maximum Letter Size	Border Width
5" Capital or Upper Case	1/2 inch
8" or 10 2/3" Upper Case	1 inch
10" or 12" Capital	1 inch
13 1/3" or 16" Upper Case	2 inches
15" or 16" Capital	2 inches

The corner radii shall be approximately one-eighth of the least dimension of the sign. Determine the corner radii by rounding this approximate value to the nearest 1 1/2 inches, 3 inches, 6 inches, 9 inches, or 12 inches.

Except for the corners, mount the border flush with the edge of the sign. Do not round the corners of the aluminum panels.

00940.46 Inspection - The Engineer will inspect signs at the fabrication shop or at the jobsite. Inspection will be for conformance to the plans and Specifications~~. Testing~~, and for conformance to nighttime visibility~~ will be according to ODOT TM 804~~. The Contractor's expense for sign inspection will be according to 00165.91.

00940.47 Sign Erecting - Erect all signs at the locations staked and as shown or directed. Do not erect individual signs until the sign is complete with legend. Signs not mounted as shown or directed will not be accepted.

Erect the signs so the sign face is vertical, unless otherwise directed.

When signs are installed on supports 10 feet or less from the edge of guardrail, curb, or shoulder, set them to reflect 3 degrees away from traffic. When signs are installed on supports more than 10 feet from the edge of guardrail, curb or shoulder, set them to reflect 3 degrees toward traffic.

The closest edge of any column or overhead sign structures shall be as shown.

Where signs are mounted to supports by bolting through the sign, a sheeting manufacturer approved lubricant may be used on the nylon and metal washers to prevent sign sheeting deformation. Replace damaged signs, or signs with sheet deformation, with new signs at no additional cost to the Agency.

If a sign installation is a replacement for an existing sign, install the new sign immediately after removal of the existing sign unless otherwise directed.

Measurement

00940.80 Measurement - The quantities of signs will be measured on the area basis, by multiplying the height by width, using the dimensions shown. No deductions will be made for irregular shapes cut from the rectangle.

Route markers and other signs fastened to the face of larger signs will be measured as separate signs.

Payment

00940.90 Payment - The accepted quantities of signs will be paid for at the Contract unit price, per square foot, for the item "Type _____ Signs In Place".

The type of sign will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for work done under this Section will be limited to 75~~%~~ percent of the amount due until the Agency has received the signed warranties required by 02910.75.

Section 00941 - Sign Covers

Description

00941.00 Scope - This work consists of covering sign faces as shown, specified, or directed.

Materials

00941.10 Materials - For permanent signs, furnish sign covers from the QPL or porous cloth covers pre-approved by the sign sheeting manufacturer. Do not use plywood.

For temporary signs comply with Section 00225.

Construction

00941.40 Fabrication - Fabricate sign covers in one piece, unless otherwise directed. Make them large enough to completely cover the sign, and capable of easy attachment to the sign without damaging the sign face.

00941.41 Installation - Lap covers over all sign edges and secure to the sign or support as recommended by the sign sheeting manufacturer.

00941.42 Alternate - The Contractor may elect one or more of the following as alternate methods subject to approval:

- Install signs in conjunction with the movement of the traffic flow.
- Remove demountable legend from signs and re-install legend as directed.
- Remove entire sign and store in a vertical position for future reinstallation.

Measurement

00941.80 Measurement - No measurement will be made for sign covers.

Payment

00941.90 Payment - No separate or additional payment will be made for sign covers or for the alternate methods listed in 00941.42. Payment will be included in payment made for the appropriate items under which this work is required.

Section 00950 - Removal of Electrical Systems

Description

00950.00 Scope - This work consists of removing existing electrical systems as shown or specified.

00950.02 Definitions:

Electrical Systems - Electrical systems will be described in the Special Provisions.

Construction

00950.40 General - Remove existing electrical systems in the order directed.

Keep existing electrical systems to be removed in operation until the new electrical systems are ready to be turned on or as directed. Keep authorized downtime to a minimum. Perform the changeover with a minimum disruption to traffic.

Remove existing materials, as specified or approved, which interfere with or which are incompatible with new construction before completion of the new construction. Notify the Engineer at least ~~four~~ 4 calendar days in advance of removal.

00950.41 Removal and Abandonment - Remove from the right of way ~~conductors, junction boxes, wood poles, and foundations.~~electrical systems as shown. Dispose of materials according to 00290.20. Abandon conduit by removing all wiring, elbows, and risers.

~~If a foundation is shown as abandoned, remove~~Remove the top of the foundation, anchor bolts, and conduits to a depth not less than 2 feet below the adjacent finished ground line. Backfill resulting holes with material equivalent to the surrounding material. Finish and blend the surface area to the adjacent surface area.

Repair all holes or damage to existing surfacing caused by removal of existing installations as directed at no additional cost to the Agency.

00950.42 Salvaging and Stockpiling Materials - Electrical systems to be salvaged and stockpiled will be described in the Special Provisions.

Measurement

00950.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00950.90 Payment - Payment for work performed under this Section will be made by either method "A" or method "B" as follows:

- **Method "A"** - Method "A" will be used when existing electrical systems are removed and replaced with new electrical systems. Under method "A" no separate payment will be made for removal of electrical systems.

  Payment for removal of existing electrical systems will be included in payment made for the appropriate new electrical system.

- **Method "B"** - Method "B" will be used when existing electrical systems are removed and are not replaced with new electrical systems. Under method "B" payment will be made at the Contract lump sum amount for the item "Removal of Electrical Systems".

  Payment will be payment in full for all furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for salvaging and stockpiling materials.

Section 00960 - Common Provisions for Electrical Systems

Description

00960.00 Scope - This work consists of furnishing and installing materials for electrical systems and for modifying existing systems.

00960.01 Regulations, Standards, and Codes - All electrical materials and workmanship shall conform to the following standards where applicable:

- American National Standards Institute (ANSI)
- International Municipal Signal Association (IMSA)
- Underwriter's Laboratories, Inc. (UL)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Electrical Code, Oregon Amended (NEC)
- Standards of the American Society for Testing and Materials (ASTM)
- Local laws

Wherever reference is made to any of the standards mentioned above, the reference means the code, order, or standard in effect on the date the Project is advertised unless otherwise shown or specified in the Specials Provisions.

Do not begin installations until all permits are obtained and copies are given to the Engineer.

00960.02 Equipment List and Drawings - Within 30 calendar days after execution of the Contract, submit at least six copies of:

- A list of materials the Contractor proposes to install. List all material shown or specified by manufacturer's name, size, and identity number of each item. Supplement the list with other data, including but not limited to, detailed scale drawings.
- Wiring diagrams for all circuits and any nonstandard or special equipment.
- Brochures, technical bulletins, parts lists, service instructions, working drawings and other technical information relative to products proposed for use on the Project.

Use materials from the current list of acceptable materials. The updated list is available from the Engineer. Mark the list according to the instructions on it. The list eliminates the need for most catalogue cutsheets.

All engineered details and drawings which are not prepared by the Agency, but are required in the Contract Documents, shall be submitted for review prior to fabrication. Submit stamped designs, details, plans, and calculations according to 00150.35.

Upon completion of the installation, submit six copies of all changes made from the original plans. The information furnished shall include all modifications made and shall represent the material installed and in operation. It shall be sufficiently detailed to enable maintenance forces to replace or repair any part of the Project under routine or emergency maintenance by direct reference.

Materials

00960.10 Materials - Furnish electrical materials meeting the requirements of ~~Section~~Sections 02920, 02925, and 02926.

Furnish concrete meeting the requirements of Section 00440.

Labor

00960.30 Licensed Electricians - According to the Oregon Administrative Rule 918-282-0120(1), every person engaged in the installation of electrical equipment and wiring systems shall possess a valid Oregon Electrical Supervising or Journeyman's License, or be registered as an Electrical Apprentice. Every person who installs electrical systems on the Project shall submit a copy of his or her electrical license or apprentice registration to the Engineer prior to performing any work.

Construction

00960.40 General - The Agency will continue normal maintenance and operations of the existing systems including the furnishing of electrical energy.

00960.41 Excavation:

(a) General - Remove and replace sidewalks, paved surfaces, and other materials as needed. Place the conduit under curbs without disturbing curbs. Replace and finish all surfaces to correspond with the existing surfaces. Restore all disturbed landscaping and underground systems to original condition. Use hand excavation if directed.

Excavate trenches to lines, grades and cross sections established or approved. Furnish, place, and remove any shoring required to prevent caving of walls.

When excavating in paved areas, cut with an approved pavement cutting saw to a depth of at least 2 inches along the neat boundaries of the area to be removed. Cut sharp and well-defined pavement edges with no evidence of cracking, delaminating, or stressing.

(b) Excavation for Pedestal and Cabinet Foundations - Make all excavations to the neat lines of the foundations. Hand excavation may be required. Place the concrete directly against the sides of the excavation in undisturbed or well-compacted material or place in forms.

(c) Excavation for Conduit - Excavate and backfill conduits as follows:

Minimum Cover from Finished Surface [1]

Type of Conduit	Roadway and Shoulders	Other Areas
Metal	24 inches	18 inches
Rigid Nonmetallic	30 inches	18 inches

[1] Use permit depths if greater than these.

(d) Conduit under ~~Paved Surfaces~~Roadway and Shoulders - Install conduit under all ~~paved surfaces~~roadway and shoulders by horizontal directional drilling or the open trench method.

(1) Horizontal Directional Drilling - Drilling shall not "hump" or deform the pavement and shall be guided. Keep drilling pits at least 2 feet from the edge of pavement unless otherwise

authorized in writing. Do not use water to the extent that the pavement might be undermined or subgrade softened. Sand bedding and marking tape are not required with this method.

(2) Open Trench - If the open trench method is used, do the following:

a. Width - Hold trench width to a practical minimum.

b. Pavement Cuts - Cut the existing pavement as required in 00960.41(a).

(e) Conduit under Railroad Tracks - Install conduit inside a galvanized, rigid metal conduit at the depth required by the governing railroad company. Construct so that conduit ends are at least 30 feet beyond the centerline of every track or other distance as required by the railroad.

(f) Disposition of Waste Materials - Dispose of all ~~waste~~ materials according to ~~00330.41(a-5).~~00290.20.

(g) Backfill - Use an approved sand blanket, selected general backfill meeting the requirements of 00330.13, selected granular backfill meeting the requirements of 00330.14, or ~~concrete~~controlled low strength material (CLSM) meeting the requirements of Section ~~00440~~00442 as follows:

(1) Rigid Nonmetallic Conduit - For rigid nonmetallic conduit, provide bedding, cover, and backfill according to the following:

a. Bedding - Place 2 inches of sand blanket in trench bottom before placing conduit.

b. Cover - Cover conduit with 2 inches of additional sand blanket.

c. Backfill - Backfill according to the following:

1. New Roadway and Shoulder - Place selected granular backfill material in layers not greater than 6 inches thick. Compact the selected granular backfill material according to 00405.46(c-2).

2. Existing Roadway and Shoulder - Backfill all conduit trenches with CLSM ~~according to Section 00442.~~. Place to an elevation 6 inches below the ~~surface of the~~ existing ~~pavement~~surface or to the bottom of the existing pavement, whichever is lower. When this method is used the sand blanket may be omitted.

3. ~~Unpaved~~Other Areas - Place selected granular backfill material in layers not greater than 6 inches thick. Compact the selected granular backfill material according to 00405.46(c-2) to the top of trench, surrounding ground level or upper limit of excavation. The sand blanket requirement of a. and b. above may be deleted as approved when excavated material does not contain large, angular stones that could fracture or dent conduit.

d. Pavement - Place and compact ~~AC~~ACP and PCC according to Sections 00744, 00745, 00755, and 00756, as applicable, and the following:

1. Existing Non-roadway Pavement - Match existing surfacing thickness.

2. Existing Roadway and Shoulder - Match existing surfacing thicknesses or provide a minimum surfacing thickness of 6 inches, whichever is greater.

3. Finish - Finish to a smooth riding surface.

(2) Rigid Metal Conduit - For rigid metal conduit, provide backfill according to 00960.41(g-1-c) and 00960.41(g-1-d) except the sand blanket is not required.

00960.42 Conduit:

(a) General - Conduit runs shown on the plans are for bidding purposes only. Locations may be changed to avoid obstructions. Larger size conduit than specified may be used at the option and cost of the Contractor. Use the same size conduit for the entire length, outlet to outlet.

Use non-metallic or rigid metal conduit as shown or specified.

Install a No. 16 AWG THWN stranded copper wire with orange base and blue tracer in all conduits as a locate wire, even if not shown. Extend the wire 2 feet beyond conduit ends and install a wire nut. Do not join multiple locate wires under a common wire nut.

In areas to be paved or landscaped, place all conduit before paving or landscaping.

If corrosive soil conditions exist, coat metallic conduit with a non-metallic coating or wrap with corrosion protection tape at least 10 mils thick.

(b) Conduit on Wood Poles - Mount conduit on wood poles with two-hole, galvanized, steel conduit straps spaced no more than 3 feet apart. Mount conduit on utility-owned wood poles according to local utility regulations. Use stand-off brackets if required.

(c) Conduit on Metal Poles - Mount conduit on metal poles with 3/4 inch, stainless steel straps or a single-hole, galvanized steel strap, drilled and tapped with galvanized bolts. Place straps no more than 3 feet apart. After tightly drawing steel bands, cut and fold under the ends to eliminate protruding edges.

(d) Conduit in Foundations - Use fiberglass conduit and extend it as follows:

- 2 inches to 3 inches vertically above the top of the foundation
- 10 inches to 12 inches horizontally beyond edge or vertically below the foundations

(e) Underground Conduit Installation - Make conduit runs continuous between any pole, junction box, or cabinet. Do not cover conduit runs until inspected. Permanently mark all underground open trench conduit runs, except when CLSM is used as backfill, by installing an underground marking tape directly over the conduit.

The underground marking tape shall be:

- Placed 6 inches ± 1 inch below the surface.
- Continuous between pole bases, junction boxes and cabinet locations.

(f) Elbows - Use a standard factory fiberglass bend where a conduit bend is required that:

- Has a radius of at least six times the inside diameter of the conduit.
- Is bent without crimping or flattening.
- ~~Is fiberglass conduit.~~

(g) Conduit Ends and Couplings - Ream the ends of all conduits to remove burrs and rough edges. Make cuts square and true so the ends will fit together for their full circumference. Slip joints or running threads will not be allowed for coupling conduit. Plug or cap all conduit ends

until wiring is installed. After wiring is installed install duct seal compound or precut closed cell polyethylene foam that will prevent debris from entering the conduit system.

(1) Metallic Conduit - Paint the following with rust-preventative coating:

- Threads on all metal conduit
- Areas where the coating has been damaged so underlying metal is exposed.
- Exposed, ungalvanized threads resulting from field cuts.

(2) Nonmetallic Conduit - Connect nonmetallic conduit with solvent welds. Use a nonmetallic female threaded connector to connect nonmetallic conduit to metallic conduit.

(3) Riser - Provide and install conduit risers within junction boxes according to the following:

- Use PVC conduit risers with fiberglass elbows.

(4) Bushings - Provide and install bushing according to the following:

- **Push on PVC End Bell** - Use push on PVC end bells with fiberglass elbows, PVC risers, nonmetallic junction boxes with nonmetallic lids.
- **Metallic Bushing** - Use metallic bushings with rigid metallic elbows, metallic risers, and junction boxes containing circuits less than 25 V.
- **Metallic Bonding Bushing** - Use metallic bonding bushings with rigid metallic elbows, metallic risers, and junction boxes containing 25 V or greater circuits.

(h) Conduit in Junction Boxes:

(1) General - Install conduit in junction boxes according to the following:

- Enter through the bottom of boxes.
- Enter the box from the direction of the run.
- If shown, terminate conduit 1 inch inside the box wall when entering through the side walls.

(2) Cast Iron Junction Boxes - Conduit entrances into new or existing cast iron junction boxes shall:

- Use a watertight malleable iron hub for metal conduit entrances when installed in pavement or earth.
- Use lock nuts and a metallic bushing for metal conduit entrances when installed in cast in place portland cement concrete walls, barrier, or structures.
- Be cut with a hole saw.
- Repair damage to galvanizing.

(3) Concrete Junction Boxes - Install conduit entrances into concrete junction boxes according to the following:

- Locate conduits near the end walls to leave the major portion of the box clear.
- Orient conduit ends towards the top of the box so that conductors may be pulled out of the conduit from the top of the box without touching the side of the box or other conduits.

(i) Conduit Installed for Future Use - If conduit is noted on the plans for future use, with no conductors installed, insert a polyethylene pull line.

Include 3 feet of slack in the polyethylene pull line within the conduit and 3 feet outside the conduit.

(j) Existing Conduit - Use existing conduit only where shown. Clean existing conduit, without conductors, with a mandrel or cylindrical wire brush, and blow out with compressed air before incorporating into the new system.

(k) Conduit In or On Structures - Install conduit in or on structures as shown. Use expansion fittings at all expansion joints in or on a structure.

(l) Installation by Horizontal Directional Drilling - If jointed conduit is used, verify the joints have not separated by pulling a mandrel through the conduit after installation.

00960.43 Foundations:

(a) General - Construct foundations for pedestals, posts, and cabinets according to Section 00440 and the applicable portions of 00540.48(a). Place concrete:

- With a continuous pour.
- To the elevation shown or directed.
- With conduit ends and anchor ~~bolts~~rods held securely in proper vertical position, to proper height, using a manufacturer's recommended template until the concrete sets.
- Maintain rebar clearances during concrete pour.

Make no adjustment of anchor ~~bolts~~rods after concrete has set.

Set forms square and true to line and grade. Construct forms of rigid materials that remain in position until removed.

Remove forms and place subsequent loading according to Table 00540-1.

Finish tops of foundations to roadway, sidewalk or curb grade, or as directed.

Finish exposed concrete foundations to present a smooth, neat appearance. Fill all holes.

Where breakaway bases are specified, the post stub projection shall not exceed the limits shown.

(b) Treatment for Aluminum-Concrete Contact - Separate the aluminum from the concrete with one layer of 30 pound nonperforated, asphalt-saturated felt. Neatly trim the felt pad to the size and shape of the base contact surface.

00960.44 Junction Boxes:

(a) General - Install junction boxes at the approximate locations shown, or, if not shown, no more than 300 feet apart. The Contractor may, at no additional cost to the Agency, install additional junction boxes to facilitate the work.

The tops of junction boxes installed in the ground or in sidewalk areas shall be flush with the surrounding grade or top of curb. ~~Where practical, place~~Place pull boxes as shown ~~behind curbs against the back of the curb~~. If installed in the roadway or shoulder, leave the top of junction box

1/2 inch below the pavement surface. If installed outside roadways or shoulders, install a portland cement concrete apron around the junction box.

In boxes having an open bottom, construct a sump of reasonably well graded 3/4" - 0 crushed gravel, 12 inches deep covering the approximate area of the box. Do not install conductors until the sump has been constructed.

(b) Junction Box Locations - Mark the location of all flush-mounted junction boxes installed in unsurfaced areas with a Type 1 delineator, placed 3 feet behind the box, or as directed. Use white targets with black, 3 inch, series "B" letters reading "JCT. BOX". Reflectors are not required.

00960.45 Cable and Wire - Arrange wiring neatly within cabinets and junction boxes. Use electrical lubricants when inserting conductors in conduit. Before pulling wires through underground conduit runs, blow the conduit out with 120 cubic feet per minute compressed air.

Before cable and wire installation, clean all existing and new conduit with cylindrical mandrel of the proper size for that conduit and blow out with compressed air. Mechanical pulling methods may be used for conduit cleaning.

Do not use tapes, straps, ties or other binding materials to bundle single conductors or cables together inside conduits or poles. Bundling of conductors or cables will be allowed at the terminating end points for pulling only.

Pull all wire and cable by hand and on a straight line with the conduit opening to prevent damage to wire and cable insulation. If pulls are made with poles or controller cabinet in place, use a pulley device to achieve a straight pull.

If an existing pull line is used, replace the existing pull line with a new pull line during the installation.

00960.46 Wiring Practices:

(a) General - Install electrical system and electrical system components in a neat and workmanlike manner.

(b) In-Line Fuse Holder - Insulate terminal ends using either heat shrink tubing or electrical insulating rubber tape over-wrapped with electrical vinyl plastic tape as specified.

00960.47 Wood Poles - Submit wood pole designs according to 00960.02 including proposed ANSI 05.1 wood pole Class, guy anchor and span wire designs, and pole setting depths.

00960.48 Coating - Coatings shall conform to all applicable portions of Section 00594. Do not paint equipment fabricated of aluminum, stainless steel, or hot-dipped galvanized material, except as shown or specified.

00960.49 Electrical Service:

(a) General - Service points shown on the plans are approximate only. The exact location will be determined in the field. Wiring connections to the terminal screws on the circuit breakers and contactors shall make full contact under the screw head. Size and depth of power service conduit shall be as specified by the supplying power company.

Equip each service cabinet with a solid copper neutral bus and the number and size of switches or circuit breakers shown or specified. Notify the local serving utility before making any connections to utility poles.

As a part of each service installation, furnish and install a meter base approved by the serving utility (with cover, if required by the utility), when shown.

(b) Circuit Breakers - Provide circuit breakers of the rating shown or specified.

00960.50 Grounding and Bonding:

(a) General - Make all ground rods, metal conduit, metal poles, grounding wire, metallic junction boxes, metallic junction box covers, and cabinets mechanically and electrically secure to form a continuous, effectively grounded and bonded system. Ground/bond wire shall be No. 6 AWG stranded copper wire or as shown.

(b) Ground Rods - Drive ground rods into the ground with the top about 6 inches below the finished grade at the ground rod locations. Ground each above ground metallic structure with a separate ground rod. The equipment ground rod may be placed in the foundation if shown, or in the first junction box nearest the equipment.

(c) Services and Cabinets - Bond the neutral conductor, the control cabinets, and the metal base to the grounding electrode system.

(d) Structure Mounted Poles and Cabinets - Bond all poles and cabinets mounted on structures or walls to a common ground rod at the end of the structure. Ground the system at the first convenient acceptable location off the structure.

(e) Wood Poles - Bond all metallic conduit, messenger cable, terminal cabinet, and other metallic parts within 10 feet of the ground line.

(f) Nonmetallic Conduit - In all nonmetallic conduit, run a ground/bond wire continuously between all poles, pedestals, posts, and cabinets. Bond wires are not required in conduit that only contains circuits that operate at less than 25 volts.

(g) Metallic Junction Boxes and Lids - Bond metal junction boxes and lids to form a continuous effectively grounded and bonded system with metallic conduit, grounding wire, metal standards and controller cabinets. Leave enough slack in the bond wire connected to the lid to allow complete removal of the lid. Junction boxes only containing circuits that operate at less than 25 V do not need to be bonded.

00960.70 Electrical Energy - Obtain the required permits and have the power service inspected by the utility providing power. Arrange for the utility to make the electrical hookup. When agreeable to the Agency and the local power company, power consumption for traffic signals may be flat-rated.

Electrical energy costs will be billed to the Agency or those named in the construction agreement for permanent installations. Do not use for construction purposes electrical energy billed to the Agency or other agencies.

Section 00962 - Metal Illumination and Traffic Signal Supports

Description

00962.00 Scope - This work consists of furnishing, fabricating, galvanizing, and installing materials for illumination and traffic signal supports and foundations. The location of illumination/signal material shown is approximate, with exact locations established in the field.

00962.01 Regulations, Standards, and Codes - All designs and workmanship shall conform to the following standards where applicable:

- AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals
- AWS D1.1

Wherever reference is made to any of the standards mentioned above, the reference means the code, order, or standard in effect on the date the Project is advertised unless otherwise shown or specified in the Specials Provisions.

Do not begin installations until all permits are obtained and copies are given to the Engineer.

00962.02 Calculations and Drawings - Within 30 calendar days after execution of the Contract, submit at least six copies of:

- Pre-approved manufacturing shop drawings
- Calculations and shop drawings of all nonstandard poles
- Calculations and installation drawing of all nonstandard pole foundations

All engineered details and drawings which are not prepared by the Agency, but are required in the Contract Documents, shall be submitted for review prior to fabrication. Designs, details, plans, and calculations shall be stamped and submitted according to 00150.35. Include the Field Verification Forms for Signal and Illumination supports, available from the Engineer.

Upon completion of the installation, submit six copies of all changes made from the original plans. The information furnished shall include all modifications made and shall represent the material installed and in operation. It shall be sufficiently detailed to enable maintenance forces to replace or repair any part of the Project under routine or emergency maintenance by direct reference.

00962.05 Design - Design all traffic signal and illumination poles according to the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

(a) Traffic Signal Mast Arm Supports - Design non-standard poles and foundations according to the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 4th Edition" with 2001, 2002, and 2003 interim revisions. Design factors include:

Basic wind speed (3 second gust) .....~~110 mph~~As shown
Gust factor (G) 1.14
Importance Factor (Ir) .....1.0 (50 year recurrence interval)
Fatigue Category II

(b) Traffic Signal Strain Pole Supports - Design non-standard poles and foundations according to the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 4th Edition" with 2001, 2002, and 2003 interim revisions. Design factors include:

Basic wind speed (3 second gust) .....~~110 mph~~As shown
Gust factor (G) 1.14
Importance Factor (Ir) .....1.0 (50 year recurrence interval)

Fatigue design is not required.

(c) Illumination Supports - Design non-standard Luminaire slip base, fixed base, and high mast poles and foundations according to the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 1994". Design factors include:

Basic wind speed (fastest mile per hour) ..... 100 mph

Materials

00962.10 Materials - Furnish materials meeting the following requirements:

Anchor Rods 02560.30
Commercial Grade Concrete.....00440
High-Strength Fasteners 02560.20

Furnish steel pole materials meeting the requirements of 02530 modified as follows:

- Provide steel sheet for pole and arms meeting the requirements of ASTM A 595, Grade A or B, ASTM A 572, or approved equal.
- Provide all other steel sheet and plate meeting the requirements of ASTM A 36 or ASTM A 572, or approved equal.
- Supplementary Requirement S18 (ASTM A 6), maximum tensile strength, is required.
- Galvanized base plates and small and hidden pieces do not require controlled silicon content.

Construction

00962.41 Excavation - Protect all existing pipes that become a part of a foundation as directed by the Engineer or local utility company.

Do all excavation, backfilling and resurfacing work necessary to complete the work. This includes removal and replacement of curbs, sidewalks, paved surfaces and other materials. On completion of the work, replace and finish all surfaces to correspond with the existing surfaces.

Furnish, place, and remove any shoring required to prevent caving of walls.

When excavating in paved areas, cut with an approved pavement cutting saw to a depth of at least 2 inches along the neat boundaries of the area to be removed. Cut sharp and well-defined pavement edges with no evidence of cracking, delaminating, or stressing.

Restore all disturbed landscaping and underground systems to original condition upon completion of the work at no additional cost to the Agency. Use hand excavation if directed.

(a) Excavation for Poles Foundations - Make all excavations for pole foundations to the neat lines of the foundations. Hand excavation may be required. Place the concrete directly against the sides of the excavation in undisturbed or well-compacted material.

(b) ~~Disposition~~Disposal of ~~Waste~~ Materials - ~~On completion of the work, dispose~~Dispose of all ~~waste~~ materials according to ~~00330.41(a-5).~~00290.20.

00962.43 Foundations - Construct foundations according to Section 00440 and the applicable portions of 00540.48(a). Place concrete as follows:

- With a continuous pour.
- To the elevation shown or directed.
- With conduit ends and anchor rods held securely in proper vertical position and height with the manufacturer's recommended template until the concrete sets.

Make no adjustment of anchor rods after concrete has set. Any adjustment made may be cause for rejection of the foundation.

Maintain rebar clearances during concrete pour.

Set forms square and true to line and grade. Construct forms of rigid materials that remain in position until removed. Use a steel template to accurately locate the anchor rods and hold them plumb and in proper alignment. Out-of-position anchor rods and anchor rods installed more than 40V:1H out of plumb are cause for rejection of the foundation. Field bending of anchor rods and field modification of the base plate are not allowed.

Remove forms and place subsequent loading according to Table 00540-1.

Finish tops of foundations to roadway, sidewalk or curb grade, or as directed.

Finish exposed concrete foundations to present a smooth, neat appearance. Fill all holes.

Where breakaway bases are specified, the post stub projection shall not exceed the limits shown.

Where obstructions prevent the construction of planned foundations, construct the foundations in the location directed. Any extra cost due to the site change will be paid according to ~~Section 00196~~ 00195.20.

If it is determined that foundations will extend deeper than shown, the extra foundation depth will be paid according to ~~Section 00196~~00195.20.

(a) Design of Illumination Pole Foundations - Design non-standard foundations according to the Rutledge method using a S1 allowable average soils stress of 1,500 pounds per square foot unless site conditions do not meet poor soil requirements as listed in the Rutledge method.

(b) Design of Non-Standard Foundations - Design non-standard foundations according to the Agency's Traffic Structures Design Manual

(c) Installation of Traffic Signal Pole Foundations - Construct drilled shafts according to Section 00963.

00962.46 Steel Illumination and Signal Poles - Metal poles include vertical posts, signal mast arm, luminaire arms, connection hardware, and anchor rods. Do not erect poles until the Engineer has made a visual inspection of pole welding.

Fabricate entrance openings in metal poles and arms, including handholes, before galvanizing, except as shown for mounting traffic signal material.

(a) Design - Design all metal poles with self-supporting upsweep arms similar to the details shown.

(b) Pole Height - Before poles are ordered, the Engineer will check the pole heights in the field and verify that the specified luminaire mounting heights above pavement are provided. Provide upsweep bracket arms of lengths shown in the Metal Light Pole Table or shown on the plans. Provide traffic signal poles of heights as shown or specified. Height of poles requiring slip plate bases is the length of shaft above the slip plate.

(c) Mast Arm - Install mast arms for traffic signals and signs according to details provided by the manufacturer. Use proper type and size of mounting appurtenances that correctly fit the pole furnished, or as shown. Provide self-supporting mast arms without tie rods or braces. Provide tapered mast arms that are either round, 8 sided, 12 sided, or 16 sided.

All mast arms shall allow wiring entrances directly into the pole from inside the mast arm.

(d) Luminaire Arm - The luminaire end of the arm shall be level when loaded to design weight. Use a bolted, flange type connection to join the upsweep arm to the pole. The connection shall be raintight and shall develop the strength of the arm. Provide the mast arm rise according to the Metal Light Pole Table, or as shown or specified.

Arms shall be self-supporting without tie rods, or braces. Measure upsweep rise from the point of attachment to the pole to the end tangent portion of the arm. Provide tapered arms that are either round, 8 sided, 12 sided, or 16 sided.

All arms shall allow for wiring entrances directly into the pole from inside the arm.

All pole bracket attachments for mounting upsweep arms shall have reamed, smooth ends.

The nominal mounting height (MH) shown in the Metal Light Pole Table or on the plans is the distance between the roadway at the edge of the pavement and the luminaire. This height may vary plus or minus 1 foot.

(e) Deflection - The horizontal dead load deflection at the top of the poles shall not exceed 1~~%~~ percent of the pole length (2~~%~~ percent for strain poles).

(f) Deviation from Straightness - After the poles are delivered to the jobsite, and before they are erected on the foundations, the Contractor may be required to check any or all poles for deviation from straightness according to the following:

(1) Deviation in One Plane and One Direction Only - A straight line joining the surface of the pole at the base and the same surface of the pole at the top shall not be more than 1/2 inch from the surface of the pole for each 10 feet of length from the closest of these points. The opposite surface shall meet the same requirement.

(2) Deviation in Any Plane - A straight line connecting the midpoint of the pole at the base, with the midpoint at the top, shall not pass through the surface of the pole at any intermediate point.

Any pole not meeting these requirements will be rejected. If more than 25~~%~~ percent of the poles fail to meet these requirements, sufficient cause exists to reject the entire shipment of poles for the Project.

(g) Welding - Weld steel illumination and signal poles according to AWS D1.1. The fabricator shall inspect welds according to details and requirements called out on the Contract Documents. This requirement will override all appropriate weld inspection requirements called out in Section 5.15 WELDING CONNECTIONS in AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals". Submit all testing procedures for Engineer's review prior to starting inspection. Submit certified copies of inspection reports to the Engineer for review.

If requested by the Engineer, additional weld inspection may be required upon arrival of the material at the job site. If defects are found by this additional inspection, the Contractor shall be responsible for the additional testing and repair costs. If no defects are found, the Engineer will be responsible for the additional inspection costs.

(h) Welding Steel After Galvanizing - No field welding of galvanized steel will be allowed. The effected piece shall have the existing galvanizing removed from the heat effected area before welding. Perform the weld, remove the galvanizing totally from the entire piece, and hot-dip ~~galvanized~~galvanize it. Submit the following data, stamped according to 00150.35, for review:

- Explanation for modification
- Name of shop performing the work
- Welding procedure
- Description of the work that will be performed
- Name of the shop performing the hot-dip galvanizing

(i) Identifying Tags - Attach a stainless steel identifying tag to all poles. Provide tags that are at least 1/16 inch thick. Tag lettering shall be at least 1/4 inch in height, and be stamped into the tag. Attach tags with stainless steel pop rivets of at least 3/16 inch nominal body diameter. Do not locate pop rivet holes within 6 inches of welds. Locate the pole tag approximately 24 inches below the top of the mast arm or messenger cable attachment point. Locate the tag on the side of the pole furthest from the intersection. Drill holes for pop rivets prior to hot-dip galvanizing. Remove excess hot-dip galvanizing from holes and repair according to ASTM A 780.

Include the following information on the tags, if applicable:

- Manufacturer
- Month and year of manufacture
- Lum Arm Yield (ksi)
- Lum Arm thickness (inch)
- Mast Arm Yield (ksi)
- Mast Arm thickness (inch)
- Pole Yield (ksi)
- Pole thickness (inch)
- Base Plate Yield (ksi)
- Anchor Rod Yield (ksi)

(j) Erecting Metal Poles - Erect metal poles on concrete foundations and according to the recommendations of the pole manufacturer and as shown. Exercise reasonable care to prevent marking the finish and damaging poles.

Install all joint traffic signal and illumination poles so the distance from the pavement to the light center is as shown or specified. Use the same tapered design for traffic signal and street light arms.

Bolt protrusion on slip base poles shall not interfere with the breakaway action of pole. File sharp edges smooth and repair according to ASTM A 780.

(1) Repair Damaged Finish - Repair damaged galvanizing according to ASTM A 780. Minor scratches less than 3 inches long by 3/16 inch wide or an area of 1/2 square inch can be repaired with the sprayed zinc method.

(2) Assembly of Supports and Bolt Tightening - Nuts shall have full thread engagement.

a. Anchor Rods for Signal Supports and Fixed Base Luminaire Supports - After foundation concrete strength and curing requirements are satisfied and after inspection of the foundation, pole installation may begin.

Lubricate anchor rods and nuts according to 02560.70. Estimate the required rake, if any, and set the lubricated leveling nuts accordingly, so that when pole installation is complete and all appurtenances are installed on the pole, the top of the pole is plumb with the base of the pole.

Lift the pole into position on the leveling nuts and washers. Make sure all leveling nuts and washers are in full contact with the base plate.

Install washers and lubricated top nuts, and bring to a snug tight condition. Snug tight is defined as the condition when all plies of the connection are in firm contact, and can be obtained by the full effort of a worker on the end of a 12 inch long wrench. Several passes may be required to obtain uniform snug tightness.

When all anchor rods are snug tight, proceed with installation of arms and other appurtenances, if not previously installed. When installation of arms and appurtenances is complete, and the pole is plumb as defined above, final anchor rod tightening may begin. If the pole is not plumb, adjust as required and repeat snug tightening as described above. Make sure all leveling nuts and washers are in full contact with the base plate. As a safety measure, provide crane support of the pole until anchor rods tightening is completed.

Mark the position of each turned element (nut or bolt head) with a felt tip pen or similar marker. Rotate each top nut past snug tight by the amount shown in "d." below. Several passes may be required to obtain uniform final tightness. "Cheater" bars or slugging wrenches are allowed if required for large diameter anchor rods.

b. Anchor rods for Slip Base (Break-away) Luminaire Supports - After foundation concrete strength and curing requirements are satisfied and after inspection of the foundation, pole installation may begin.

Furnish, at no additional cost to the Agency, a calibrated torque wrench of a capacity appropriate to the size and type of the bolts being tightened. Confirm the accuracy of the calibrated torque wrench through calibration by an approved independent testing agency at least one a year.

Lubricate anchor rods and nuts according to 02560.70. Estimate the required rake, if any, and set the lubricated leveling nuts accordingly, so that when pole installation is complete and all appurtenances are installed on the pole, the top of the pole is plumb with the base of the pole.

Install the anchor plate on the leveling nuts and washers. Make sure all leveling nuts and washers are in full contact with base plate.

Install washers and lubricated top nuts, and bring to a snug tight condition. Snug tight is defined as the condition when all plies of the connection are in firm contact, and can be obtained by the full effort of a worker on the end of a 12 inch long wrench. Several passes may be required to obtain uniform snug tightness.

When all anchor rods are snug tight, proceed with the "Slip Base Bolting Procedure" as shown. When the slip base bolting procedure is complete, final anchor rod tightening may begin. As a safety measure, provide crane support of the pole until anchor rod tightening is complete.

Mark the position of each turned element (nut or bolt head) with a felt tip pen or similar marker. Rotate the top nut of each anchor rod past snug tight by the amount indicated in paragraph "d." below. Several passes may be required to obtain uniform final tightness. "Cheater" bars or slugging wrenches are allowed if required for large diameter anchor rods.

c. High-Strength Bolts in Mast Arm-to-Pole Connections and Luminaire Arm-to-Pole Connections - Lubricate high-strength bolts according to 02560.70. Provide all high-strength bolts with hardened flat washers under the element turned during tightening.

If arms or appurtenances are attached after pole erection, support them until bolts are snug tight.

Install high-strength 4-bolt connections to a snug tight condition. Snug tight is defined as the condition when all plies of the connection are in firm contact, and can be obtained by the full effort of a worker on the end of a 12 inch long wrench. Mark the position of each turned element (nut or bolt head) with a felt tip pen or similar marker. Rotate the top nut of each ~~anchor rod~~bolt past snug tight by the amount indicated in paragraph .d below. Several passes may be required to obtain uniform snug tightness.

Install high-strength 8-bolt connections according to 00930.40(d).

d. Final Tightening - Required final tightening of anchor rods and high-strength bolts are shown in the following Table:

Connection Type	Rotation Past Snug Tight
ASTM A 307 Anchor rods	30° (1/12 turn)
ASTM A 449 Anchor rods	60° (1/6 turn)
ASTM F 1554 Gr. 55 Anchor rods	60° (1/6 turn)
ASTM A 325 4-bolt connection	60° (1/6 turn)

(3) Bolt Inspection - The Engineer will observe the installation and tightening operations to ensure that proper procedures are followed. All inspections will be visual and no testing will be conducted.

Top surface of bolts or rods that are not flush or extend passed the top of the nut requires the rejection of the installation.

00962.48 Coating - ~~Coat~~Prepare and coat supports as shown or specified according to all applicable portions of Section 00593 or Section 00594~~.~~ as the Contractor elects with color as specified or shown. Provide paint for field application, repair damaged coatings, and paint hardware after installation. Do not paint:

- Slip plate or arm connected surfaces.
- Slip base bolting hardware.
- Anchor rods, anchor rod washers, and anchor rod nuts.

00962.50 Grounding and Bonding:

(a) Metal Poles - For fixed base poles, provide a 1/2 inch, Type 308, 309, or 310 stainless steel stud on the inside of the shaft. Locate the stud directly opposite and level with the handhole in the pole. Attach grounding electrode conductors and bonding conductors to the stud with a grounding wire clamp, "acorn style".

For slip base poles, do not allow the grounding wire to intrude into the slip plane. Instead, run a bond wire from the grounding electrode to a 1/2 inch, Type 308, 309, or 310 threaded stainless steel stud welded to the bottom base slip plate.

Section 00963 - Signal Support Drilled Shafts

Description

00963.00 Scope - This work consists of excavating and constructing drilled, cast-in-place, reinforced concrete shafts for signal supports according to these Specifications.

00963.01 Definitions:

Drilled Shafts - Reinforced concrete sections, cast-in-place against in situ soil, rock or a casing.

Temporary Casing - Casing installed to facilitate drilled shaft construction only and removed during or after concrete placement.

00963.02 Subsurface Investigation - The Soils and Geological Exploration Logs are available for review through the Engineer's office. The data shown for each test boring or test pit applies only to that particular boring or test pit. Subsurface conditions may vary between borings or test pits. Core samples and laboratory test results, if obtained and performed for the Project, are available for review by contacting the Engineer.

Materials

00963.10 Materials - Furnish materials meeting the following requirements:

~~Commercial Grade Concrete.....00440~~
Reinforcement.....00530 and 02510

Furnish commercial grade concrete meeting the requirements of Section 00440 except provide the mixture with a slump of 8 inches ± 1 1/2 inches.

00963.13 Steel Casing - Furnish temporary casing meeting the requirements of ASTM A 252 or ASTM A 36. Test each heat of steel at 40 °F with a minimum absorbed energy requirement of 15 foot pounds. Use casing of sufficient strength to resist handling, transportation and installation stresses and the external stresses of the subsurface materials. Ensure that the casing is clean and watertight prior to placement in the drilled shaft excavation. Use casing with an outside diameter not less than the specified drilled shaft diameter.

00963.19 Quality Control - Provide quality control according to 00512.19.

Labor

00963.30 Personnel Qualifications - Perform the drilled shaft construction work using a company and personnel experienced in drilled shaft construction work. Submit a list to the Engineer for approval identifying the on-site supervisors and drill rig operators assigned to the Project and the companies experience relevant to the project. Experience shall be relevant to the anticipated subsurface materials, groundwater conditions, shaft size, depth, and all special construction techniques required. Before the preconstruction conference, provide the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the drilled shaft construction:

- Submit a project reference list of at least three separate foundation projects, successfully completed in the last ~~five~~ 5 years, with drilled shafts of diameters and depths equal to or larger than those shown in the plans and in ground conditions similar to those indicated. Include a brief description of each project and the owner's contact person's name and current phone number for each project listed.

- On-site supervisors shall have at least ~~two~~ 2 years experience in supervising construction of drilled shaft foundations of similar ~~size (~~diameter and depth~~)~~ and scope to those shown in the plans and in similar geotechnical conditions to those described in the geotechnical report. Experience shall include the direct supervisory responsibility for the on-site construction operations.
- Drill operators shall have at least ~~one~~ 1 year experience in the construction of drilled shaft foundations.

The Engineer will respond within 21 calendar days after receipt of the submittal. Do not begin work on any drilled shafts until the qualifications have been approved. The Engineer may suspend the drilled shaft construction if the Contractor substitutes unapproved personnel during construction. Submit requests for substitution of either on-site supervisors or drill operators to the Engineer, who will have ~~seven~~ 7 calendar days to respond to each request. Additional costs resulting from the suspension of work due to the changing of personnel will be the Contractor's responsibility, and no adjustment in Contract Time resulting from the suspension of work will be allowed.

Construction

00963.40 Submittals - Provide the following submittals to the Agency for review and approval:

(a) Drilled Shaft Installation Plan - At least 21 calendar days before beginning shaft construction, submit the following:

- The sequence of drilled shaft construction as it relates to the overall construction plan.
- A review of equipment suitability based on the Contractor's understanding of the site subsurface conditions. Include a project history of the drilling equipment that demonstrates the successful use of the equipment for drilled shafts of equal or greater size in similar subsurface conditions.
- Details of shaft excavation methods, including proposed drilling methods and a disposal plan for excavated material. Include details of methods used to perform final cleaning of the excavation. Include details of the methods and materials used to fill or eliminate all voids between the plan shaft diameter and excavated shaft diameter, or between the casing and surrounding soil, if permanent casing is specified. Include a disposal plan for any water or contaminated concrete expelled from the top of the shaft ~~(~~if applicable~~).~~.
- Details of the proposed ~~method(s)~~methods for ensuring drilled shaft stability during excavation and concrete placement.
- Unstamped reinforcing steel shop drawings and details of reinforcement placement, including bracing, centering and lifting methods and the method for supporting the reinforcement on the bottom of the shaft excavation. Include details on the type, number and placement of spacers and other devices for ensuring the reinforcing cage position is maintained during construction.
- Evidence that the proposed materials conform to all applicable Specifications.
- Details of concrete placement, including proposed operational procedures for pumping and tremie methods.
- Detailed procedures for temporary casing installation and removal. Include casing diameters, dimensions, and depths and the methods and equipment for casing installation and removal.
- Confinement methods required to contain drilling fluids, spoils, waste concrete and other products from contacting sensitive environmental areas according to Section 00290 and all applicable regulatory permits.
- Methods for protecting existing structures according to 00170.82.

The Engineer will approve or reject the drilled shaft installation plan within 21 calendar days after receipt of all submissions. Provide any additional information and submit a revised plan, if requested, for review and approval. All procedural approvals given by the Engineer will be subject to trial in the field and will not relieve the Contractor of the responsibility to satisfactorily complete the work. Submit requests for modification of adopted procedures to the Engineer. Allow 21 calendar days for approval of modifications. Do not begin drilled shaft construction work until all drilled shaft submittals have been approved.

(b) Drilled Shaft Repair Plans - For any shaft determined to be unacceptable, submit a repair plan to the Engineer for approval. Furnish all materials and work, including engineering analysis and design, needed to correct unacceptable drilled shafts, at no additional cost to the Agency. Do not begin repair operations before remedial procedures or designs are approved. Any modifications to the dimensions or materials of the drilled shafts shown on the plans that are proposed in the repair plan will require stamped calculations and working drawings according to 00150.35.

00963.41 Drilled Shaft Coordination Meeting - Hold a drilled shaft coordination meeting at least ~~seven~~ 7 calendar days before beginning any shaft construction work at the site to discuss construction procedures, schedules, staging, personnel, equipment to be used, and other elements of the approved shaft installation plan as specified in 00963.40. Those attending the meeting include:

- **Representing the Contractor** - The superintendent, on-site supervisors, and all supervisors in charge of excavating the shaft, placing the temporary casing, placing the steel reinforcing bars, and placing the concrete.

- **Representing the Contracting Agency** - The Project Engineer, key inspection personnel, and designers of record or their appointed representatives.

If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved shaft installation plan, an additional meeting shall be held before any additional shaft construction operations are performed.

00963.42 Construction Tolerances - Excavate drilled shafts as accurately as possible at the locations shown. Determine the drilled shaft dimensions and alignment with approved methods.

Frequently check the plumbness alignment and dimensions of the shaft during construction. Correct all out-of-tolerance shaft excavations and completed shafts to the satisfaction of the Engineer. Correct out-of-tolerance drilled shafts at no additional cost to the Agency, and no extension of the Project completion date will be granted. Materials and work necessary to complete corrections for out-of-tolerance drilled shafts resulting from the removal of unexpected drilled shaft obstructions will be paid for ~~as Extra Work~~according to 00195.20.

00963.43 Drilled Shaft Excavation - Perform drilled shaft excavation according to the following:

(a) General - Excavate drilled shafts to the dimensions and elevations shown or as directed. Provide and maintain stabilized drilled shaft sidewalls for the full depth of the excavation, using approved materials, equipment and methods. If caving or other unstable conditions occur during any construction procedure, stop further construction, notify the Engineer, and stabilize the shaft excavation by approved methods and submit a revised installation plan which addresses the problem and prevents further instability. Do not continue with shaft construction until any damage which occurred has been repaired according to the Specifications and until receiving the Engineer's approval of the revised shaft installation plan.

If the Engineer has reason to believe that the drilled shaft excavation techniques or workmanship have been deficient, so that the integrity of any excavation is in question, work on that drilled shaft may be stopped. Drilled shaft excavation will not be allowed to resume until the deficient excavation techniques or workmanship have been changed to the Engineer's satisfaction.

Dispose of materials removed from the shaft excavations according to 00290.20.

Do not leave partially completed shaft excavations open overnight unless they are cased full depth or otherwise stabilized with approved methods. If approved by the Engineer, a partially excavated shaft may be left open overnight, provided that the excavation:

- Is stabilized at the bottom, sides and surface to prevent soil caving or swelling or a reduction of soil strength, and
- Is covered at the surface to protect the public.

Extend the drilled shaft excavation if the Engineer determines that the subsurface materials encountered are not capable of providing the required bearing resistance or differ from those anticipated in the design of the drilled shafts.

(b) Protection of Existing Structures - Protect existing structures according to 00512.43(b).

(c) Temporary Casing - Provide temporary casing according to the approved installation plan and of sufficient quantities to meet the needs of the anticipated construction method.

(d) Unexpected Drilled Shaft Obstructions - Remove unexpected drilled shaft obstructions according to 00512.43(d).

(e) Lost Tools - Promptly remove drilling tools lost in the excavation. Lost tools will not be considered unexpected obstructions and shall be removed without additional compensation. Drilling tools lost during the course of removing unexpected drilled shaft obstructions will be paid ~~as Extra Work~~according to 00195.20.

(f) Clean Out - Clean out drilled shafts according to 00512.43(h).

00963.45 Reinforcing Steel - Furnish and place reinforcing steel as shown and according to the following:

(a) Placement - Do not place reinforcing steel in the shaft excavation until the Engineer has approved the final elevation of the bottom of the shaft.

In each shaft, place reinforcing steel extending from 3 inches above the bottom of the shaft excavation to the elevation shown. The reinforcing cage may be supported on the bottom of the shaft excavation if approved. Support the reinforcing cage to prevent distortion or settlement during concrete placement. If concrete placement does not immediately follow cage placement, remove the reinforcing cage from the excavation and rectify the integrity of the excavation prior to reinstallation of the cage.

(b) Bracing - Rigidly brace the reinforcing cage to retain its shape for lifting. Lift the cage in a manner that does not cause permanent racking or distortion. Show bracing and any extra reinforcing steel required for fabrication of the cage on the submitted shop drawings. Remove cross bracing during cage placement, unless otherwise approved.

(c) Concrete Cover - Maintain the required concrete cover shown on the plans by placing concentric spacer bars or other approved devices around the reinforcing cage. Provide details of the proposed centering method on the shop drawings submitted according to 00963.40.

00963.47 Concrete - Furnish and place concrete according to the following:

(a) Concrete Placement - Place concrete immediately after completion of the shaft excavation and with the approval of the Engineer. Immediately prior to concrete placement ensure the shaft clean out requirements are met according to 00963.43(f).

Place concrete according to 00540.48(a) and continuously until concrete at the top of the shaft is free of water, soil, and debris, and uncontaminated concrete extends to the plan top-of-shaft elevation. Dispose of all contaminated concrete expelled from the top of the shaft in an approved manner. Remove waste concrete from the site. If a delay in concrete placement occur because of a delay in concrete delivery or other factors reduce the placement rate to maintain a flow of fresh concrete into the shaft excavation.

Unless otherwise approved, allow a maximum of 60 minutes between concrete placements and use no concrete older than 90 minutes from batch time. In addition to the above, use procedures for concrete placement which ensure that the concrete within the shaft becomes a monolithic, homogeneous unit.

Place concrete using hoses or pipes having watertight joints. For concrete placement by gravity tremie, use hose or pipe having an inside diameter not less than 8 inches. For placement by concrete pump, use hose with inside diameter not less than 4 inches. Provide an alternate delivery system that can be used in case of failure of the primary delivery system. Place concrete only against the bottom of the drilled shaft or into fresh concrete.

If caving occurs during concrete placement, the shaft may be rejected.

(b) Wet Shaft Concrete Placement - Perform wet shaft concrete placement according to 00512.47(c).

(c) Concrete Curing and Cleaning - Allow the exposed top of concrete to cure a minimum of ~~seven~~ 7 days by covering with wet burlap overlain with plastic sheets or by keeping top of concrete under water. Keep the burlap wet during the concrete cure.

Prior to placing any fresh concrete on top of a completed shaft, clean the upper surface of the concrete by removing all scum, laitance, loose gravel and sediment and chip off any high spots on the upper surface that would prevent the steel reinforcing bar cage from being properly placed in the position shown on the plans.

(d) Casing Removal - Remove all temporary casing during or after completion of concrete placement. Do not start temporary casing removal until the level of fresh concrete within the casing has reached a depth of 10 feet or the level necessary to adequately counteract the external hydrostatic pressure head. As the temporary casing is withdrawn, maintain a minimum 5 feet head of concrete above the bottom of the casing. A slight downward movement of the casing while exerting downward pressure, or hammering or vibrating the casing will be allowed to facilitate extraction. Extract the casing so that concrete is cast directly against the surrounding in-situ material. Check the elevation of the top of the reinforcing cage before and after temporary casing extraction for conformance with the construction tolerance criteria of 00963.42. Casing that cannot be extracted during or immediately after the concrete placement operation may be cause for rejection of the shaft.

00963.48 Drilled Shaft Testing and Acceptance - Acceptance of drilled shafts will be based on the Engineer's review of the field inspection reports and visual observations during drilled shaft construction. The Engineer has final authority on the approval of drilled shafts.

00963.49 Scheduling and Restrictions - Do not proceed with additional shafts until the first drilled shaft has been approved. After the first drilled shaft on the project has been accepted, make no significant change in construction methods, equipment or materials used in the construction of subsequent shafts, unless approved by the Engineer.

For 24 hours after completion of concrete placement in a newly-constructed shaft, including withdrawal of casing if applicable, do not, within 15 feet of the shaft:

- Excavate adjacent shafts
- Construct footings
- Apply equipment wheel loads
- Introduce vibrations with a velocity greater than 1/4 inch per second

Measurement

00963.80 Measurement - The quantities of signal support drilled shafts will be measured on the length basis, by the vertical excavated length from the bottom of the shaft to the ground surface. If directed to construct drilled shafts below the elevations shown, the drilled shaft will be measured from the revised bottom of shaft.

Payment

00963.90 Payment - The accepted quantities of signal support drilled shafts will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) 36 Inch Diameter Signal Support Drilled Shaft	Foot
(b) 42 Inch Diameter Signal Support Drilled Shaft	Foot

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- excavating the shafts and disposing of the excavated material
- furnishing, placing, splicing and removing temporary shaft casing and forms
- concrete and all reinforcement
- anchor rods, anchor plates, nuts, and washers

Section 00970 - Highway Illumination

Description

00970.00 Scope - In addition to requirements of Section 00960, Section 00962, and Section ~~00962~~02926, install highway illumination according to the following Specifications.

00970.02 Equipment List and Drawings - Submit six copies of isocandela diagrams indicating the vertical light distribution, vertical control limits and the lateral light distribution classifications for each type of luminaire submitted for approval. Include a letter from the luminaire manufacturer detailing lamp socket position with respect to lamps and refractors furnished for each Illuminating Engineering Society (IES) light distribution type specified.

Upon request, submit one copy of luminous intensity distribution data in IES format on a compact disk or using electronic mail for each type of luminaire submitted with the following:

- **Vertical angles** - Provide data in increments of 5 degrees or less for the vertical angles of 0 to 90 degrees, inclusive.

- **Horizontal angles** - Use a maximum of 10 degree increments for all horizontal angles.

Complete description data is required.

00970.03 Luminaire Submittal - Provide a sample luminaire for inspection and photometric testing if required. Sample luminaires may be considered as part of the shipment furnished for installation.

Construction

00970.41 Metal Light Pole or Tower Table - The metal light pole or high mast tower table for the Project is shown on the highway illumination plans.

00970.42 Cable and Wire - Use type XHHW stranded copper wire in all current-carrying conductors in raceways.

Support the conductors at the top of the pole using a flexible metal cable support grip to prevent insulation damage at the upsweep arm opening. When splicing into a new or existing circuit at a pole base (minimum wire length: 18 inches outside handhole), install a watertight, in-line fuseholder in the pole base for each ungrounded wire going up the pole. This fuseholder shall conform to the requirements of 02920.26 and be constructed so the wire to the ballast can be disconnected without cutting or disconnecting wiring at the ballast.

Use No. 12 AWG Type XHHW or THWN wire from the control cabinet to the photoelectric relay.

Use 3 conductor No. 10 ~~type~~AWG Type TC cable from the pole base to luminaire ballast. Use 2 conductors for luminaire ballast connection and 1 conductor for circuit grounding at the luminaire. Extend and securely connect electrical circuit grounding for each circuit connected to the luminaire end.

For double arm illumination pole, two sets of wires shall be installed separately from the pole base to each luminaire end. Do not splice wires inside the illumination pole except at the pole base.

Wires from the ballast to the lamp holders shall conform to the manufacturer's recommendations.

00970.43 Photocontrol Electronic Relay - Install the photocontrol electronic relay on either the control cabinet or on the metal pole as shown.

Use 1 1/4 inch welded hub in top of cabinet to install photocontrol electronic relay with minimum 24 inch long galvanized metal conduit and twistlock plug. When photocontrol relay is attached on the side of the cabinet, use LB type conduit outlet body, 1 1/4 inch galvanized metal conduit riser, and galvanized channel support for the riser. Riser conduit shall be minimum 2 feet above the top of the control cabinet. Secure field installed relay and conduit extensions against vandalism and ensure they are rain tight.

When photocontrol relay is installed on metal pole, use welded hub outlet located 180 degree from luminaire arm, threaded close nipple and 1 1/4 inch LB type conduit outlet body. Locate the hub 30 feet above base plate or as shown.

Mount the relay away from adjacent light units, and orient the light sensitive relay's window to the northern sky. Mark the date of installation on the bottom of the photocontrol electronic relay.

00970.44 HID Luminaires - Level luminaires on the upsweep arms in both the transverse and the longitudinal direction, as recommended by the manufacturer.

On roadway grades greater than 4~~%,~~ percent, orient luminaires on the upsweep arm so that the light beams strike the pavement equidistant from the luminaire.

(a) Mounting Height - Mount luminaires at heights shown. Measure the nominal mounting height from the top of the nearest edge of pavement to be lighted to the center of the luminaire.

(b) Lamp Marking - Mark the month and year the lamp is installed on the lamp base dating system with a sharp instrument.

(c) Lamp Size and Identification Decals:

(1) Identification Decals for High-Intensity Discharge Lamps - Indicate the lamp size and type with a NEMA-approved decal on each luminaire as specified below. Apply decals on clean and prepared surfaces. Use decals that provide a durable, legible surface for the life of the luminaire, and:

- Are at least 3 inches square.
- Are made of noncorrosive, pressure sensitive material.
- Have a colored background with black numbers as shown in Table 00970-1.

For pole-mounted luminaires, install the decals on the bottom side of the luminaire or on the arm adjacent to the luminaire, whichever is more visible, as directed.

For wall-mounted luminaires, install the decals vertically on the luminaire housing or adjacent to the luminaire on the wall, as directed.

For pendant-mounted luminaires, install the decals horizontally on the ballast housing or externally at the top portion of the reflector if a remote ballast installation.

(2) Lamp Size and Identification Decal Code - Use the lamp size and color codes that conform to the following:

Tables 00970-1 A and 1 B - Lamp Decal Code
High Intensity Discharge Lamps

TABLE 00970-1 A

Lamp Wattage	Identifying Number
50	5
70	7
100	10
150	15
175	17
200	20
250	25
310	31
400	40
750	75
1000	x1

TABLE 00970-1 B

Lamp Type	Background Color
Phosphor-Coated Mercury	White
High Pressure Sodium	Gold - Yellow
Clear Metal Halide [1]	Red
Phosphor-Coated Metal Halide [1]	Green
Induction Lamp	Orange

[1] In addition, metal halide lamp targets shall include a 1/2 inch wide by 3 inch long strip of pressure sensitive, flat top, wide angle reflective tape to show lamp burning position requirements. Apply tape 1/2 inch from the lamp size target as follows:

Lamp Burning Position	Target Color
Any position	None
Base up to horizontal	None
Base down to horizontal	Gold
Position-oriented-mogul socket (POM)	Red

00970.45 LED Luminaires - Install LED luminaires as shown or as specified in the Special Provisions.

00970.46 Pole Identification - Identify luminaire poles with a numbered label corresponding to the pole numbers on the highway illumination plans. Labels shall:

- Be made of noncorrosive, pressure-sensitive material suitable for outdoor use and resistant to fading and abrasion.
- Have blue or black numbers with a high-contrast colored background.
- Have 1/4 inch block numbers at least 2 inches high.

Install labels on poles so they are visible from a passing vehicle.

00970.50 Grounding and Bonding - In addition to the requirements of 00960.50 and 00962.50, ground and bond metal illumination poles and high mast towers according to the following:

Install 1 inch non-metallic conduit from the pole base to the concrete and polymer concrete junction box at each pole. Install a ground rod in each junction box and install No. 6 AWG copper ground wire from the ground stud in the pole base to the ground rod in the junction box. The ground rod may be installed in the same junction box that provides illumination circuitry to the pole, however,

provide a separate and independent conduit for the ground wire. Bond all metal conduit and metal junction box covers, if used, together to the ground rod.

On the inside of high mast tower shafts, weld a 1/2 inch Type 308, 309, or 310 threaded stainless steel stud for a grounding lug. Locate the grounding lug 90 degrees from and level with the bottom of the handhole.

Maintenance

00970.60 Maintaining Existing and Temporary Illumination Systems - Protect existing illumination systems and approved temporary replacements. Shutdown of a system may be allowed for alterations or final removal, as approved. Lighting system shutdowns shall not interfere with the regular lighting schedule. Notify the Engineer before performing any work on existing systems.

Determine the exact location of existing conduit runs and pull boxes before using equipment that may damage such facilities or interfere with any system.

Where roadways are to remain open to traffic and existing lighting systems are to be modified, keep the existing systems in operation until the final connection to the modified circuit is made. The modified circuit is to be complete and operating by nightfall of the same day the existing system is disconnected.

Finishing and Testing

00970.70 Field Test - Operate the completed lighting system or subsystem continuously for ~~seven~~ 7 consecutive days and an additional ~~seven~~ 7 days normal burn afterwards. When the lighting performance is satisfactory, the Contractor may be relieved of maintenance responsibility according to 00170.80(b).

Before completing the work, conduct the following tests on all lighting circuits in the presence of the Engineer.

- A Megger test on each circuit between the conductor and ground with all switchboards, panelboards, fuse holders, switches, receptacles and overcurrent devices in place. Record all readings. Furnish the Engineer with one copy of the test results identifying observed readings with their respective circuits.
- Test the insulation resistance between conductor and ground. Resistance shall be as follows on circuits with total single conduction length of:
  - 2,500 feet and over - at least 6 MΩ
  - Less than 2,500 feet - at least 8 MΩ

Measurement

00970.80 Measurement - No measurement of quantities will be made for work performed under this Section.

The estimated quantities of lighting poles and arms ~~will be~~are listed ~~in~~on the ~~Special Provisions.~~Project plans. If ~~plan changes by more than three feet are made to~~individual pole lengths or ~~arm lengths or if field verified pole lengths or~~individual arm lengths increase or decrease by more than ~~three feet~~3 feet from the estimated quantities shown, adjustments to the Contract lump sum amount for the items "Lighting Poles, Fixed Base", "Lighting Poles, Slip Base", or "Lighting Pole Arms" will be made according to 00190.10(h). Adjustments will be made only for the increased or decreased ~~length~~individual pole lengths or individual arm lengths greater than ~~three~~ 3 feet.

Payment

00970.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Pole Foundations	Lump Sum
(b)	Lighting Poles, Fixed Base	Lump Sum
(c)	Lighting Poles, Slip Base	Lump Sum
(d)	Lighting Pole Arms	Lump Sum
(e)	Luminaires, Lamps, and Ballasts	Lump Sum
(f)	Switching, Conduit, and Wiring.	Lump Sum
(g)	Refurbishing and Reinstalling Existing Illumination Systems	Lump Sum

Item (a) includes all concrete foundations for lighting poles.

Item (f) includes all switches, conduit, cabinets, wiring, delineators, junction boxes, and other items required to construct the lighting system as specified.

Item (g) includes all refurbishing, reinstalling, and other work as specified and not included in the removal of existing illumination.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for labeling the lights or poles.

If shown or specified as part of the work for concrete bridges or retaining walls, all conduit, junction boxes, cabinets, and other items permanently encased within concrete bridges and retaining walls, as well as pole foundations incorporated into a bridge or wall, will be included in payment made for the appropriate bridge and wall items.

00970.92 Electrical Energy Costs - All electrical energy costs for the lighting systems or subsystems will be paid for by the Agency.

Section 00990 - Traffic Signals

Description

00990.00 Scope - In addition to requirements of Section 00960, Section 00962, and Section ~~00962~~02925, install traffic signals according to the following Specifications.

Materials

00990.10 Backer Rod and Loop Sealant - Furnish backer rod material and hot-melt loop sealant from the QPL.

Construction

00990.40 Cable and Wire:

(a) General - Install wire and cable according to 00960.45 and the following:

Install wire and cable between terminal blocks without splicing, except for loop wire to loop feeder cable.

Leave slack in each wire and cable at each ~~pull~~junction box, pole, and controller cabinet as follows:

- 2 feet in ~~pull~~junction boxes and poles
- 6 feet in controller cabinets
- 6 feet in the first ~~pull~~junction box nearest the controller

In mast arm poles, use control cable from the pole terminal cabinet to vehicle signal heads and signs. Run a separate No. 14 AWG cable as required for each signal head. If existing cables or equipment are damaged by the Contractor's operations, immediately notify the Engineer and the affected owner.

Tape the ends of unused conductors with insulating vinyl plastic tape.

(b) Control Cable Attachment - Use self-locking cable ties to attach cables to the messenger cable. Tighten to remove gaps between the control cable and the messenger cable. After tightening, trim all excess material.

(c) Messenger Cable - Install the eyebolts through the entire pole. Pull the shoulder of the eye tight against the front face of the pole.

(d) Tether and Stabilizer Cable - Tighten cables to limit signal and sign movement. Install Agency furnished S-hooks between the eyebolt and turnbuckle.

(e) Interconnect Cable:

(1) Labels - Label all interconnect cable with approved bronze or plastic labels, permanently and ruggedly attached. The labels shall be embossed with the cable identification number if shown. Additionally, labels used on utility facilities shall bear the legend "TRAFFIC SIGNAL". Label all ends of cables. Label all overhead cable in each direction away from the point of attachment, 2 feet from utility poles. Do not install labels until the Engineer approves the labels and attachment mechanism. Label all cables in the interconnect terminal cabinets and at terminal panel locations.

(2) Installation - Use approved cable guides, feeders, shoes and bushings to prevent damage to the cable during installation. Do not pull cable over edges or corners, over or around obstructions or through unnecessary curves or bends.

Cable in trunk runs may be installed by hand or by mechanical methods, as approved. Trunk runs are those lengths of conduit that will have 25 or more pairs of interconnect cable installed. Install all other cable by hand methods only.

Before installing cable, provide the Engineer with one copy of the cable manufacturer's recommended and maximum pulling tensions for each cable type.

When installing cable using a pulling eye, do not exceed the cable manufacturer's maximum recommended pulling tension for pulling from the pulling eye. When installing cable using a pulling sock over the outer jacket, do not exceed the cable manufacturer's maximum recommended pulling tension for pulling by the outer jacket, or 80~~%~~ percent of the manufacturer's maximum recommended pulling tension for pulling by a pulling eye, whichever is smaller. Use an approved dynamometer to ensure that the maximum allowable pulling tension is not exceeded during installation.

(3) Aerial Cable - Use terminal cabinets for aerial pole entrance of interconnect cable.

Match the sag as closely as possible with wires already on poles to minimize movement in windstorms and conflict with adjacent wires.

Use a cable grip on the jacketed messenger when pulling and tensioning. Pull and tension cable without damaging the jacket. When separating the messenger on figure-8 cable from the jacketed conductor assembly for dead-ending or splicing, split the web using approved tools designed for this task.

At corners and run ends, dead-end the messenger strand with approved automatic dead end connectors. Cut the strand and remove the jacket, exposing enough strand so that the ends of the strands coming through the chucks of both vises can be overlapped and bonded together to form a continuous ground. Use a one-bolt guy clamp to bond the strand ends together. Remove unused strand.

(4) Underground - In transition areas from overhead to underground, continue the aerial cable underground to the nearest termination panel. If figure-8 type cable is used for overhead locations, strip the messenger wire from the cable, using approved tools, where the cable is within a conduit, pole or cabinet.

Pull the necessary length of cable to be installed from pull point to pull point skipping any intermediate junction box, handhole, or other opening in underground system. Carefully store the remaining length of cable to be installed in the next conduit in a manner that is not hazardous to pedestrian or vehicular traffic, and protects the cable from damage. Obtain the Engineer's approval of the storage methods to be used.

(5) Testing - Test interconnect cable according to 00990.70(i).

00990.41 Cabinet:

(a) Signal Circuit Overhead Terminal Cabinets - Mount signal circuit terminal cabinets as shown.

In each cabinet, install the number of sectional terminal blocks needed for the circuits, plus ~~two~~three spare terminal blocks. These spares are not to be used by the Contractor. Divide the number of terminal blocks required as evenly as possible among the mounting brackets in the cabinet.

Terminate only one wire in each termination point. If necessary, add additional terminals of the same capacity to accommodate additional taps. If additional terminals are required, use a factory jumper between the terminals.

Enter on the marking strip the wire number and/or letter as coded at the terminal strips in the controller cabinets. Use only mechanically printed labels.

Use weatherproof compression fittings in the bottom of the cabinets for cable entrances.

(b) Flasher Cabinet - Cabinets shall contain the devices shown.

(c) Power Service Cabinet - Install traffic signal service cabinets so that the meter placement is acceptable to the local power company if shown.

(d) Cabinet Protection - Keep interiors of all cabinets clean and free of dust, dirt, moisture, and other foreign matter.

00990.42 Indication Equipment:

(a) Standard Vehicle Signal Heads - Standard traffic signal heads shall be one-way, ~~three~~multi-section heads, adjustable through 360 degrees about a vertical axis, and designed for the method of mounting shown or specified. Furnish heads complete, including ~~lamps, lenses,~~ LED modules, visors, ~~reflectors, sockets,~~ backboards, and mounting appurtenances.

Vehicular signal heads shall be:

- Designed so they can be suspended from mast arms or span wires, or mounted on brackets or pedestals as required.
- Equipped with positive lock rings and fittings designed to prevent the heads from turning due to external forces.
- Equipped with all necessary appurtenances for the type of mounting required.

Tighten all backboards and visors securely against the signal head.

(b) LED Traffic Signal Modules - Fit modules into all types of traffic signal heads without the need to modify the head.

(c) Optically Programmed Vehicle Signals - Conform to all applicable portions of 00990.42(a). A complete vehicle signal includes the required number of signal sections with optical components, individual intensity control, cutaway visor, backboard, and mounting hardware.

Optically programmed vehicle signals shall:

- Use lamps of the type and wattage recommended by the signal manufacturer.
- Permit selective programming of the visibility zone of the projected indication anywhere within 15 degrees of the optical axis of each signal section.

When mounted on span wires, install additional washers on the hanger to shoe attachment pin to limit the lateral movement of the hanger.

(d) Pedestrian Signal Heads - All relevant portions of 00990.42(a) and 02925.65 apply to pedestrian signal heads.

(e) Flashing Beacon Signal Heads - Flashing beacons shall:

- Conform to all applicable portions of this subsection.
- Be of single-section construction.
- Be equipped for the type of mounting shown.

Use ~~the size of lamps~~LED modules specified in 02925.51.

Mount single-section heads on span wires as shown for three-section heads.

(f) Suspension of Signal Heads - Suspend vehicle and pedestrian signal heads as shown.

(g) Signal Head Covers - Cover mounted vehicle signal heads and pedestrian signal heads at all times until the signal installation is ready for continuous operation.
(h) Audible Pedestrian Signals - Provide and install audible pedestrian signals (APS) as shown or as specified in the Special Provisions.

00990.43 Traffic Signal Detection Devices:

(a) Pedestrian Push Buttons - Mount pedestrian push buttons on a pole, pedestal or post whose foundation directly abuts an asphalt concrete or portland cement concrete landing or walkway. Install push buttons in an H-frame mount having an arrow pointing to the crosswalk for which it is intended.

(b) Inductive Loop Detectors:

(1) Saw Cut - Make cuts compatible with construction and in the most practical, direct line between loops and junction boxes, except where parallel to, or nearly parallel to, a lane line; then locate cuts under the lane lines.

Make saw cuts 1/2 inch wide for loop wire.

Saw cuts shall have smooth bottoms, with no edges due to differences in cut depth.

Limit saw cut angles to 90 degrees or less to limit the bend in loop wire. Cuts shall not create islands of pavement less than 2.5 square feet in area.

Flush cuts thoroughly with a high-pressure water stream immediately after sawing, and before the cuttings dry. Blow cuts free of water, debris, rock, and grit with high-volume or high-pressure air. Slots may also be cleaned by means of a high-pressure water injection/vacuum extraction system. Remove all cuttings from the Project.

Dry cuts before placing wire. Remove rocks or other material that may be wedged in the cut.

Two sets of twisted pair loop wires may be installed in a single saw cut, as long as the minimum cover shown is provided and adequate pavement depth is available. The Engineer may limit the allowable saw cut depth and width to avoid damage to the pavement.

On new open-graded AC wearing courses install loops in the base lift, or in the existing surfacing if it is to be overlaid, and after milling has been completed.

In an existing open-graded AC surface, the saw cut and installation shall be as shown.

(2) Wire - Place a permanent plastic label on each loop feeder cable indicating the loop numbers~~, in indelible ink,~~ as shown on the Loop Detector Wiring Diagram. Place labels within 4 inches of the end of the jacket at each end of the loop feeder cables. Remove all existing labels that do not match the Loop Detector Wiring Diagram.

Do not remove the outside jacket and shield of loop feeder cables more than 6 inches from the end, inside the controller cabinet. Solder all loop feeder conductor terminations from field wiring in signal controller cabinets after crimp lugs have been installed. Crimp lugs used for loop wire field terminals may be insulated or non-insulated. Terminate loop feeder shield drain wire to the cabinet input panel grounding bus nearest the feeder wire termination points.

(3) Installation - The Engineer will mark or approve the center point location of all loops to be installed. Do not place wire in saw cuts until the cuts have been inspected by the Engineer.

After the saw cut is cleaned of debris, place the loop wire by pushing it into the slot with a blunt, nonmetallic object. Use care to avoid damaging the insulation.

Use one continuous, unbroken length of loop wire to form a loop of the number of turns required and to reach the loop feeder cable splice point shown or specified. Twist the loop wire pair together 4 to 6 twists for each foot from the exit point of the loop to the splice point of the loop feeder cable or termination point in the controller cabinet as shown. Use one continuous, unbroken length of loop feeder cable from the loop wire splice point to the cabinet.

After loop wire is placed and before the saw slot is sealed, install loop wire hold-downs (backer rods) made of closed-cell polyurethane. Place 1 inch lengths of the hold-down material along the loop perimeter and all other saw slots containing loop wire 6 inches from loop corners and at maximum 12 inch centers. Hold-downs shall fit snugly in saw slots.

~~After placing the wire, perform loop resistance testing before filling the slots with hot-melt sealant.~~ Install the sealant in slots according to the manufacturer's instructions. Furnish a copy of the manufacturer's specifications including application procedures. The Engineer may order a test run of any application method or material before filling saw cuts.

Sealant shall not protrude above the pavement, nor be more than 1/8 inch below the pavement level after curing. Where cuts are made on a slope and sealant runs or puddles, start at the low end, pour the sealant, and hold it in place with 2 inch duct tape placed on the roadway surface over the cut. If duct tape or other device is used to contain the sealant in the saw cut, remove it on the same day, after the sealant is fully cured.

In order to prevent heat damage to the insulation, do not allow the temperature of the sealant to exceed 410 °F during application. Install hot-melt sealants in layers to prevent damage to wire insulation. Allow each layer to cool before the next layer is installed. Do not use water to accelerate cooling. Do not seal street boxes with sealant that remains soft after setting or cooling.

Sealants that crack or pull away from the saw cuts after curing will be rejected.

(4) Splice - Splice loop wires to feeder cable in junction boxes. Connect loop wires to loop feeder cable with a screw on silicon grease filled wire connector. Remove 4 inches to 6 inches of feeder cable outer jacket, drain wire and shield. Do not damage the conductor insulation. Offset splices to ensure they do not make contact with each other. Strip feeder and loop conductors back about 1/2 inch. Cover the splice with a two piece plastic enclosure flooded with silicon grease.

(5) Resistance Testing - The resistance to ground of the loop and loop feeder combinations, tested with a 500 V wire insulation Megger tester, shall be 500 MΩ or greater when checked both before placing the sealant and after the sealant has set.

Furnish a report identifying the resistance and continuity for each loop:

- Before splicing and sealing - continuity test
- Before splicing and sealing - resistance test
- After splicing and sealing - resistance test

(6) Loop Sensitivity - Loops shall be sensitive to bicycles. After installation is complete the Engineer will test each loop.

(c) Video Detection Systems - Install video detection systems as shown or as specified in the Special Provisions.

(d) Microwave and Radar Detection Systems - Install microwave and radar detection systems as shown or as specifies in the Special Provisions.

00990.44 Traffic Control Signs - The type of sign and method of mounting will be as shown or specified. Signs shall conform to applicable portions of Section 00940.

00990.46 Fire Preemption - Fire preemption systems shall:

- Include all required control modules, detector units, detector feeder cable, wiring harness, interface circuitry and miscellaneous hardware.
- Have cable that runs continuously without splices from the detector unit to the controller cabinet.
- Not include emitter units.

00990.47 Railroad Interconnect - Run the circuit conductors in underground electrical conduit of the size shown. Terminate the conduit at the railroad cabinet at the location and in the manner directed by the railroad company. Extend the ends of the wire at least 3 feet beyond the end fitting of the supplied conduit. All other work inside the railroad cabinet is the responsibility of the railroad.

Do not work in the immediate vicinity of the railroad cabinet without first notifying the Engineer and receiving permission. The Agency will obtain supervisory personnel from the railroad company.

Do not place any materials or equipment in the vicinity of the tracks without observing proper clearance (see 00170.01(e)).

Finishing and Testing

00990.70 Testing and Turn-on - This work includes the testing traffic signal control equipment, testing traffic signal installations, and turning on completed traffic signal installations.

(a) Delivery of Control Equipment - Provide manuals, diagrams, and other documents as required by the Agency. Deliver all traffic signal control equipment, including wiring diagrams and operation manuals, in one shipment. Partial shipments will not be accepted and will be returned, at Contractor's cost, to the Contractor. Include the following information with equipment shipments:

- Contractor
- Supplier
- Manufacturer
- Location
- Contract number
- Agency for which the equipment is to be tested. For agencies other than ODOT, include a complete set of plans and specifications to which the equipment is to be tested.

Deliver the traffic signal control equipment and information for testing to:

Oregon Department of Transportation
Traffic Systems Services Unit
2445 Liberty St. NE
Salem, Oregon 97303-6738

(b) Control Equipment Testing - The following traffic signal control equipment will be tested by the Agency for conformance with the Contract Documents before being installed:

- Controller unit
- Controller cabinet
- Power supplies
- Input devices
- Output devices
- Conflict monitors
- Flasher units
- Relays
- Preemption devices
- Auxiliary equipment in the cabinet
- Other equipment required for the operation of the installation

Control equipment will be tested at no cost to the Contractor.

The control equipment will be tested in three categories: physical, functional, and environmental as specified in the Standard Specification for Microcomputer Signal Controller. ODOT will require ~~six~~6 weeks for completion and evaluation of the testing.

(c) Control Equipment Failure - A traffic signal control equipment failure is any occurrence that results in nonspecified operation of the equipment.

The Contractor will be notified of all control equipment failures, and shall make on-site repairs within ~~five~~ 5 days of receiving the notification.

Following repair of the control equipment, the testing will be resumed at the beginning of the test category in which the failure occurred.

(d) Control Equipment Rejection - The traffic signal control equipment will be rejected under either of the following conditions:

(1) Twice Fail - The control equipment fails twice in the same testing category.

(2) Failure to Repair - The Contractor fails to repair the control equipment within ~~five~~ 5 days of receiving notification of the failure.

Pick up rejected traffic signal control equipment within 10 days of receiving the rejection notice, or it will be returned, at Contractor's cost, to the Contractor.

Replace rejected control equipment with equipment having a different serial number.

Rejected control equipment will not be accepted for testing or installation on any subsequent traffic signal project within the State of Oregon.

(e) Control Equipment Acceptance - Traffic signal control equipment that successfully passes the testing procedure will be certified by the Agency as acceptable for installation. Acceptability for installation does not guaranty final acceptance of the completed installation.

The successful completion of the testing does not relieve the Contractor of the responsibility to furnish a complete working signal installation at the time the equipment is placed in operation.

The Contractor will be notified when the testing has been completed. Pick up the controller cabinet at the test facility.

(f) Control Equipment Installation - Be responsible for pick-up, delivery and installation of the controller cabinet.

The Agency will be responsible for delivery and installation of the other control equipment, such as controller units, input devices, switch packs, monitor units, miscellaneous plug-in devices and auxiliary devices not physically wired to the controller cabinet.

Other control equipment that the Agency is to install will be stored at the test facility until the signal installation is ready to be turned on.

(g) Field Testing - Field testing of traffic signal installations will be performed by Agency electrical crews. Notify the Engineer ~~one~~ 1 week in advance of the anticipated signal completion date. The Engineer will notify the Agency's Traffic Systems Services Unit and the Agency's electrical crew of the anticipated completion date. Field testing will be performed within ~~one~~ 1 week following the date of completion. The Engineer will notify the Contractor of the test results.

Information on Agency testing procedures is available from the Engineer.

(h) Traffic Signal Turn-on - The Engineer will establish the date and time the installation is to be turned on. The Agency will turn on the signal within ~~one~~ 1 week after completion of corrections identified during field testing.

Be present at the Project Site.

After traffic signals are turned on and operating as designed, the agency ultimately responsible for maintenance will assume operation and maintenance of the signal. Turn-on does not constitute final approval. The Contractor is still obligated to finish any incomplete portion of the installation and correct problems with workmanship or replace material that does not meet Specifications. After turn-on, damage to the traffic signal installation caused by conditions beyond the Contractor's control will be the responsibility of the maintaining agency.

(i) Interconnect System Testing:

Test each new interconnect cable circuit installed in the system. Test the complete system only when all terminations for each cable circuit are completed from the interconnect or controller cabinet at the beginning of the new cable run to the controller or interconnect cabinet at the end of the new cable run. If any test is failed, repair the circuit and repeat the entire test series for that cable circuit.

Perform all tests in the presence of the Engineer. Document the test results. When the tests are completed, furnish the test results and the test data to the Engineer. Conduct tests, as described below, for all cable conductors, including spares, the cable shield, and all field terminations.

In addition to testing the complete system, perform the following tests for each cable circuit:

(1) Continuity - Perform a continuity measurement for each conductor and the cable shield in the system. Conductor resistance shall not be more than 10 Ω per 1,000 feet for each cable pair and shield of the communications cable. Measure the resistance with an ohmmeter having a minimum input impedance of 10 MΩ/V. Record the resistance of each pair and furnish to the Engineer as described above.

(2) Isolation - Perform an isolation measurement for each conductor and cable shield in the system. Measure the insulation resistance with all connections to the conductor or shield under test removed and all other conductors in the cable grounded. Make the measurement with a DC potential of not less than 360 V nor more than 550 V, continuously applied for ~~one~~ 1 minute. Insulation resistance of each cable conductor and the shield shall exceed 1,000 MΩ per mile. Use an insulation resistance (Megger) tester with a meter scale for measurements, marked with a range from 100 KΩ to 100 GΩ, and with zero and infinity also marked.

~~**00990.75 Warranty** - Provide a one year Contractor warranty according to 00170.85(b). This Contractor warranty does not replace or reduce other warranties, including manufacturer's warranties, that are longer than one year.~~

Measurement

00990.80 Measurement - No measurement of quantities will be made for work performed under this Section.

Payment

00990.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement

(a) Traffic Signal Installation ..... Lump Sum
(b) Traffic Signal Modification ..... Lump Sum
(c) ~~Loop~~ Detector Installation ..... Lump Sum
(d) Ramp Meter Signal Installation ..... Lump Sum
(e) Interconnect System ..... Lump Sum
(f) Flashing Beacon Installation ..... Lump Sum
(g) Automatic Traffic Recorder Installation ..... Lump Sum

Item (a) includes furnishing and installing all items of the traffic signal system~~, including the fire preemption system, the controller, the controller cabinet equipment,~~ and the detection system.

Item (b) includes furnishing and replacing or installing items for an existing traffic signal installation.

Item (c) includes furnishing and installing a complete traffic ~~loop detector installation~~detection system for an existing installation, including required controller equipment.

Item (d) includes furnishing all items of the ramp meter signal system~~, including the controller and controller cabinet equipment~~.

Item (e) includes furnishing all the interconnect system.

Item (f) includes furnishing and installing all items of the flashing beacon system.

Item (g) includes furnishing and installing all items of the automatic traffic recorder system.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Mast arm pole and strain pole foundations will be paid for according to 00963.90.

No separate or additional payment will be made for replacement of disturbed earthwork, base, and surfacing.

PART 01000 - RIGHT OF WAY DEVELOPMENT AND CONTROL

Section 01030 - Seeding

Description

01030.00 Scope - This work consists of seeding and associated tasks to develop plant growth for erosion control, environmental mitigation, and roadside development.

01030.02 Definitions:

Certified Seed - A grass or legume seed named variety that has been reviewed and accepted into the Oregon Certified Seed program. Currently certified seed is individually sold in bags with a blue-colored Oregon Certification Tag, thus the name commonly used for such seed is "blue tag stock".

Establishment Period - A period when planting work has been performed and initially accepted, and there is a Contract requirement to care for the planted areas in some way until the period ends.

Native Plant (existing) - A variety of plant species occurring in its natural habitat without direct or indirect human actions.

Noxious Weed - All weed designated by the Oregon State Weed Board as injurious to public health, agriculture, recreation, wildlife, or all public or private property. The Oregon Department of Agriculture (ODA) will be the authority in determination of noxious weed species.

Pure Live Seed (PLS) - The amount of living seed in the total quantity of seed when non-viable seed or non-seed material is excluded.

Riparian - Related to the bank, shore, or water-influenced areas of a watercourse or water body.

Sensitive Areas - Defined areas such as wetlands, natural water and riparian resources, special environmental zones, or where certain activities are restricted such as the use of chemicals.

Specified Weeds - All noxious weeds as defined above, and all plant species identified in the Special Provisions or on the plans as a species to be removed.

Waters of the State - See ORS 468B.005 for "Waters of the State" definition.

Weed - A plant that is undesirable where it is growing.

Weed Free - For these Specifications, "Weed Free" is defined as the following maximum amount of living weeds per square yard:

- Zero "Type A" or "Type T" Noxious Weeds
- One "Type B" Noxious Weed
- One of each non-noxious weed listed in the Special Provisions

The ODA Noxious Weed Policy and Classification System lists Type "A", "B", and "T" Noxious Weeds.

Weed Management Area (WMA) - A defined project area with Specified Weeds to remove, including areas where weeds begin growing because of project-associated ground disturbance. A WMA may be the entire project site or any portion, including material source and disposal sites as shown.

Materials

01030.11 Topsoil - Furnish topsoil meeting the requirements of 01040.14.

01030.12 Soil Conditioners, Amendments, and Bio-Amendments - Furnish soil modifiers meeting the requirements of 01040.15, 01040.16, and 01040.17.

01030.13 Seed - Furnish seed meeting the following requirements:

(a) Label - Deliver all seed in standard, sealed containers. Label each container with the following:

- The kind and variety of each seed of 3~~%~~ percent or more in a mixture, by weight. Be sure that seed mix labels include the words "mixture" or "mixed seed" when the seed is a mixture
- The country or state where the seed is grown
- The lot number or other lot identification
- The total percentage, by weight, of other crop seed
- The total percentage, by weight, of weed seed
- The total percentage, by weight, of inert matter
- Statement of "No Noxious (weed) Found"
- For each named seed:
  - Percentage of germination
  - Percentage of hard (non-living) seed, if more than 1~~%~~ percent
- Percent of PLS for each kind of seed
- Percent and kind of other crop
- Month and year of seed test
- Net weight of contents
- Name and address of seed labeler or seller
- Origin for each seed (state or foreign country)
- If seed inoculant is used, the claimed date that inoculant effectiveness ends
- For treated seeds (if any):
  - Statement that the seeds have been treated
  - Name of all chemical used in the treatment
  - Description process used in the treatment
  - Warning statement for all residual chemicals used
- Net weight of each container
- For seeds listed as native, date and location of collection of source (first generation) seed
- For native seeds specified to be collected for direct use on a project, label containers with the date and location of collection sites for each seed species

Alternate label requirements may be identified in the Special Provisions for certain native plant seeds.

(b) Quality - Furnish seed meeting the following requirements:

- The seed and labeling complies with Oregon Seed Law and Federal Seed Act.
- The seed has been tested within 18 months of the planting date.
- The seed is not sprouted, moldy, or showing evidence of having been wet or otherwise damaged.
- The seed is labeled as "Oregon Certified Seed" or the equivalent from another state when identified in the Special Provisions. Information about certified seed is available from County Extension Offices, Oregon State University, and the Oregon Department of Agriculture.

(c) Pure Live Seed - Obtain the amount of seed to apply by using the purity and germination percentages from the label on actual bags of seed to be used on the Project.

To calculate the amount of seed to be applied:

- Obtain the PLS factor - Multiply the seed label germination percentage times the seed label purity percentage.
- Divide the specified PLS rate by the PLS factor.

Example: A PLS seeding rate of 10 pounds per acre is specified. The seed label shows a purity of 80~~%~~ percent and germination is 90~~%.~~ percent. After converting percentages to decimals, 0.80 x 0.90 equals a factor of 0.72. The specified PLS rate, 10 pounds per acre, divided by the factor of 0.72 equals 13.88. In order to meet a PLS seeding rate of 10 pounds per acre, about 14 pounds of seed needs to be applied per acre. For a seed mix, make this calculation for every seed to obtain the total amount to be applied.

(d) Inspection - Each lot of seed is subject to inspection upon delivery to the Project. Seed that is not labeled or that does not conform to the Specifications will be rejected and shall be replaced at no additional cost to the Agency.

(e) Mixes - Furnish seed mixes that meet the labeling, quality and inspection requirements stated above. Submit all other proposed seed or seed mixes for consideration and receive written approval before seeding work begins. Replace rejected seed before planting.

(f) Types of Seed Mixes - Seed mixes, quantities, standards, seeding rates, and other information will be included in the Special Provisions for each type of seed mix.

The following are the functional categories of seed mixes that may be included on projects (a category may have multiple functions on a project site):

- **Temporary Seeding** - To provide short-term control of soil erosion until permanent seeding is performed or all potential for erosion is removed.

- **Permanent Seeding** - The final seeding, or only seeding performed for erosion control.

- **Lawn Seeding** - Seeding for areas where finished turf appearance is desired.

- **Wildflower Seeding** - Seeding to develop growth of wildflowers. The seed mix will typically contain grass or other plant seed to provide erosion control.

- **Plant Seeding** - Seeding which typically includes more than just grass species, such as seeds of woody or herbaceous plants.

- **Water Quality Seeding** - For use in water quality facilities such as swales or settling basins.

- **Wetland Seeding** - To vegetate existing or constructed wetlands with native plant species.

- **Native Plant Seeding** - Seeding to restore native vegetation.

(g) Availability - Provide a list of seed sources for all specified seeds within 60 calendar days after execution of the Contract. Verify that all specified seed has been located and will be available for use on the Project.

01030.14 Fertilizer - Furnish standard, commercial grade fertilizer meeting the following requirements:

(a) General - Deliver fertilizers in separate or mixture containers that have the percentage of total nitrogen, available phosphoric acid, and water-soluble potash (NPK) in the amounts specified. Label each container with a quality compliance certificate that includes the container weight, the percentage of each ingredient, and the source of each component in the mixture. Ensure that each container is labeled with a quality compliance certificate that meets the applicable requirements of Section 00165.

Furnish fertilizer according to State and federal regulations. Fertilizer is subject to testing by the State Department of Agriculture.

(b) Type of Fertilizer - Provide the following fertilizer:

(1) West of the Cascades - Furnish 22-16-8 inorganic fertilizer analyzing 22~~%~~ percent nitrogen, 16~~%~~ percent phosphoric acid, 8~~%~~ percent soluble potash, and including a minimum of 2~~%~~ percent sulfur. Furnish fertilizer containing not less than 50~~%~~ percent available water-insoluble, controlled-release nitrogen derived from one of the following sources:

- Urea formaldehyde (Nitroform)
- Isobutylidene Diurea (IBDU)
- Polymer coated urea (no sulfur)

(2) East of the Cascades - Furnish 22-10-5 inorganic fertilizer analyzing 22~~%~~ percent nitrogen, 10~~%~~ percent phosphoric acid, 5~~%~~ percent soluble potash, and including a minimum of 10~~%~~ percent sulfur. Furnish fertilizer containing not less than 50~~%~~ percent available water-insoluble, controlled-release nitrogen derived from one of the three sources stated for West of the Cascades above.

(3) Statewide, Near Water - For application within 50 feet of open water, furnish 22-2-11 low-phosphorus fertilizer analyzing 22~~%~~ percent nitrogen, 2~~%~~ percent phosphorus, and 11~~%~~ percent potassium which releases slowly over an eight to nine month period. Furnish fertilizer containing a minimum of 60~~%~~ percent available water-insoluble, controlled-release nitrogen derived from one of the three sources stated for west of the Cascades above. Furnish phosphorus and potassium that is coated to allow a minimum of 95~~%~~ percent controlled-release.

01030.15 Mulch - Furnish mulch materials free of all weed or plant seeds and containing no substances detrimental to plant life. The kind of mulch ~~material(s)~~materials acceptable for use will

be shown on the plans, listed in the Special Provisions, or will be as approved. Furnish mulch meeting the following requirements:

(a) Hydromulch from Cellulose, Wood, or Straw Fiber - ~~Furnish cellulose~~Cellulose fiber produced from virgin wood, straw, or paper fiber product from the QPL. Furnish wood or straw mulch processed so the fibers remain uniformly suspended under agitation in water and the fibers have moisture-absorption and percolation properties. Ship hydromulch in packages of uniform weight, ~~plus or minus~~ ± 5~~%~~, percent, and labeled with the manufacturer's name and air-dry weight. Include enough green dye tracer so applied mulch is easily visible.

(b) Straw - ~~Unless otherwise specified, furnish straw~~Straw mulch for non-hydroseeding applications from bentgrass, bluegrass, fescue or ryegrass singly or in combination. Cereal grain straw from barley, oat or wheat may be allowed upon approval of the Agency. Provide straw that is not moldy, caked, decayed or of otherwise low quality. Submit certification from the supplier that the straw is free of noxious weed seeds or plant parts. Acceptable documentation is any one of the following:

- The straw source is an "Oregon Certified Seed" field.
- The straw is certified by a recognized program accepted by the Oregon Department of Agriculture as being weed free.
- Seed lab test results of seed harvested from the straw meet minimum Oregon Certified Seed quality for weed seed content.

~~**(c) Tracer** - For hydromulch application, include enough green dye so applied mulch is easily visible.~~
(c) Compost - Commercially manufactured fine and medium compost material meeting the requirements of Section 03020.

01030.16 Tackifier - Furnish a commercial quality tackifier containing no agent toxic to plant life. Furnish tackifier of either a liquid stabilizing emulsion or a dry powder tackifier meeting the following requirements:

(a) Liquid Stabilizer Emulsion - Tackifier with a base material of liquid, polyvinyl acetate polymers, using emulsion resins and containing not less than 55~~%~~ percent total solids by weight. Furnish tackifier containing no polyacrylates or polyvinyl acrylics. The emulsion shall, when diluted with water and upon drying, allow exchange of air and moisture to the seeds and have an effective life of ~~one~~ 1 year or more.

(b) Dry Powder Tackifier - Tackifier base consisting of one or more active hydrocolloids from natural plant sources, which hydrates in water and blends with other slurry materials, and upon application and drying tacks the slurry particles to the soil surface, and exhibits no growth or germination inhibiting factors. Provide stabilizing emulsion in a dry powder form that may be re-emulsifiable, and consisting of a processed organic adhesive derivative of one of the following:

- Gumbinder derived from guar (Cyamopsis tetragonoloba)
- Gumbinder derived from plantain (Plantago insularis)

01030.17 Pesticides - Submit proposed pesticides and receive approval before using. Submit a copy of the ~~manufacturer's~~manufacturer's federal registered label and, if requested, a Material Safety Data Sheet. The Agency reserves the right to restrict chemicals from being used on Sensitive Areas.

Labor

01030.30 General:

(a) Weed Control Coordinator - Submit certification at the preconstruction conference that the weed control coordinator meets the following minimum requirements:

- Demonstrates ability to identify noxious and other weed species commonly seen in Oregon. Some examples of potentially acceptable credentials are at least ~~one~~ 1 year conducting weed surveys in Oregon or Washington State or a degree in botany or horticulture from an accredited institution.
- Has successful weed control experience, with similar duties to those stated under typical duties below, on at least three construction or vegetation management projects. Two examples of acceptable certification are an Oregon Pesticide Consultant License or Oregon Landscape ~~Contractor's~~Contractor's License held in the ~~individual's~~individual's name.

~~Typical duties of the~~The weed control coordinator duties include~~ the following~~:

- Identify Specified Weeds.
- Prepare and update the Weed Control Work Plan (WCWP).
- Coordinate ~~Contractor's~~Contractor's weed removal work and records.
- Resolve weed control issues as the ~~Contractor's~~Contractor's representative.
- Determine when Specified Weed content exists in disposable materials and ensures the materials are disposed of at an approved off-site facility.

(b) Pesticide Applicator - Submit certification before application of pesticide work begins, that when chemical weed control is used, that each applicator possesses an Oregon Commercial Pesticide ~~Applicator's~~Applicator's License held in the ~~individual's~~individual's name. Submit a certification each time a new applicator begins application work on the Project.

Construction

01030.40 General - Notify the Agency not less than 24 hours in advance of seeding operations. Do not begin seeding until prepared slopes in an area have been approved for seeding. Do not perform seeding during windy weather or when the ground is frozen, excessively wet, or otherwise not tillable.

Do not disturb or damage existing desirable vegetation to be left in place. Do not disturb areas previously seeded and mulched, with the exception of disturbances caused by stage construction. If previously seeded areas are disturbed, rework and reseed as directed, at no additional cost to the Agency.

Remove all non-approved plants resulting from the seed mixes provided for the Project at no additional cost to the Agency, including erosion protection required during reseeding.

01030.41 Area Preparation - Refer to 01040.48 for area preparation for the following kinds of seeding:

- Temporary Seeding - Method E
- Permanent Seeding - Method D
- Wildflower Seeding - Method B
- Plant Seeding - Method B

- Water Quality Seeding - Method B
- Wetland Seeding - Method B
- Lawn Seeding - Method C
- Native Plant Seeding - Method B

01030.42 Weed Control - When the Contract Schedule of Items includes an item for "Weed Control", remove and prevent regrowth of Specified Weeds, weed plant parts, and weed seeds from areas within the Project limits.

Do not harm or disturb existing native or ornamental vegetation, unless directed to do so. Do not compact soil with heavy equipment in areas where soil will not be disturbed for roadway or other construction.

If a pesticide has been approved for use, apply according to federal and State laws, including conditions and requirements of the federal registered pesticide label.

(a) Weed Control Work Plan - Depending on project conditions such as location, sensitive environments, permit requirements, jurisdictional regulations, or other items, there may be limits on the use of chemicals or other weed control methods. Before submitting the initial WCWP, determine if there are restrictions or all potential for restrictions on weed control methods on project sites. At the preconstruction conference, submit a WCWP with the following:

- Name and contact information for the approved weed control coordinator.
- WMA's with existing Specified Weeds mapped on project plan sheets where possible.
- Botanical and common name of each species of weed to be removed.
- The proposed methods of weed removal and continuing control for each weed species listed.
- Schedule of weed control measures.
- Request to use wheeled or tracked construction equipment in sensitive areas.

If changes of the WCWP are necessary, resubmit a revised WCWP for approval before proceeding.

(b) Weed Control Inspections - Inspect the project for new growth of specified weeds at least monthly and apply weed control measures as appropriate. This requirement may be waived by the Engineer during the period that weeds are fully dormant. To ensure satisfactory weed removal, the last WMA inspection will occur at least 30 days after growing season has begun or as directed.

At a minimum, schedule weed control inspection with the Agency at the following times:

- After approval of WCWP and prior to beginning weed control within a WMA.
- Monthly.
- Upon request by the Agency to discuss non-compliant weed control work.
- After completing weed control at material sources and disposal sites.

(c) Remove and Control of Weeds - Remove and control weeds according to the following:

(1) All areas:

- At least ~~three~~ 3 calendar days prior to beginning weed control activities, walk through each WMA with the Engineer and confirm the identity, location, type, and approximate number of Specified Weeds. Verify that control methods in the WCWP are acceptable as planned for each WMA before proceeding with weed control activities.
- Remove Specified Weeds and receive approval prior to beginning construction or equipment mobilization in that area. As much as practicable, ensure that weed seeds or reproducing plant parts such as vines, runners, or rhizomes ~~don't~~do not remain or become disbursed during control activities.
- As soon as practicable, place weeds and related materials in an approved container and transport to an approved offsite disposal facility according to applicable laws and regulations. During transport, ensure that materials are fully enclosed at all times to prevent escape.
- Keep a record of all weed material loads transported off the Project and submit documentation from the approved disposal facilities that a corresponding number of weed material loads were disposed of at that facility.
- Keep WMA's Weed Free including weeds not initially present in the walk through.

(2) Sensitive Areas:

- Unless otherwise approved in writing, use only hand or light mechanical weed control methods within 50 feet of Sensitive Areas. Hand methods include the use of hand tools. Light mechanical methods include the use of hand carried, motorized machinery.
- Inside Sensitive Areas, obtain approval before using wheeled or tracked construction equipment. Requests will be approved only when all vegetation in the area will be cleared, such as under new roadways or slopes.
- The Engineer will be the authority in the determination of Sensitive Areas.

(d) Weed Control Corrective Work - If corrective work for areas identified as deficient by the Engineer is not completed within a 15 calendar day period, the Engineer may suspend the work according to 00180.70. If the ~~Contactor's~~Contractor's weed control work is determined to be unsatisfactory, the Agency reserves the right to do the work at the ~~Contractor's~~Contractor's expense.

01030.43 Temporary and Permanent Seeding:

(a) Temporary Seeding - Temporarily seed disturbed soils and slopes that are not at finished grade and which will be exposed for ~~two~~ 2 months or longer before being disturbed again. Provide fertilizer, mulch, water, and other amendments necessary to ensure establishment. Ensure that temporary seeding work achieves the coverage of live plants required by 01030.60 by the end of the next permanent seeding date stated in 01030.43(b). If this coverage is not achieved, or if the Agency determines that it is not effective in stabilizing the soil from erosion, stabilize the area with other temporary stabilization methods as described in 00280.42 at no additional cost to the Agency.

(b) Permanent Seeding - Perform this seeding during the permanent seeding dates shown below. If work done within the seeding dates does not provide coverage according to 01030.60, re-seed according to 01030.48 and as directed. The dates for permanent, wildflower, plant, water quality, wetland, lawn, and native plant seeding are as follows:

- **West of the Cascades** - March 1 through May 15 and September 1 through October 31. If new lawn areas are regularly watered, they can be seeded from March 1 through November 15.

- **East of the Cascades** - October 1 through February 1. If new lawn areas are regularly watered, they can be seeded from March 1 through October 31.

- **Wetland (Statewide)** - September 1 through October 31 and March 1 through April 30.

Permanent seeding outside the these dates requires written authorization from the Agency. Approval to seed outside these dates will only be given when physical completion of Project work is imminent and environmental conditions are conducive to satisfactory growth. For permanent seeding done outside the seeding dates, ensure that the coverage of live plants required by 01030.60 is achieved no later than ~~three~~ 3 weeks into the next permanent seeding period. If this coverage is not achieved, re-seed and re-fertilize areas of insufficient coverage according to the permanent seeding requirements, at no additional cost to the Agency.

01030.44 Fertilizer:

(a) Inorganic - Apply 22-16-8 or 22-10-5 inorganic fertilizer at the rate of 400 pounds per acre.

(b) Low-Phosphorous - Apply 22-2-11 polymer coated urea low-phosphorus fertilizer at the rate of 200 pounds per acre.

01030.45 Soil Testing - Test soil according to 01040.13.

01030.46 Topsoil and Wetland Topsoil - Construct topsoil areas according to 01040.43 and 01040.44, as appropriate.

01030.47 Soil Amendments and Bio-Amendments - Incorporate soil amendments and bio-amendments into the seeding operation according to 01040.45 and 01040.46, as appropriate.

01030.48 Application - The following application methods are acceptable for both temporary and permanent seeding:

(a) Hydroseeding, Fertilizing, Hydromulching, and Tacking - Apply seed, fertilizer, mulch, and tackifier as follows:

Use hydraulic equipment that continuously mixes and agitates the slurry and applies the mixture uniformly through a pressure-spray system providing a continuous, non-fluctuating delivery. Ensure the equipment and application method provides a uniform distribution of the slurry. Place seed, fertilizer, mulch, and tackifier in the hydroseeder tank no more than 30 minutes prior to application.

(1) Hydroseeding Operation - Perform hydroseeding according to the following:

a. One-step Operation - Apply materials in one step only for the following situations:

- When seeding in conjunction with erosion control matting. Apply seed, fertilizer, and tracer before installing matting.
- When treating small areas according to 01030.48(e). Double the amount of seed to compensate for seed suspended above soil by the mulch.

b. Two-step Operation - Except for the one-step method situations in 01030.48(a-1-a), use the two-step method for all hydroseeding operations:

1. Step 1 - Apply seed, fertilizer, and tracer. The seed and fertilizer may be applied separately or together. If hydromulch is used as a tracer, apply it at a rate of 500 pounds per acre.

2. Step 2 - Apply mulch and tackifier. Hydromulch, if used as a tracer in Step 1, will be included as part of the specified hydromulch rate specified in 01030.48(a-3).

(2) Seed - Thoroughly mix seeds when more than one kind is to be used.

(3) Mulch - Apply hydromulch at the following rates based on dry fiber weight:

a. Slopes Flatter Than 1V:2H - Apply cellulose fiber that includes a tackifier at a rate of 2,000 pounds per acre.

b. Slopes 1V:2H or Steeper - Apply cellulose fiber that includes a tackifier at a rate of 3,000 pounds per acre.

(4) Tackifier for Cellulose Fiber Applications - Use one of the following:

a. Liquid Stabilizer Emulsion - Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at the rate of 865 gallons per acre unless the manufacturer recommends a greater rate of application.

b. Dry Powder Tackifier - Apply at the following rates unless the manufacturer recommends a greater rate of application:

1. Slopes flatter Than 1V:2H - 60 pounds per acre mixed with hydromulch fibers at the rate specified.

2. Slopes of 1V:2H or Steeper - 100 pounds per acre mixed with hydromulch fibers at the rate specified.

(b) Seeding, Fertilizing, Dry Mulching, and Tacking - Apply seed and fertilizer separately or together as the first step. Apply dry mulch as the second step. Tackify the mulch as the third step.

(1) Seed and Fertilizer - Apply seed and fertilizer at the specified rates. When fertilizer and seed are to be applied in dry condition, except when compost material is used, apply them separately. When applied from separate compartments, the application may be done in one operation~~. Apply seed and fertilizer~~ by one of the following methods:

a. Blower - Blower equipment using air pressure and an adjustable spout that uniformly applies dry fertilizer and dry seed in separate and successive applications at constant measured rates.

b. Helicopter - Helicopter equipped with hoppers and adjustable disseminating mechanisms that separately and successively apply fertilizer and seed in uniform and prescribed quantities.

c. Mechanical Spreaders - Hand or machine operated mechanical spreaders that uniformly apply dry fertilizer and dry seed separately and successively in the prescribed quantities.

d. Hydroseeding - Uniformly apply at the rate specified. Add 500 pounds per acre of hydromulch fiber to the seed and fertilizer mixture to visibly aid uniform application at no additional cost to the Agency.

(2) Dry Mulch:

a. Straw Mulch - Evenly apply straw mulch within 24 hours after seeding and fertilizing. In areas not accessible to heavy equipment or hose, apply straw mulch by hand or other approved method.

Place straw mulch approximately 2 inches deep, in loose condition, which requires approximately 2 1/2 tons per acre of dry mulch, depending on moisture content. Do not use straw mulch on slopes of 1V:1.5H or steeper.

b. Compost Material Mulch - Evenly apply compost material mulch with a pneumatic blower or other equipment that propels the material directly at the soil surface and achieves direct contact with the soil. Apply compost at a uniform depth of 2 inches. Apply at least 3 feet over the top of the slope or overlap the material into existing vegetation.

When seed is required, apply it by one of the following methods:

1. Two-step Pneumatic Application:

- **Step 1** - Apply compost to a uniform depth of 2 inches with a pneumatic blower or other equipment that propels the material directly at the soil surface and achieves direct contact with the soil.
- **Step 2** - Uniformly mix seed with additional compost material and apply the combined seed and compost material over the first layer to a depth of 1/4 inch with a pneumatic blower or other similar methods.

2. Two-step Pneumatic and Hydroseeding Application:

- **Step 1** - Apply compost to a uniform depth of 2 inches with a pneumatic blower or other equipment that propels the material directly at the soil surface and achieves direct contact with the soil.
- **Step 2** - Hydroseed over the first layer according to 001030.48(a) except do not use fertilizer unless shown.

(3) Tacking - Anchor straw mulch using one of the following methods:

a. Dry Powder Tackifier - Unless the manufacturer recommends a greater rate, apply dry powder tackifier at the rate of 80 pounds per acre mixed with 800 pounds per acre of hydromulch.

b. Mechanical Crimping - Mechanically incorporate the straw into the top 2 inches of the soil forming a uniform surface cover effective at preventing erosion by one of the following:

1. Crimping Disc - A heavy disk with flat scalloped discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.

2. ~~Sheep's~~Sheep's-Foot Roller - Modified ~~sheep's~~sheep's foot roller equipped with straight studs, made of approximately 3/4 inch steel plate, placed approximately 8 inches apart and staggered. Ensure that the studs are not less than 6 inches long or more than 6 inches wide, and are rounded to prevent withdrawing the straw from the soil. Use a roller with enough weight to incorporate the straw sufficiently into the soil providing a uniform surface cover.

(c) Drill Seeder - Apply seed and fertilizer with a grass seed drill that works fertilizer into the soil and places seed under about a 1/4 inch soil cover.

(d) Seeding Over Mulched Areas - If an area has been previously mulched for erosion control or temporary seed and mulch is present on the soil surface, double the amount of each seed type used. Apply seed and fertilizer hydraulically and add a green dye to the mixture to visibly aid uniform application. Upon approval, fertilizer and seed may only be applied after mulching if one of the following conditions apply:

- Mulch is punched into the soil by mechanized means.
- It is necessary to hold down mulch with netting or like material.
- The slope is 1V:1.5H or steeper and a slurry mixture would tend to run down the slope.
- Mulch is removed prior to seeding.

(e) Optional Temporary or Permanent Seeding - Upon approval, the following may be used to stabilized disturbed areas that are 1,500 square feet or less and totaling no more than 0.5 acre:

(1) Seed - Seed the disturbed area with the seed mix at the rate of 2 pounds per 1,000 square feet. Seed may be spread by mechanical spreader according to 01030.48(b-1-c).

(2) Cover - Cover seeded areas with one of the following:

- Straw mulch at a rate of 100 pounds per 1,000 square feet. Spread the mulch uniformly and apply commercial tackifier or netting to hold in place.
- Bark mulch spread uniformly at an approximate depth of 1/2 inch. Use well-decomposed mulch for seed mulching.
- Suitable open-weave, biodegradable erosion control matting installed according to ~~manufacturer's~~manufacturer's instructions.
- Hydromulch applied in one step according to 01030.48(a).

(3) Fertilizer - Fertilize according to 01030.44.

01030.49 Work Quality:

(a) Drift - Prevent drift and displacement of seed and fertilizer regardless of equipment and methods used. Use protective covering on structures and objects where coverage and stains would be objectionable and when tacking agents are used with mulch. Protect vehicles and people from drifting spray. If equipment and methods of application result in wasting material, make corrections to prevent waste.

(b) Displacement - Prevent seed, fertilizer, and mulch from falling or drifting onto areas occupied by rock base, rock shoulders, plant beds, or other areas where grass is detrimental. Remove material that falls on plants, roadways, gravel shoulders, structures, and other surfaces where material is not specified.

(c) Damage - Prevent damage to prepared areas and to completed fertilizer, seed, and mulch work. Replace all material that becomes displaced before acceptance of the work.

Maintenance

01030.60 General - Ensure that each seeded area has a uniform, healthy and weed-free stand of grass or other seeded plants growing at the end of the establishment period. The minimum living plant coverage standards for acceptance of seeding in a planted area are as follows:

- **Temporary Seeding** - 70~~%~~ percent coverage of ground surface.
- **Permanent Seeding** - 90~~%~~ percent coverage of ground surface.
- **Wildflower and Wetland Seeding** - 70~~%~~ percent coverage of ground surface.
- **Water Quality and Lawn Seeding** - 100~~%~~ percent of ground surface.
- **Woody or Other Plant Seeding** - See Special Provisions for minimum living plant coverage.
- **Native Plant Seeding** - See Special Provisions for minimum living plant coverage.

01030.61 Establishment Period - The seeding establishment period is as follows:

(a) Erosion Control Seeding - For temporary and permanent seeding done solely for erosion control, the establishment period begins upon acceptance of the initial seeding work and ends upon satisfactory plant growth and coverage of the seeded areas according to 01030.~~42~~43 and 01030.60.

(b) All Other Seeding - Establishment periods for wildflower, plant, water quality, lawn, wetland, native plant, and permanent seeding begins upon acceptance of the initial seeding work and ends as follows:

- The seeding establishment period will end 45 days after the beginning of the establishment period, if the area was seeded during the seeding season and all establishment responsibilities have been met.
- If the original seeding construction is completed and accepted outside the permanent seeding dates, the establishment period will end 45 calendar days after all necessary reseeding is completed and accepted during the following seeding season.

01030.62 Establishment Work:

(a) Erosion Control Seeding - Select and provide establishment work for erosion control seeding from 01030.62(b) necessary to provide performance described in 01030.60.

(b) All Other Seeding - Ensure the establishment of wildflower, lawn, plant, water quality, wetland, native plant, and permanent seeding by the following:

(1) Protection - Protect seeded areas from trespass and other hazards of damage. Use protective fences and signs at no additional cost to the Agency. Obtain approval of protective methods used.

(2) Fertilizing and Watering - Apply fertilizer according to 01030.44. Apply water according to good horticultural practice under the prevailing conditions, as required to promote a healthy stand of plants. Obtain water at no additional cost to the Agency.

(3) Weed Control - Remove Specified Weeds prior to plants going to seed and keep WMA's and seeded areas "Weed Free" throughout the establishment period.

(4) Mowing - Mowing is required for lawn seeding and water quality seeding. Do the first mowing of grass when soil is firm enough to prevent rutting and grass is about 3 inches tall. After mowing, leave grass that is approximately 2 inches tall. At each subsequent mowing,

leave about 1 1/2 inches of growth. After the second mowing, grass clippings may be left in place upon written approval. The approval may be granted if:

- Mowing is done with a mulching blade.
- There are no weed seeds in the mulch.
- Mulch is not detrimental to the growth of grass.

(5) Repair and Restore - Repair and restore soil grades and re-seed damaged, settled, or unproductive areas to the specified conditions of this Section at no additional cost to the Agency.

Finishing and ~~Clean~~Cleaning Up

01030.70 Cleanup - Remove weeds, trash, debris, stones, and other extraneous matter from seeded areas as directed and dispose of according to 00290.20.

01030.71 Waste Disposal - ~~Protective coverings used on structures and all waste materials associated with seeding, fertilizing, mulching, and associated activities become the property of the Contractor at the point of origin. Dispose of these waste~~Dispose of materials according to 00290.20.

Measurement

01030.80 Measurement - The quantities of seeding and associated work performed under this Section will be measured according to the following:

- **Unit Basis** - Unit basis items will be measured by actual count.
- **Area Basis** - Area basis items will be measured on the ground surface.

Payment

01030.90 Payment - The accepted quantities of seeding and associated work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement

(a) Weed Control……Acre
(b) Seeding Mobilization.....Each
(c) Temporary Seeding, _____..... Acre
(d) Permanent Seeding, _____ ..... Acre
(e) Wetland Seeding, _____..... Acre
(f) Water Quality Seeding, _____ ..... Acre
(g) Plant Seeding, _____..... Acre
(h) Native Plant Seeding, _____..... Acre
(i) Wildflower Seeding, _____ ..... Acre
(k) Lawn Seeding .....Acre or Square Yard
(l) Fertilizing..... Acre
(m) Mulching..... Acre

Item (a) includes all work associated with the WCWP.

Item (b) includes all labor and transportation of materials and equipment, each time the Contractor mobilizes as required for all hydraulically or airborne applied seeding, fertilizing, and mulching.

In items (c) through (i), the type of seed mix, such as Mix No. 1, if applicable, will be inserted in the blank.

Items (c) through (k) include preparing the seed bed, soil preparation, seeding, fertilizing, mulching, applying tacking agent, and all establishment work.

When temporary seeding, applied according to 01030.43(a), is later accepted as permanent seeding according to 01030.43(b), payment will be made only one time under the permanent seeding pay item. No separate payment will be made for the initial seeding.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- mobilization for application by blowers, mechanical spreaders, or hand spreading
- inspections or maintenance
- seeding mobilization if it is not included in the Contract Schedule of Items

Partial payments for permanent seeding, regardless of type, will be made as follows:

- At completion of seeding ……70%
- At completion of seeding establishment period……30%

Section 01040 - Planting

Description

01040.00 Scope - This work consists of planting and associated work as shown or directed.

01040.02 Definitions:

Arborist - A specialist in the care and maintenance of trees.

Certified Arborist - An Arborist certified by the International Society of Arboriculture (ISA).

Consulting Arborist - An Arborist registered with the American Society of Consulting Arborists (ASCA).

Caliper - The diameter of a tree measured at a point 6 inches above the ground. If the measurement is over 4 inches, a new measurement is taken at a point 12 inches above the ground.

Dripline - The area directly under the branch and leaf canopy of trees and large shrubs. This area typically contains the most important of a plant's roots and is sometimes used as an approximate guide to estimate a root protection zone.

Licensed Nursery - Commercial nursery licensed by the Oregon Department of Agriculture to operate as a grower, dealer or agent, or to transport or store nursery stock grown or held for sale.

Native Plant (existing) - See 01030.02 for native plant definition.

Noxious Weed - See 01030.02 for noxious weed definition.

Ornamental Plant - A desirable plant species that is not native, or a plant propagated in such a way that it does not carry genetic characteristics of the species that are native to the area where it is planted.

Plant Establishment Period - A period of time, that is part of the planting work, that ensures satisfactory growth and establishment of plants.

Permanent Wilting Point - The level of soil wetness at which point a plant wilts and can no longer recover its sustainable turgidity when placed in a saturated atmosphere for 12 hours.

Root Protection Zone - A generally circular area around an existing plant to be protected from disturbance or compaction by the use of temporary fencing or other means. The zone as actually staked may exceed the current root area to allow for future growth of the plant. Root Protection Zones will be shown on the plans or staked before construction activities begin.

Weed - See 01030.02 for weed definition.

01040.03 General - Ensure that work meets the following requirements:

(a) Existing Vegetation - Do not disturb existing desirable vegetation that is to remain or is designated for protection, unless approved by the Agency prior to construction.

(b) Pesticide Applicators License and Chemical Registration - Furnish evidence to the Agency that each applicator is licensed for the specific class of chemical being applied. Also, furnish evidence that any chemical is registered for the proposed use by the Oregon Department of Agriculture according to ORS Chapters 452, 561, 570, and 634.

(c) Weather Conditions - Planting work will not be allowed during the following conditions, unless otherwise approved:

- **Cold weather** - When air or ground temperatures are expected to be below 32 °F.
- **Hot weather** - When air or ground temperatures are expected to be above 88 °F.
- **Wet weather** - When the ground reaches saturation, except as approved when planting wetland plants.
- **Windy weather** - When wind velocity exceeds 25 mph.

(d) Work Performed During Unacceptable Conditions - If any work occurs during unacceptable weather conditions, the Contractor may be required to provide the following services at no additional cost to the Agency:

(1) Expert Consultation - Consultation with a certified Arborist (for trees) or other expert as approved (for other plants) to determine what plant care measures are required to maintain the plants installed during the unacceptable weather conditions in a healthy and vigorous condition.

(2) Replacement - Replacement of all work performed during unacceptable weather conditions.

(3) Watering and Maintenance - Watering and maintenance of all plant materials installed during the unacceptable weather conditions and responsibility for all extra costs incurred.

01040.04 Coordination - Coordinate the following elements with the Agency prior to construction:

(a) Planting Work Plan ~~(PWP)~~ - Within 90 calendar days of award of the Contract, submit a planting work plan (PWP) for approval. Include or describe the proposed methods for the following:

- Work progress schedule according to 00180.41
- Material submittals according to 01040.10
- Contract Growing Plan according to 01040.19(g)
- Topsoil and/or Wetland Topsoil approvals according to 01040.14
- Plant installation and establishment
- Weed Control Work Plan (WCWP) according to 01030.42(a)
- Emergency contact person, including the Name, telephone and pager numbers, and voice mail and/or email address information

The following are included as part of the PWP, but are required only before the related planting work begins:

- Soil Fertility Test and Soil Amendment Report according to 01040.13.
- Soil Testing and Soil Bio-amendment Report according to 01040.13.

Proceed according to the approved PWP once written approval is received from the Agency. If any part of the PWP become unworkable at any time during construction, notify the Agency, then submit a revised plan. Do not proceed with the planting work until approved by the Agency.

(b) Notice for Inspections - Notify the Agency a minimum of 24 hours prior to each required inspection.

(c) Site Conditions - Ensure that the area is properly prepared prior to the start of the planting operation.

(d) Utility Locate - Coordinate all existing utility locations according to Section 00150.

(e) Utility Use - Provide required water and electricity for planting and plant establishment at no additional cost to the Agency unless an approved Agency source is available.

(f) Verification - Verify actual ground dimensions prior to construction. Notify the Agency of any discrepancies before beginning work.

Materials

01040.10 General - Submit a list of Project materials for approval according to 01040.04(a) before arranging for procurement of any materials. For materials not approved, submit a list of alternate materials for approval. Materials installed without approval will be subject to removal and replacement with acceptable material at no additional cost to the Agency.

Substitute materials may be allowed if proof of equivalent quality, suitable product specifications, ~~manufacturer's~~manufacturer's literature and other detailed information is furnished to the Agency according to 00140.70.

01040.12 Product Delivery, Storage, and Handling - Deliver manufactured products in original, unopened containers, each bearing the ~~manufacturer's~~manufacturer's guaranteed analysis, name, trade name, and conformance with governing regulations and laws. Protect products against damage or dehydration. Remove unacceptable products as soon as possible from the Project site. If required or requested, provide any manufacturer's literature to the Agency.

01040.13 Soil Testing - Furnish the following kinds of soil testing and reports:

(a) Soil Fertility Test and Soil Amendment Report - Prior to planting, furnish a soil fertility analysis of existing soils performed by a certified testing lab. Prior to planting, adjust soil amendment and fertilizer applications as recommended by the soil amendment report and as approved by the Agency.

(1) Sampling - Take five samples per acre of each soil type. Mix the five samples into one test sample for each soil type. Furnish soil fertility test results that provide information on available nutrient content and fertility status of the soil. Conduct sampling procedures according to the Oregon State University Extension Service handout EC 628, "How to Take a Soil Sample… and Why".

(2) Testing - The test may be performed by any qualified soils testing laboratory. A list of qualified soils testing laboratories is available from the Oregon State University Extension Service. Include testing for levels of acidity (pH), salinity, nitrates, ammonium, phosphates, potassium, calcium, magnesium, and any other tests necessary to determine appropriate fertilization and amendment needs for the type of plants being planted.

(3) Soil Amendment Report - Provide a report from the testing laboratory summarizing sampling locations and procedures with printed results, and which makes recommendations for fertilizers and soil amendments to effectively develop productive soil.

(b) Testing and Soil Bio-Amendment Report - Have soils tested prior to planting by an approved soil ecology lab. Provide information on soil foodweb structure and function, and include total and active bacterial biomass, total and active fungal biomass, protozoan numbers, nematodes, microarthropods, and mycorrhizal colonization. Adjust the kind and amount of soil conditioners, soil amendments, soil bio-amendments, and fertilizers (if any) as recommended by the soil bio-amendment report, and as approved by the Agency prior to construction.

(1) Sampling - Take five samples per acre of each soil type. Mix the five samples into one test sample for each soil type. Conduct sampling according to the standard procedures for soil organism assessment as recommended by the soil ecology lab.

(2) Testing - Perform the following soil ecology tests and furnish soil meeting these minimum soil organism biomass requirements:

Test	Minimum Requirements
Percent active bacterial and fungal biomass	between 5% and 25% activity
Total bacterial biomass	6×10^8 per gram of dry soil
Total fungal biomass	100 μg for grasslands
	200 μg for shrubs or perennials
	300 μg for forested areas
Protozoa	5000 per gram of soil
Beneficial nematodes	20 per gram of soil
	(No root-feeding nematodes)

Determine if anaerobic or compacted conditions are present, based on the assessment of total bacterial biomass, percent bacterial activity, and protozoan biomass.

If the soil contains biomass numbers lower than these levels, apply amendments and inoculates according to the soil ecology lab recommendations in the soil bio-amendment report in 01040.13(b-3).

(3) Soil Bio-Amendment Report - Provide a report summarizing sampling locations and procedures. Include the soil ecology lab report of the soil organism assessment and the recommendations for:

- Inoculation of missing organisms groups to the soil.
- Amendment with food resources for organism groups with too low of a biomass.
- Reduction of undesirable groups, or groups with the biomass too high for the optimal growth of the desired plants.
- Any adjustments to the bio-amendments required for the types of plants being planted.

01040.14 Topsoil - Furnish topsoil containing no substance detrimental to the growth of plants and that is free of plants designated by the Oregon Department of Agriculture as Type "A" or Type "B" weeds. Unsuitable topsoil, or topsoil placed by the Contractor without approval in areas to be planted, may be required to be replaced at no additional cost to the Agency.

~~20~~Twenty days before furnishing any type of topsoil, do the following:

- Give the Agency notice of intent to use the source.
- Provide access to the source for Agency inspection.

- Provide one 20 pound representative soil sample of each topsoil type for testing of particle size range and organic matter by the Agency, unless otherwise specified.
- Obtain approval of the source before excavation of topsoil begins.

(a) Selected Topsoil - Furnish native topsoil from the required excavations meeting the requirements of 00330.10 or from other Agency-controlled lands. The general limits of topsoil materials will be indicated on the plans. The Agency will make the final determination of the areas where the most suitable materials exist. Furnish topsoil that is the fertile part of a soil profile commonly referred to as the "A" horizon, typically ranging in depth from 3 inches to 12 inches. Do not take material for topsoil from a depth greater than 12 inches below existing ground, unless approved.

Select only sources that are well-drained and, before stripping, have a healthy crop of vegetative growth. Remove and dispose of all heavy grass or other vegetation before taking materials from the source.

(b) Imported Topsoil - Furnish imported topsoil from non-Agency controlled lands that, when tested according to AASHTO T 88, ~~meeting~~meet the following limits:

Standard Sieve Analysis

Particle Size Range	Percent Retained (by Weight)
Larger than 2"	0
2" - 3/4"	0 - 5
3/4" - No. 4	0 - 20
No. 4 or less	0 - 100

Of the fraction passing the No. 4 sieve, excluding organic material, furnish topsoil that conforms to the following limits:

Hydrometer Analysis

Particle Size Range	Percent (by Weight)
No. 4 - No. 200	5 - 70 (Retained)
No. 200 - 2 µm	20 - 80 (Retained)
Less than 2 µm	5 - 30 (Passing)

In addition, furnish topsoil that analyzes at least 2 percent organic matter according to ASTM D 2974.

(c) Wetland topsoil - Furnish a native, naturally hydric wetland topsoil consisting of silts, clays, and organic matter in combination that is free from substances detrimental to plant growth, such as noxious weeds, undesirable plant roots, refuse, sticks, or lumps. Provide wetland topsoil that is from a wetland with an existing, well established, healthy growth of the desired wetland plants. Obtain approval of the source before excavation of wetland topsoil begins.

Excavate, at a minimum, the top 24 inch depth of existing wetland soils using standard construction equipment.

01040.15 Soil Conditioners - Soil conditioners are for modifying soil structure and improving soil aeration characteristics, as distinguished from plant foods, mulch, and soil organism amendments. Furnish soil conditioners free of noxious weeds, living plants and rhizomes, and substances detrimental to plant life. ~~Submit~~For mushroom compost and peat moss only, submit a 15 pound

sample for approval by the Agency prior to construction. Provide soil conditioners that are free of weed seeds, excessive salts, chemicals detrimental to plant growth, and pest organisms. Soil conditioners proposed for use are subject to testing at any time or place the Agency deems appropriate.

Furnish one or more of the following soil conditioners:

(a) Mushroom Compost - The used bedding material from commercial mushroom production.

~~**(b) Composted Yard Debris** - Commercially manufactured material, made from dead plant material such as grass clippings, weeds, green and dead dry leaves, garden and vegetable material, and ground branches of trees and shrubs. Furnish a product that is composted under controlled aerobic decomposition, with the internal temperature reaching 135 °F for 15 days, without exceeding 155 °F. Ensure that it contains a maximum of 10% bacteria and 10% fungus. Additional certification may be required in areas having a certification program.~~
(b) Commercially Manufactured Compost - Commercially manufactured fine and medium compost material meeting the requirements of Section 03020.

(c) Peat Moss - Horticultural grade, natural peat moss in air-dry condition, free from woody substances, in bales or bags labeled for content and volume. Only peat moss used in combination with one of the above composts is acceptable.

01040.16 Soil Amendments - Soil amendments are intended to improve soil nutrition. Furnish soil amendments that are free of materials detrimental to plant life. Furnish manufacturer or supplier quality compliance certification according to 00165.35. Ensure that material testing methods meet the requirements of the Oregon Department of Agriculture appropriate to that material. Obtain approval for use before beginning work. Soil amendments may include the following:

- Lime
- Dolomite Lime
- Gypsum
- Rock, Diammonia, or other Phosphate
- Calcium or Potassium Nitrate
- Iron Sulfate

01040.17 Soil Bio-Amendments - Soil bio-amendments are intended to increase beneficial soil organism numbers or soil organic nutrient content. Furnish bio-amendment products or materials that are free of substances or life forms detrimental to plant life and receive approval prior to use on the Project. Furnish manufacturer or supplier quality compliance certification according to 00165.35. Ensure that material testing methods meet the requirements of the Oregon Department of Agriculture appropriate to that material. The following are typical soil bio-amendments that may be identified in the soil bio-amendment report:

(a) Bacterial Food Amendments:

- Simple sugars such as brown sugar, brown syrups, or molasses
- Plant extracts of Yucca or Nettle, usually containing sap of the plant comprised of a combination of simple sugars, proteins, and carbohydrates
- Fulvic acids
- Yeast, including baker's yeast, brewer's yeast, and champagne yeast
- Kelp meal
- Rock dust

(b) Fungal Food Amendments:

- Cellulose
- Lignin
- Humic acids - brown to dark brown products (black is not acceptable)

(c) Protozoa Food Amendments:

- Bacteria
- Hay infusions - A method of growing protozoa for soil inoculation by using hay in water

(d) Nematode Food Resources - Nematodes come as four types: bacterial-feeders, fungal-feeders, root-feeders, and predatory nematodes. Predatory nematodes eat other nematodes, while the name of the other groups indicate what organisms they eat.

The primary source of material containing a wide diversity of beneficial nematodes is good compost. Provide certification that the compost contains beneficial nematodes and does not contain root-feeding or other detrimental nematodes.

(e) Mycorrhizal Inoculates - Commercially produced ectomycorrhizal and endomycorrhizal fungi that improve plant root absorption of soil nutrients.

(f) Microbes - Commercially produced product designed to enhance microbiological activity in the soil by the addition of beneficial and essential microbes. Commercial products may also contain vitamins, amino acids, plant growth hormones, micronutrients, and plant stress relievers.

(g) Earthworms - Common earthworms that are either "Red Wigglers" or "Night Crawlers" delivered in peat moss or other damp medium.

01040.18 Fertilizer - The soil amendment and bio-amendment reports will recommend fertilizer types and application rates. When identified in the report furnish commercial fertilizer meeting the requirements of 01030.14 and the following:

(a) Organic - Organic fertilizer 5-4-3, analyzing 5~~%~~ percent nitrogen, 4~~%~~ percent available phosphoric acid, and 3~~%~~ percent soluble potash.

(b) Plant Bags and Tablets - Plant bags or tablets containing 20-10-5, or approved equal, may be used instead of granular fertilizer in pit planting.

Furnish plant bags or tablets that are controlled-release with a minimum one-year release period. Chemical formulation, rates and use will be approved by the Agency.

01040.19 Plants:

(a) Nomenclature - Botanical identification and nomenclature of plant materials shall be according to the most current edition of "Hortus Third", by Bailey. The Agency may authorize use of other references such as the "Sunset Western Garden Book", the "Flora of the Pacific Northwest", by Hitchcock, or the "Manual of California Plants", by Jepson.

Furnish plants that conform to the applicable requirements of the current issue of the "American Standard for Nursery Stock", published by the American Association of Nurserymen. When a conflict exists between this publication and the Specifications, the Specifications will prevail.

(b) Quality - Provide plants that are healthy, first-class representatives of their species or variety, free from disease and insect pests, with top growth that is well developed and free of disfiguring knots, sun scalds, bark abrasions, wind or frost injury or any other objectionable features.

Furnish plants that are acclimated to the specific project environmental site conditions prior to planting. Store all container-grown and balled and burlapped (B&B) plant materials acquired for fall planting a minimum of ~~three~~ 3 months before planting, at a location north of the 42nd Latitude (Oregon - California border).

Furnish plants that ~~possess~~possess top growth and root systems typical to their variety. Provide trees with central leaders that have a symmetrical, well-branched, straight trunk. Trees with a damaged or missing leader, multiple leaders or Y-crotches will be rejected, as will sheared conifer trees.

Protect plants at all times during handling, shipping, storage and planting against such detrimental effects as windburn, extreme weather conditions and drying of roots, root balls and foliage.

(c) Certification - Furnish a State inspection certificate and shipping certificate for each load or lot of plant material that includes the following information:

- Date of shipment
- Name of nursery where grown
- Name of plants (Including all names as specified in the Contract)
- Number of plants
- Grade or classification of plants (Verifying conformance with the Specifications)
- Size (Including height, spread, runner length, caliper and other measurements as required)
- Identify at least one plant (botanical and common name) within each group of like species
- Identify one plant (botanical and common name) within each different size category

(d) Inspection - Plants will be subject to inspection by the Agency, at any time and place. The Agency will make no plant material inspection at the source, except as it may elect. Notify the Agency of each delivery of plants to the Project site no less than 24 hours ahead of delivery. Do no planting until the plants have been inspected and approved for use. Any planting done without prior approval of the plants will be considered in violation of these Specifications.

The presence of noxious weeds in the soil accompanying plants or at the nursery source will be cause for rejection of any or all plants from that source.

(e) Availability - Furnish a list of nursery sources for all specified plants within 90 calendar days after execution of the Contract. Verify, by this list, that all specified plant material has been located and will be available for use on the Project. If applicable, see 01040.19(g) for alternate requirements.

(f) Plant Substitution - No substitution of plant materials will be allowed unless written evidence is submitted that a specified plant or material cannot be obtained and has been unobtainable since the execution of the Contract. If substitution is allowed, it will be by written approval from the Agency for the nearest acceptable variety, size and grade. Make any request for substitution in writing to the Agency with ample time for approval without delaying the work.

(g) Contract Grown Plant Materials - When required by the Special Provisions, include a contract growing agreement between the Contractor and a nursery supplier in order to ensure plant availability or suitability.

If a contract growing agreement is part of the Project, submit a Contract Growing Plan that describes plant material size at delivery, growth environment, name and location of nursery, and the source for each plant (native seed, indigenous cuttings, or commercially grown). Submit this required information as part of the PWP.

(h) Definition of Plants and Descriptive Terms - The following definitions describe the distinctive habit and characteristics of the most common plant materials:

(1) Conifer Trees - Trees with needle or scale-like leaves that maintain live-leaf foliage throughout the year, and that usually bear seed from a woody cone.

(2) Deciduous Trees - Trees with leaves that are shed at the end of the growing season, and which remain leafless throughout dormancy.

(3) Transplanted Specimen Plants - Unique or large plants typically used in low numbers on projects. See the plans for specimen type, size, and location. Deliver trees to the site that are dormant and with buds that have not yet swelled. Furnish plants that have an unbroken root ball sufficient to sustain continued growth. Ensure that the root ball size conforms to the current edition of the "American Standard for Nursery Stock". Provide plants with no broken limbs or bark abrasions, and cleanly cut off any frayed roots or damaged limbs. Deliver trees that are balled and burlapped, boxed or moved by commercial tree spade.

(4) Balled and Burlapped (B&B) Plants - Plants excavated with soil around the root system whose root ball is wrapped for shipping and handling. B&B materials are generally trees or shrubs, such as evergreens, that require a large ball of earth to sustain them after the transplant. Furnish plants that are balled and burlapped meeting the requirements of the latest edition of the "American Standard for Nursery Stock", including minimum size of root balls.

Furnish plants with root balls securely wrapped in burlap or similar mesh fabrics not harmful to plants, and bound with removable twine or wire. Provide root balls that are firm, intact and held solidly together by a fibrous root system consisting of only the earth in which the plant was growing. "Made" balls will be rejected.

(5) Collected Plants - Plant material that is harvested from existing on- or off-site plant populations. Furnish collected plants that conform to all appropriate quality, grade and class requirements of the current issue of the "American Standard for Nursery Stock".

(6) Container Grown Plants - Plants that are grown and delivered in containers which possess well-formed top growth and whose root growth is typical to the variety.

Furnish plants that are resident in their delivery containers long enough to have established new fibrous roots, have a root mass that will retain its shape, and hold 90~~%~~ percent (visual estimate) of the root ball material when removed from their containers. Some root growth should be visible along the outer edges of the container. Root-bound container grown plants and "made" container plants will be rejected.

(7) Seedling Trees - Plants that are grown from seed in a nursery and brought to the site in a bare root condition. Provide seedlings labeled with age and certification (class number) which shows the number of seasons grown in a nursery seedbed, followed by the number of seasons grown in a transplant bed. Furnish seedling trees that are a minimum ~~two~~ 2 years old.

Furnish seedling trees that are Oregon Department of Forestry "zoned" (grown) within approximately 500 vertical feet of the Project site elevation. Submit seedling zone information for the proposed plants to the Agency prior to construction.

(8) Bare-root Plants - Small deciduous plant material that is excavated for transplant with exposed roots. Furnish only bare-root plant materials that have dormant buds at the time of planting. Take great care to protect bare root plants against dehydration and sunburn.

(9) Plant Cuttings - Living, freshly cut branches from certain woody shrub or tree species that readily propagate when embedded in damp soil. Furnish plant cuttings of regionally native species and dimensions as shown on the plans. Obtain written approval of the cutting stock sources before taking any cuttings and furnish a brief, written description of the cutting ~~site(s)~~sites and the date and time the cuttings were taken to the Agency. Take cuttings in such a manner so as to leave no long-term damage to the source population. If willow species are called for, select the local native shrub variety.

~~(~~**10) Fascine** - Bound, cylindrical bundles of live plant cuttings that are placed in shallow trenches, partially covered with soil, and staked in place, typically used to stabilize stream banks against erosion. Furnish only fascines of regionally native materials having the dimensions shown on the plans.

(11) Brush Mattress - A combination of plant cuttings and fascines installed to cover and protect stream banks and shorelines. Brush mattress dimensions and any material requirements will be shown on the plans.

(12) Tubeling Plants - Plants grown in containers that encourage deep root growth.

(13) Vines - Plants with growth primarily along stems, often having climbing characteristics, and typically attaching to walls by tendrils or other means.

(14) Groundcovers - Low growing or spreading plants.

(15) Wetland Plants - Plants that meet the definition of hydrophyte, which is any macrophyte that grows in water, or on a substrate, that is at least periodically deficient in oxygen as a result of excessive water content.

(16) Bulbs - For the purposes of this section, these will typically include the forms known as bulbs, corms, culms, plantlets, rhizomes, runners, small offsets, stolons and tubers. These plants will be collectively referred to as "Bulbs". The appropriate propagule (plant part that can be separated and used to grow another plant) will vary depending on the plant species.

(17) Sod Lawn - Grass sod grown on agricultural land that is commercially cultivated specifically for turf sod. Furnish sod that is free of weeds, diseases, harmful nematodes and insects. Provide sod that is mature, not less than 10 months old, and machine cut to a uniform thickness of 5/8 inch or more, excluding top growth and thatch. Broken pieces and torn or uneven ends will not be accepted. Plant sod within 36 hours of harvest.

01040.20 Mulch - Furnish plant bed mulch materials free of noxious weed seeds or plants and which contain no substance detrimental to plant life. Mulches are subject to inspection at any time and place at the discretion of the Agency. The following are some types of materials that fall under the category of "mulch", and may be used on projects:

(a) Bark Mulch - Ground, shredded or broken particles from the bark of fir, pine or hemlock trees which is free of non-bark debris, harmful bacteria, disease spores, pests and substances toxic to plant growth. Provide mulch that is the standard trade size known as "medium fine mulch".

(b) Cinder Mulch - Crushed lava cinders, screened to an approximate size between 3/16 inch to 5/8 inch. Furnish cinders free of fines and other non-cinder material.

(c) Straw Mulch - Provide straw mulch according to 01030.15.

(d) Rock Mulch - Round 3/8" - No. 4 pea gravel or round 2" - 3/8" rock. Provide material that is free of fines and other non-gravel material. Rock colors may vary.

(e) Wood Chip Mulch - Mulch that is chipped from cleared site vegetation. Ensure that chipped material is free of any noxious weeds or invasive vegetation. Allowable size range or other qualities may be listed in the Special Provisions.

(f) Compost Mulch - Commercially manufactured fine and medium compost meeting the requirements of Section 03020.

01040.21 Herbicides - The use of herbicide chemicals will be allowed only upon approval of the Agency. Select and apply chemical herbicides according to all applicable Federal, State and local laws, as well as the WCWP requirements of the PWP. The following are standard herbicide functional categories:

(a) Soil Sterilant - Chemical herbicide that is used to kill all new emergent vegetation, often including seeds or other plant parts.

(b) Pre-emergent - Chemical herbicide that is used to stop the germination of seeds before they grow above the soil level.

(c) Post-emergent - Chemical herbicide that is used to selectively or non-selectively kill vegetation after germination and emergence above ground.

01040.22 Water - When required by the Special Provisions, furnish the following:

(a) Pressure Moisture Stress Sensor - A pressure chamber instrument capable of applying up to 40 bars or 600 psi to a small leaf or shoot in order to determine its water uptake potential. Instrument is to include all accessories necessary to perform a plant moisture stress test.

(b) Timed-Release Water - Containerized moisture retension chemical in the form of a solid gel delivered in biodegradable cartons. Typical ingredients are 97.85% percent water, 2% percent cellulose and 0.15% percent aluminum sulfate.

(c) Moisture Retention Chemicals - Granular chemical that are typically cross-linked potassium based polyacrylate or polyacrylamide copolymers. Provide commercial quality product from the QPL.

01040.23 Miscellaneous Items - Furnish miscellaneous items meeting the following requirements or provide commercial-quality products from the QPL. Obtain approval from the Agency prior to use.

(a) Anti-transpirant - Apply liquid anti-transpirant spray to all appropriate deliverable plant materials, prior to transport.

(b) Boulders - Furnish boulders of indigenous materials, with source, dimensions, and other characteristics as shown.

(c) Browsing Protectors - Flexible, semi-rigid plastic or metal mesh, brown or light green in color, with stake supports.

(d) Game Repellent - A commercial nontoxic spray that makes vegetation unpalatable for animal forage.

(e) Root Barrier - A root barrier designed to contain and control root intrusion into unwanted areas.

(f) Tree Grates - Tree grates complete with frames, all required attachment hardware, and at least one issue of any specialty key or tool that is required to open or move the item for maintenance.

(g) Tree Stakes and Ties - Rough sawn tree stakes of 1 1/2 inches x 1 1/2 inches douglas fir or pine, construction grade or better. Use stakes 6 ~~foot~~feet long for trees less than 8 feet tall, and stakes 8 ~~foot~~feet long for trees 8 feet or taller. Stain all tree stakes with an approved, dark green penetrating oil stain. Provide tree trunk protection of guying material of either a commercially available tree tie or a section of garden hose. Furnish tree guying material of a commercial product manufactured for this use, such as plastic chain, or stainless steel woven-wire with clamp fasteners. Size the guying material appropriate to the size of the tree and the wind factors of the area.

(h) Trunk Wrap - Typically manufactured of waterproof, crinkled paper and is designed to protect tree trunks against sunscald, loss of moisture and insect attack.

(i) Weed Control Geotextile - Weed control geotextile is typically manufactured of permeable, fibrous synthetic material and is generally for use under material such as mulch or gravel.

(j) Woody Course Debris - Logs or root-wads salvaged from on-site deciduous tree clearing and grubbing activity.

Construction

01040.40 General - Planting areas and plant locations shown on the plans are approximate unless shown with dimensions. Be responsible for layout and staking for plant placement, subject to approval by the Agency before planting. The Agency will make only field measurements necessary to calculate and verify quantities for payment.

Adjust tree locations to avoid possible conflicts with vehicle recovery clear zones, utilities, structures, miscellaneous appurtenances, and signing, as directed. In mowable grass areas, locate trees at least 10 feet from the edge of plant beds, other trees, fences, and ditch bottoms, unless otherwise specified.

01040.41 Planting Season (West of the Cascades) - Perform all plant installation work from September 1 to May 15, unless otherwise specified. Container-grown materials located within irrigated areas may be planted at other times, depending upon written Agency approval.

Do not place lawn sod before March 15 or after September 30 without written Agency approval.

01040.42 Planting Season (East of the Cascades) - Perform all plant installation work from October 15 to November 30, unless otherwise specified. Container-grown materials located within irrigated areas may be planted at other times, depending upon written Agency approval.

01040.43 Topsoil:

(a) Excavation - Prevent fouling of suitable material with subsoil or other detrimental matter. Form stockpiled soil into windrows at least 6 feet high, not to exceed 13 feet high, to maintain and preserve soil organism vitality.

(b) Subsoil Preparation - Grade and finish areas that are to receive topsoil, allowing for the specified amounts of topsoil. Scarify or till subsoil that is not loose and friable to a depth of 6 inches and obtain approval from the Agency before placing topsoil.

(c) Hauling and Spreading - Haul and spread material without compacting the topsoil or areas where it is placed. Protect from damage any surrounding objects, pavement, structures and areas that are traveled, crossed, or mounted by equipment.

Smoothly spread the topsoil over the specified areas to the thickness, grades, and slopes shown or directed. Avoid wasting topsoil and do not place material during wet conditions. Do not work saturated soils in any manner. Material placed contrary to Agency instructions or in undesignated places will not be paid for and removal may be required at the discretion of the Agency.

(d) Finishing and Cleaning Up - Finish areas covered with topsoil to proper grade, contour and cross section. Cultivate all topsoil not in a loose and friable condition to a depth of at least 4 inches. Bring the surface to a condition ready for planting operations.

01040.44 Select Wetland Topsoil:

(a) Excavation - Stage construction so that excavated soils may be moved directly to the wetland mitigation location. If that is not possible, stockpile the material for not more than 28 days. Water stockpiled material twice weekly and keep moist until used. Form stockpiled soil into windrows at least 6 feet high, not to exceed13 feet high, to maintain and preserve soil organism vitality.

(b) Subsoil Preparation - Excavate or grade areas to receive selected wetland topsoil as shown on the plans and finish as smooth as practicable through one pass of standard construction equipment. Have subsoil preparation inspected and approved by the Agency prior to spreading the selected wetland topsoil.

(c) Hauling and Spreading - Transport select wetland topsoil to the site by any means which meets all applicable regulations related to hauling potentially wet or moist materials. Spread the topsoil to a depth of 6 inches minimum to 24 inches maximum, or to meet the finished elevations as specified on the plans. Make as smooth as practicable without excessive soil compaction. After spreading, have the area inspected and approved by the Agency prior to planting.

01040.45 Soil Amendments - Incorporate soil amendments into the topsoil when required by the soil fertility test and soil amendment report. The application rate will be verified by checking settings on the spreading or application equipment.

01040.46 Soil Bio-Amendments - Incorporate the following soil bio-amendments into the topsoil of areas to be planted, according to the recommendations of the soil bio-amendment report, the supplier, or the following:

- Bacterial Food Amendments
- Fungal Food Amendments
- Protozoa Food Amendments
- Nematode Food Amendments

- Microbes and Biostimulants
- Earthworms - Add nine worms per cubic yard of topsoil (this ~~roughly equates to~~is approximately three worms ~~per~~for each 10 square feet of topsoil at 12 inches depth).
- Mycorrhizal inoculation - Incorporate into the planting hole quantities of mycorrhizia sufficient to correct the soil for the type of plants or grasses being grown.

- Mycorrhizal Inoculation (Injection) - Provide pre-measured packets containing live endomycorrhizal and ectomycorrhizal fungi.
- Mycorrhizal Inoculation (Root Dip) - Apply root dip material containing live endomycorrhizal and ectomycorrhizal fungi.

The application rate will be verified by visual inspection of application rates. A one-time application should be adequate, as long as pesticides, fertilizers or other toxic materials are not used at the same time. If it becomes necessary to apply pesticides that have non-target organism effects, or to apply fertilizer at rates greater than 13 pounds per acre, re-inoculate the organisms about ~~one~~ 1 month after the pesticide or fertilizer was applied.

01040.47 Fertilizers - Incorporate fertilizer based upon recommendations of the soil amendment and soil bio-amendment reports or, with Agency approval, at the type and rate as follows:

Plant Bags/Tablets

Plant	Rate	Size
Tree	3 per tree	3/4 ounce
Shrub	2 per shrub	3/4 ounce
Vine/Ground Cover	1 per plant	3/16 ounce

Granular Fertilizer Rate

1 pound per tree per application
1/2 pound per shrub per application
1/8 pound per vine/ground cover per application

Evenly space planting bags or tablets around plants after planting pits are two-thirds filled with backfill. Mix granular fertilizer into the upper one-half of plant backfill.

The application rate will be verified by visual inspection. Furnish manufacturer or supplier quality compliance certification according to 00165.35. Ensure that material testing methods meet the requirements of the Oregon Department of Agriculture appropriate to that material.

Do not allow the fertilizer application to conflict with the soil bio-amendments. In case of questions, provide the soil bio-amendment supplier's written recommendations to the Agency.

01040.48 Planting Area Preparation - All planting areas shall be Weed Free before planting or seeding operations begin. Identify, kill, and remove plants according to 01030.62(b-3).

Prepare planting areas according to the following methods, or as otherwise specified:

(a) Method "A" (Cultivated Planting Areas, Non-lawn) - Cultivate plant beds to a depth of ~~2~~12 inches. Thoroughly mix ~~52~~2 inches of soil conditioners into the top 12 inches of plant beds. In addition, add soil amendments, soil bio-amendments and fertilizers, as shown or

specified, according to the soil amendment and soil bio-amendment reports recommendations, into the top 12 inches of topsoil.

Finish grades by raking to a grade tolerance of plus or minus 1 inch, with a smooth and firm condition, and an even grade that is free of undulations or low areas that could create standing water. Match existing grades at the perimeter. Finish to the proposed grades shown or specified.

On slopes that the Agency determines are too steep to cultivate, plants may be planted in individual planting holes prepared using method "B".

(b) Method "B" (Non-Cultivated Planting Areas) - Spray existing weeds and non-desirable vegetation with herbicide to kill all top growth and roots in areas not requiring cultivation. Use herbicides that have limited residual toxicity to permit safe planting as required under the Contract. Do not spray or otherwise harm plants to be saved. After inspection and approval, remove the dead top growth of plant material within 2 inches of the surface and dispose of according to Section 00320. Replace plants to be saved that are damaged by herbicide application at no additional cost to the Agency.

Add any soil conditioners, soil amendments, soil bio-amendments or fertilizers with the backfill at each plant pit or to the seeding operation.

Finish wetland mitigation planting areas to specified finish elevations, blending to existing ground smoothly, as required and directed. Except for projects that are less than ~~one~~ 1 year in duration and unless otherwise approved, review the seasonal hydrology of the area to be planted for one full winter season (November 15 to February 28) prior to planting any wetland plants. Adjust plant types and planting locations as required or directed, based on the review of site hydrology.

When planting seedling plants, completely scalp vegetation from a 12 inch diameter area around each planting hole. Clear all debris such as wood and rocks from the planting spots, provided debris is not deeper than 12 inches. When debris is deeper, move the planting location. Use herbicides around seedlings only upon written approval of the Agency.

(c) Method "C" (Sod Lawn and Seeded Lawn Areas) - Cultivate existing ground to a depth of 6 inches, achieving a loose and friable condition suitable for fine grading. Remove all vegetation, rocks larger than 2 inch diameter, clods, roots, sticks, debris, and other matter detrimental to the growth of sod.

Uniformly spread soil conditioners, soil amendments, soil bio-amendments, and fertilizer evenly over the area and thoroughly rototill into the soil to a depth of 4 inches. Apply at rates recommended by soil testing, or as follows:

Material	Rate (per 100 square yards)
Soil Conditioner	1/2 cubic yard
Fertilizer	10 pounds
Lime (Western Oregon only)	40 pounds

Fine grade and roll planting areas with a water-filled roller to provide a fine-textured, smooth, firm surface, free of undulations, irregularities or low areas that could create standing water. Grade areas receiving sod to within 1/2 inch of the designed grades, and 1 inch below adjacent walks, curbs and pavement. Since sod thickness varies, adjust initial grades so the final sod soil level is slightly below adjacent hard surface grades. Ensure that final sod grade does not create a pedestrian tripping hazard.

Furnish the Agency with sod mixture information and a quality compliance certificate from the sod grower, certifying sod compliance with mixture requirements, according to 01040.10.

Prior to completion of any sodding and seeding, re-grade ruts, footprints, washouts, or any other irregularities, and re-seed or re-sod repaired areas as originally specified.

(d) Method "D" (Rough Areas Seeded for Revegetation or Erosion Control) - Remove any matter detrimental or toxic to the growth of plants, including weeds, clods, rocks or debris. On slopes 1V:3H or flatter, remove all debris larger than 2 inches in any dimension. On cut slopes 1V:1.5H or flatter, roughen the surface with furrows parallel with slope contours and loosen the soil to a depth between 3 inches and 6 inches.

(e) Method "E" (Temporary Seeding Areas) - If grading is required or directed, make equipment passes at right angles to the slope in order to form seed-holding tracks in the soil.

01040.49 General Planting - Plant trees, shrubs, groundcover, vines, and bulbs using the following practices:

- Inspect plants after arrival at the Project and before planting. Do not install plant materials until each required inspection by the Agency is complete. Replace plants not meeting the requirements of the Specifications with plants as specified or otherwise directed, at no additional cost to the Agency. Initial approval of plant materials for planting by the Agency will not constitute final acceptance.
- Protect all plants during shipping, handling, storage, and planting from windburn or exposure to harmful weather conditions, and root or root ball drying.
- When excavating planting holes, stockpile excavated topsoil separately from subsoil. Do not include alkali soil, subsoil, gravel, debris or rocks in the topsoil. Dispose of any substandard excavated materials in a manner not harmful to plants or planting work. Scarify planting pit sides and bottoms to eliminate glazed surfaces. Dispose of excess soil in a manner that is not harmful to plants or planting work.
- Do not plant in standing water unless approved by the Agency. If standing water is present within a plant pit, notify the Agency prior to planting to determine what corrective measures are required. ~~Perform corrective measures on an Extra Work basis according to Section 00196.~~
- Excavate tree plant pits a minimum of twice the diameter of the plant root ball or 2 feet larger than the root ball, whichever is greater. Dig shrub plant pits a minimum of 1 foot larger than the root ball diameter. Dig pits to the same depth as the root ball, root mass, or container. Spread root systems of bare root plants and container stock as necessary to keep plants from being root bound.
- Cleanly cut off broken or frayed roots of bare-root plants before planting. Spread out roots in their natural position within the pit and trim only damaged roots as approved by the Agency. Remove all labels, tags and attachment materials from the plants before final inspection.
- Set upright growing plants straight and plumb, and prostrate growing plants level to the ground surface. Set all plants so that, after settlement, they are at the same level as when growing in the nursery or container.
- Place the backfill then add soil amendments, soil bio-amendments, and fertilizers as recommended by the soil amendment and bio-amendment reports. Moisten backfill completely after placing to eliminate air pockets and minimize settlement of the backfill. Form a shallow (2 inch high) water-holding saucer in the soil around the plant unless directed otherwise.
- Balled and burlapped plants may be placed with the root ball wrapping removed or, if all materials are untreated and fully biodegradable, left in place. If the root ball wrapping (burlap)

is left around the plant, completely remove all tie wire, string or twine and fold down the burlap from the top half of the root ball.

- Perform any required pruning using good horticultural practice appropriate to the type of plant. Prune to remove all dead, damaged, crossed or rubbing twigs and branches, and to compensate for loss of roots during planting. Make cuts close to the parent stem, but not flush or through the bark "knob" at the branch joint. Do not prune terminal ends of tree leaders without approval of the Agency.
- Apply bark or wood chip mulch of the type and depth as shown. Correct contamination of new mulch due to the ~~Contractor's~~Contractor's operations at no additional cost to the Agency. Feather mulch into plant material trunks, stems, canes or root collars, and leave 1 inch below the top of junction and valve boxes, curbs and pavement edges. Any mulch placed to a thickness greater than specified will be at no additional cost to the Agency.
- Do not disturb protected existing vegetation unless approved by the Agency prior to construction.
- Dig pits for street trees that have hard surfaces around them so the crown of the root ball is 3 inches below the finished surface of the surrounding grade.
- Water deciduous trees that are 1 1/2 inches or larger in diameter, conifer trees that are over 4 feet in height, and all shrubs at a minimum frequency identified in the Special Provisions.

01040.50 Special Planting Requirements:

(a) Transplanted Specimen Plants - Use the following methods for transplanting specimen plants, unless otherwise specified:

(1) Mechanical Digging - Use a ~~"Vermeer" type of~~ tree spade ~~or approved equal~~unless otherwise directed. Move only during the season that the tree is dormant. Treat deciduous plants with anti-transpirant prior to excavation. Confirm with the Agency that the size of the spade is appropriate to the size and type of tree prior to beginning work. Dig the receiving hole prior to digging the tree to be transplanted. Take care not to damage the tree bark. Refill the original hole after transplanting. Do not move Oregon White Oak (Quercus garryana) by this method.

(2) Hand Digging - Before digging, obtain approval from the Agency for the size of container or root ball to be used for each plant. Begin digging at a diameter greater than the expected size of the root ball and remove dirt toward the plant until the surface roots show. When completely dug, secure the root ball with burlap and twine, wire basket or in a wooden box. Take special care to dig deep enough so that the taproot is not cut until it is smaller than 3/8 inch. Take care not to damage the tree bark. Refill the original hole and compact the soil after transplanting.

Install perforated plastic drainpipe as shown. Add fertilizer, soil amendments or bio-amendments to backfill topsoil mixture. Stake or guy the tree as specified.

Provide one application of anti-transpirant before transplanting, and one application of Vitamin B1 growth hormone after planting to each specimen plant according to the ~~manufacturer's~~manufacturer's recommendations.

Perform all replanting of specimen plants according to 01040.41 and 01040.42.

(b) Staking and Guying Trees - Stake and guy planted trees as shown or directed.

(c) Seedling Trees - Plant seedling trees using one of the following three methods:

- Planting hoe capable of opening a vertical hole broken out on three sides, with a minimum blade length of 12 inches and width of 3 inches.
- Planting shovel capable of opening a vertical hole broken out on three sides and at least 10 inches deep.
- Normal bare-root planting method.

No pre-staking of planting locations will be required. The Agency will be present as planting begins and will approve the spacing, planting method, and areas to be planted before work can begin. Vary plant spacing in order to allow seedlings to be planted in suitable soil. During the planting process, remove one tree at a time from the planting bag or other container to prevent drying of roots.

Place the roots of each seedling in the ground so that they assume a natural arrangement and do not twist, angle, bunch together or turn up at the ends. Plant seedlings so that the root collar is at or above the ground plane by no more than 1/2 inch. During planting, tamp soil around the roots in the lower half of the hole. Then fill the hole to the surrounding soil level and firmly pack so that no air pockets remain around the roots.

Ensure that seedlings do not pull loose with a tug strong enough to detach a small group of needles or small branch ends as applicable. Place a stake at the edge of each planting pit and install browsing protection and browsing repellant.

(d) Tubeling Plants - Place the tubeling into the planting pit without breaking the root mass. Set the top of the root collar 1/2 inch above finish grade, and gently tamp soil around the plant to compact the backfill. Place a stake at the edge of the plant pit and attach a browsing protector around each plant.

(e) Collected Plants - After plants become dormant, excavate collected plants by hand, protecting the root mass against drying, freezing or breaking. If possible, plant all collected stock the same day as gathered, or transport to a local nursery for temporary storage until final planting.

If immediate planting is not possible, place collected plants in heavy paper or plastic with slightly damp peat moss or sterile potting soil. Store dormant plants at 32 °F to 37 °F until planting. Examine stored material frequently for signs of stress or disease and correct storage conditions as necessary. Plant collected plants before dormant bud development.

(f) Bulbs - Plant dormant bulbs at a depth of 1 inch to 2 inches or to the grade they grew naturally. Compact the soil firmly around the bulbs to prevent float-out and ensure good establishment. Dig holes large enough to naturally space bulbs within the planting area.

(g) Plant Cuttings - Collect and plant the cuttings while in winter dormancy, generally between October and March. Notify the Agency if conflicts exist with permit requirements. Store all cut material in ventilated plastic containers that allow free flow of water. Protect root systems from excessive drying at all times. Do not store plants in airtight containers.

Plant stock within ~~four~~ 4 hours of harvest. If plants are a willow species, plant in the riparian zone on that portion of the slope where the plant stem ends will be in contact with year-round moist soil as determined by the Agency. Make planting holes by forcing a steel bar or similar tool into the ground about 12 inches deep. Place the cuttings into the holes and tamp soil firmly around the stems, leaving a minimum of 6 inches showing. Vary these dimensions as required for larger plant cuttings.

01040.51 Planting Wetland Plants - When planting wetland plants, do not use soil amendments, mulch, or fertilizer. Plant rhizomes, tubers and plugs within the upper 2 inches to 3 inches in exposed muddy or moist soils. When the water depth reaches or exceeds 1 inch notify the Agency of the potential need for adjustment to the planting.

01040.52 Placing Sod Lawn - Place sod only after approval of the Agency. Immediately before placing sod, water the soil bed to prevent drying of grass roots. Lay the first sod row in a straight line, then place subsequent rows parallel to and tightly against each other, staggering lateral joints. Do not stretch or overlap the sod. Tightly butt all joints. Do not use sod segments containing less than 2 square feet of surface area.

After placement, diagonally roll and thoroughly water the sod. Apply a second application of 22-16-8 fertilizer ~~(22-16-8)~~ at the rate of 510 pounds per 100 square yards and thoroughly water.

01040.53 Mulch - Apply mulch according to the following:

(a) Ornamental Plant Bed Areas - Submit a 15 pound sample of bark mulch to the Agency for visual inspection and approval. The approved sample will be the standard of acceptability for all mulch used on the Project.

Apply bark mulch after beds are made free of weeds and debris, the surface is brought to a smooth finished grade, and all planting work (except for vines and groundcovers) is complete. Uniformly bark mulch planted areas to a nominal depth of 2 inches with bark mulch. Apply bark mulch so that it presents a smooth and even appearance as approved by the Agency (raking may be required).

Keep bark mulch off plants, structures, roadways, shoulders, walks, and lawns. Uncover all plants covered by mulch material as soon as possible and leave the site in a neat, clean and finished appearance. When planting vines or groundcover, rake bark mulch away from planting pits so that the bark is not contaminated. After planting, evenly spread excess soil and rake bark mulch back into place.

Replace bark mulch that is displaced or blown away, and correct to the specified depth any bark mulch placed to a greater than specified depth, at no additional cost to the Agency.

Spread rock or cinder mulch to a depth of 2 inches after planting trees and shrubs.

Spread compost on top of the soil to a nominal depth of 3 inches.

(b) Non-Ornamental Plant Bed Areas - Apply mulch according to one of the following methods:

(1) Straw Mulch - Spread grass straw mulch to a nominal 2 inch depth and tackify, after planting of tubeling plants and seeding as required.

(2) Wood Chips - Spread wood chips to a nominal depth of 2 inches. Add 15 pounds of Ammonium Nitrate ~~/1000SF~~ per 1,000 square feet to neutralize nitrogen loss.

(3) Compost Blanket - Spread compost on top of the soil to a nominal depth of 3 inches.

01040.54 Water - Water all plants at intervals as required to maintain and promote healthy growth. Avoid excessive watering of shrub bed areas that may leach herbicide and damage adjacent lawns or desirable or protected vegetation. Repair all lawn vegetation damage at no additional cost to the Agency.

(a) Pressure Moisture Stress Sensor - When a pressure moisture stress sensor is specified, the Agency will test a 1~~%~~ to 5~~%~~ percent representative sample to ensure that the moisture stress level is below 20 bars of pressure and inform the Contractor if any material exceeds this limit. Any plant material found to have greater than 25 bars of pressure will be considered to be under extreme moisture stress. Provide sufficient water within 24 hours to bring the plant into normal range. The Agency will retest to determine the new representative pressure. Plant material that have 30 bars or greater will be considered to have reached its permanent wilting point. Replace all such material during the next planting period. Testing will occur mid-day at the following times until the end of the establishment ~~period(s):~~periods:

- After plant delivery, during temporary storage, and before planting.
- At ~~one~~ 1 month intervals throughout the summer season, up to the first fall rain or snow.
- At weekly intervals during extremely hot or dry summer periods.
- Any time the Agency believes the plant material may be under stress.

(b) Timed-Release Water - Apply timed-release water containers when specified. Cut the bottom from the carton, dig a hole next to the plant and place so the contents touches the root ball or root area approximately 4 inches beneath finish grade, or according to the ~~manufacturer's~~manufacturer's directions. Fill soil back around the carton to hold it firmly in place. Apply one carton for seedlings and tubelings, two cartons for No. 1 containers, and four cartons for larger plant material.

(c) Moisture Retention Chemicals - Utilize moisture retention chemicals according to the ~~manufacturer's~~manufacturer's recommendation, depending upon specific applications.

01040.55 Miscellaneous Items - Place or install miscellaneous items as follows:

(a) Boulders - Place boulders in locations as shown. Do not scar or break boulders with equipment. Ensure that one-third to one-half of each rock is buried beneath finish grade. Verify all rock placement with the Agency prior to installation.

(b) Tree Grates - Install grates, frames, and appurtenances as shown and according to the manufacturer's recommendations. Place frames flush at sidewalks and place guards plumb according to the manufactures recommendations.

(c) Weed Control Geotextile - Place weed control geotextile at finish soil grade when planting is complete but before mulch placement begins. Place weed control geotextile with a minimum 4 inch overlap between rolls, turned under edges, and attached to the ground as recommended by the manufacturer.

(d) Woody Course Debris - Place woody course debris within the stream channel, facing upstream at approximately 45 degrees from the stream bank, or as shown or as directed. Anchor woody course debris to the stream channel bottom as shown.

(e) Anti-transpirant - Apply anti-transpirant according to the manufacturer's directions to all exposed foliage surfaces immediately before materials are delivered to the Project, or as otherwise specified. Provide certification of compliance.

(f) Game Repellent - Apply a game repellent to all exposed foliage surfaces immediately after materials are planted, or as otherwise specified. Re-apply to each plant every 120 days, or according to the manufacturer's printed instructions, until the end of the plant establishment period.

(g) Browsing Protectors - Install browsing protectors according to the ~~manufacturer's~~manufacturer's recommendations.

(h) Root Barrier - Install root barrier according to the ~~manufacturer's~~manufacturer's recommendation.

(i) Tree Stakes and Ties - Place tree stakes parallel with the prevailing winds and drive vertically into the ground at least 12 inches below the planting hole depth, or as shown. Do not drive stakes through the root ball.

(j) Trunk Wraps - Wrap tree trunks with the specified wrap, covering all exposed trunk between finish ground and the first whorl of tree branches.

01040.56 Cleanup During Construction - Maintain the Project in a neat, orderly condition. Remove unsightly construction materials at the end of each working shift. Clean all pavement surfaces of mud, debris, or other materials that may, in the opinion of the Agency, cause problems. If material is not removed, the Agency reserves the right to have the cleanup work performed and deduct the value of this work from the monies otherwise due the Contractor.

Plant Establishment

01040.70 General - The Contractor is responsible for the survival of all plant material until the end of a plant establishment period of ~~one~~ 1 calendar year. The plant establishment period will begin when all the original planting is complete. The original planting is considered complete when all the plant material has been planted to the satisfaction of the Agency.

Establishment period work includes removing all plants that have reached their permanent wilting point, are dead, dying, or which do not meet Specifications, and replacing them with healthy plants. All plants in place after this replacement will be recognized as the original planting and will be subject to the establishment specifications. Repair, restore, and replace all plantings that have been damaged by vehicles, vandalized, and stolen according to 00170.80**.**

01040.71 Plant Care and Success Criteria - During the plant establishment period, maintain plants in a vigorous growing condition by regularly doing the following:

- Watering and fertilizing sufficiently to promote growth.
- Weeding, cultivating, pruning, and repairing.
- Adjusting tree stakes and guys.
- Controlling weeds before they seed according to 01040.48.
- Controlling pests and noxious weeds before the reproductive cycle.
- Removing dead or non-vigorous plants.
- Replacing missing plants.
- Re-mulching of plant bed areas.

The determination of a successful plant establishment period will be made at periodic plant establishment inspections. A successful planting establishment for each inspection is defined as follows:

- All plants are surviving and have vigorous growth.
- Plants are free of insects and disease.
- Plants show signs of continuing health.

- Plants have not reached permanent wilting point.

At the discretion of the Agency, certain types of regularly spaced plantings such as groundcovers may be measured using an area sampling method. To determine the rate of survival, set out (delineate) representative plots measuring 100 square feet at the completion of the original planting at random locations in each general planting area. The representative plots will be mutually agreed upon between the Contractor and the Agency. Mark the plot corners with permanent markers such as re-bar, including date and identification. Delineate a minimum of three plots per acre of new planting area.

The use of representative plots is intended to simplify the measurement of planting establishment work. If work within the representative plots does not accurately reflect the condition of the entire planting ~~area(s),~~areas, the Agency reserves the right to reject all establishment work.

01040.72 Periodic Inspections - During the plant establishment period, the Agency will make three plant establishment inspections jointly with the Contractor at the following times:

- Spring, early May
- Summer, mid July
- Fall, late September

Depending on when the establishment period begins, one of the above inspections will be the final inspection.

During each plant establishment inspection, the Agency may determine, based upon the specified success criteria, that corrective work is required. If so, the Agency will provide the Contractor with a written notice of required corrective work sent by hand-delivery or mail.

01040.73 Corrective Work - Complete all corrective work within 15 calendar days after receiving the written notice of the required corrective work to be taken. The 15 day requirement excludes those days the Agency determines to be impractical for working.

The Contractor will be allowed to replace plants outside the Planting Season to perform corrective work after each periodic inspection.

Provide plant replacements of the same variety, size, and quality as specified for the original plants, unless otherwise approved.

Notify the Agency when the corrective work is complete. When the corrective work has been re-inspected and is completed to the satisfaction of the Agency, the appropriate partial payment due the Contractor will be made.

If the Contractor does not perform the corrective work within the 15 day period after written notification, excluding those days the Agency determines to be impractical for working, the Agency may have the corrective work done by others and deduct the entire cost of the corrective work from monies due or to become due the Contractor under the Contract.

01040.75 Weed Control - Provide weed control according to 01030.42.

01040.77 Plant Establishment (Ornamental Areas) - In addition to these plant establishment requirements, perform the following:

(a) Watering, Fertilizing, and Mulching - Water all plants at the required intervals using the installed permanent or temporary irrigation systems, or such means as has been established for

the Project. Avoid excessive watering of shrub areas adjacent to lawns that may leach herbicide and damage the lawn. Repair damaged lawns at no additional cost to the Agency.

If specified for the original planting, re-fertilize plants to promote vigorous growth.

Maintain the plant bed mulch at a 2 inch depth during establishment, unless otherwise specified. Rake to a smooth and even finish grade.

Remove all timed-release water cartons that have not bio-degraded by the end of the establishment period.

(b) Trimming and Pruning - Prune in order to enhance the natural growth of plants, eliminate dead growth and crossing branches, maintain growth within available space, minimize overgrowth onto walks and walls, and minimize tree canopy damage from winds.

Prune during the dormant season unless otherwise specified. Remove and dispose of all dead and critically damaged plant material to maintain the overall appearance of the Project.

(c) Transplanted Specimen Plants - Care for transplanted specimen plants immediately after the planting work is completed. Water, fertilize, and protect specimen plants against disease and infestation as required to ensure the plants remain healthy and vigorous. Final acceptance of transplanted specimen plants will depend on plant health and condition.

(d) Sod Lawn - Mow, cut and fertilize sod lawns as required to maintain a healthy and vigorous condition. A schedule of feeding, mowing, and general treatment, including thatching and aeration will be listed in the Special Provisions. Final acceptance of sod lawn areas will depend on its health and condition. Keep sod lawns mowed to a height between 1 1/2 inches to 2 inches.

Do not perform the first mowing until the sod is firmly rooted and secure in place. Remove no more than one-third of the grass leaf during initial or subsequent cuttings.

01040.78 Plant Establishment (Mitigation or Other Non-Ornamental Areas):

(a) Watering and Mulching - Water all plants as necessary to promote and maintain growth using temporary irrigation methods. Keep planted areas raked to a smooth and even finish grade. Maintain mulch within plant saucers at a 2 inch depth, unless otherwise specified.

(b) Weeding - Perform weed control activities according to 01030.42.

(c) Soil Testing and Corrective Soil Amendments - If specified for the original planting, have a soil test performed by a soil ecology lab between the second and third periodic inspection. Present the recommendations to the Agency at the third inspection. Apply the amendments as recommended by the soil test report and as directed by the Agency.

01040.79 Final Inspection - After plant replacement work and any other required work has been completed, the Agency will make a final inspection. Ensure that all plant materials, planting beds and other facilities are according to the Specifications as a prerequisite for acceptance.

Measurement

01040.80 Measurement - The quantities of plantings and associated work performed under this Section will be measured according to the following:

(a) Soil Testing - Soil testing will be measured on the unit basis for each test that is completed and accepted. Soil testing includes the required sampling, testing, analyses, and reports for one or more of the following:

- Soil particle size range test.
- Soil fertility test and soil amendment report (including chemical analysis, acidity, salinity).
- Soil ecology analysis and soil bio-amendment report.

(b) Topsoil and Wetland Topsoil - Topsoil and wetland topsoil will be measured on the volume basis in the hauling vehicle.

Topsoil taken from the required excavations according to 00330.10 will be measured according to 00330.82.

(c) Soil Conditioners - Soil conditioners will be measured on the volume basis in the hauling vehicle or in containers delivered to the Project site.

(d) Plant Materials - Plant materials will be measured according to one of the following:

- **Unit Basis** - Under this method, plant materials will be measured on a unit basis.
- **Average Area** - This method may be used when a plant bed area is greater than or equal to 3,000 square yards and will be measured as follows:
  - The total plant bed area will be measured on the area basis, along the ground surface ~~by the foot and calculated to the nearest square yard~~.
  - ~~A total number of 30 square yard plots will be calculated.~~
  - 1~~%~~ to 5~~%~~ percent of the plant bed area will be selected and staked as 30 square yard representative plots.
  - All the plants in each staked representative plot will be counted. Unless otherwise approved, if the number of plants in a plot exceeds the number of required plants of the representative plot, the number of required plants will be used to represent the plot.
  - Based on the results of the plant count, the average number of plants per plot will be calculated.
  - The quantities of each item will be based on the calculated average number of plants per plot multiplied by the number of plots in the total plant bed area.

(e) Sod Lawn - Sod lawn will be measured on an area basis on the ground surface ~~and calculated to the nearest square yard~~.

(f) Mulch - Mulch will be measured on the volume basis in the hauling vehicle, or on the weight basis.

(g) Miscellaneous - Miscellaneous items will be measured as follows:

- **Tree Grates** - Tree grates will be measured on a unit basis. One grate includes two half grates, frame, hardware, tree guards, and appurtenances.
- **Woody Course Debris** - Woody course debris will be measure on a unit basis.
- **Boulders** - Boulders will be measured on a unit basis or on the weight basis.

- **Root Barrier** - Root barrier will be measured on the length basis.

- **Weed Control Geotextile** - Weed control geotextile will be measured on the area basis on the ground ~~surface and calculated to the nearest square foot~~.

Payment

01040.90 Payment - The accepted quantities of plantings and associated work performed under this Section will be paid for according to the following:

(a) Soil Testing - Soil tests will be paid for at the Contract unit price, per each, for the item "Soil Testing".

Payment includes mobilization, soil sampling, testing, analyses, and preparation of the soil amendment and bio-amendment reports.

(b) Topsoil and Wetland Topsoil - Topsoil, not taken from required excavations, will be paid for at the Contract unit price, per cubic yard, for the item "Topsoil".

Wetland topsoil, taken from either the Project excavations or imported from other sites, will be paid for at the Contract unit price, per cubic yard, for the item "Wetland Topsoil".

Topsoil taken from required excavations according to 00330.10 will be paid for according to 00330.94.

No payment will be made for topsoil or wetland topsoil that is placed in nondesignated areas or which is contrary to the Agency's instructions.

(c) Soil Conditioners - Soil conditioners will be paid for at the Contract unit price, per cubic yard, for the item "Soil Conditioner".

(d) Plant Materials - Plants will be paid for at the Contract unit price, per each, for the appropriate items listed in the Contract Schedule of Items. Plant materials will be listed by caliper size, size of container, or other size, or condition shown.

Transplanted plants will be paid for at the Contract unit price, per each, for the item "Transplanted Specimen Plants".

Partial payments for plant materials will be made as follows:

At the time of the original planting 30%
After the first plant establishment inspection 10%
After the second plant establishment inspection 10%
After the third plant establishment inspection 10%
At completion of the establishment period 40%

Partial payments made throughout the establishment period will be made for all surviving and replaced plants.

Upon completion of the establishment period, full payment will be made for all surviving and replaced plants, except for corrective work performed by others according to 01040.73 The Agency will pay the Contract unit price only once for the specified quantity, whether or not plants are replaced.

If the Contractor requests partial payment for plant materials on hand, payment will be made according to 00195.60.

(e) Sod Lawn - Sod lawn will be paid for at the Contract unit price, per square yard, for the item "Sod Lawn".

(f) Mulch - Mulch will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Bark Mulch	Cubic Yard
(b) Cinder Mulch	Cubic Yard
(c) Compost Mulch	Cubic Yard
(d) Wood Chip Mulch	Cubic Yard
(e) Grass Straw Mulch	Ton
(f) Rock Mulch	Ton

(g) Miscellaneous - The accepted quantities of miscellaneous items will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Tree Grates	Each
(b) Woody Course Debris	Each
(c) Boulders	Each or Ton
(d) Root Barrier	Foot
(e) Weed Control Geotextile	Square Foot

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- soil amendments
- lime, gypsum, or trace minerals
- soil bio-amendments
- fertilizer
- herbicides
- anti-transpirants
- game repellant
- browsing protectors
- pesticides
- trunk wraps
- tree stakes and ties
- water
- timed-released water
- pressure moisture stress sensors
- mulch materials required as part of replacement planting

- corrective work during the plant establishment period

Section 01050 - Fences

Description

01050.00 Scope - This work consists of constructing:

- Fences, gates, and gateways of barbed wire, woven wire fabric, chain link fabric, or combinations, to the lines and grades shown or directed.
- Protective fences, on and off structure as shown or directed.

All dimensions shown on the plans are horizontal and vertical measurement. Actual quantities required for the installation may be greater depending on the slope of the terrain.

01050.01 Definitions:

(a) Fences - Fence, gates, gateways, and appurtenances, regardless of kinds and types.

(b) Gates - Swinging units to provide an opening in the fence line.

(1) Single Gate - A unit of 16 feet or less.

(2) Double Gate - Two single gate units used together ~~for an opening of more than 16 feet~~.

(c) Gateway - Supported fence wire or fabric stretched between gate posts and fastened by bars, wire hinges and locking devices.

(d) Panel - That portion of fence between adjacent posts.

(e) Run - As used in this specification, run is defined as follows:

- **Fences, gates, and gateways** - The length of fence between end posts, intermediate end posts, corner posts, and gate posts.
- **Bridge protective fence** - A section of fence150 feet or less in length.

Materials

01050.10 Materials - Furnish materials meeting the following requirements:

Bar Reinforcement	02510.10
Barbed Wire	03010.10
Chain Link Fabric	03010.30
Commercial Grade Concrete	00440
Fence Gates	03010.60
Fence Grounding	03010.50(e) and (f)
Fence Posts, Braces, and Appurtenances	02110.30, 03010.50
Guardrail Elements	02820.10
Pickets	03010.31
Protective Fence Materials, On and Off Structures	03010.75
Vinyl Clad Fabric	03010.40
Woven Wire	03010.20

Construction

01050.40 General - Construct the several kinds and types of fences including the assembly and erection of all component parts and materials complete in place at the locations shown or directed. Confine activities and operations to the area immediately adjacent to the right-of-way line and within the highway right-of-way. Arrange for permits required from adjacent property owners to perform the work.

Schedule the installation of fencing or provide temporary fencing or other adequate means to prevent livestock from entering the Project right-of-way, easements and/or adjoining properties according to 00170.92.

At bridges, cattle passes and culverts, if shown or directed, connect the new fence to the structure in a manner that permits free passage of livestock under or through the structure.

01050.41 Lines, Grades, and Preparation Work - Unless otherwise directed, set fences so the fence fabric and wires are on right-of-way lines or Agency property lines, with posts set on Agency property. If directed, center concrete footings and fence posts 1 foot from the right-of-way or property line on Agency property.

Clear, grub and prepare the fence line area. Remove all shrubs, brush, snags, down timber, float rock, and other obstacles, including trees up to 6 inches in diameter which interfere with fence construction. If directed, preserve trees and geographic features on fence lines by varying the fence alignment to miss them.

Fill or excavate ground surface irregularities which interfere with maintaining specified clearance above ground surface of the bottom wire of the fence. Limit the width as necessary to provide a clear way for the fence.

Excavate for concrete footings to reasonably neat lines, but not less than the specified dimensions in soil, or not less than 18 inches deep in rock. Prevent disturbance of original ground at the sides and bottom of the excavation.

Clear and grade gate openings to permit the gate to swing in a horizontal plane according to 01050.48.

Dispose of materials removed under these provisions, including excess excavation, in a satisfactory manner.

01050.42 Optional Posts - Use steel or wood posts in barbed, or barbed and woven wire fence construction according to one of the following options, and once an option has been selected, use that option throughout the Project:

Option 1: Steel posts entirely in all types of fence.

Option 2: Treated wood posts entirely in:

- Type 1 fence
- Type 1-5W fence
- Type 2 fence
- Median fence on median areas exceeding 16 feet in width

Option 3: Steel line post in combination with treated wood end posts, intermediate end posts, corner posts and gate posts in:

- Type 1 fence
- Type 1-5W fence
- Type 2 fence
- Median fence on median areas exceeding 16 feet in width

01050.43 Installing Posts and Braces:

(a) General - Set all metal end posts, intermediate end posts, corner posts, gate posts, and chain link fence posts in concrete footings. Set all other posts firmly in the ground or in concrete footings as the Contractor elects.

Set posts to the depths shown. Reasonable variation in depths will be allowed and posts may be appropriately shortened or left slightly high, as approved by the Engineer, to:

- Avoid unnecessary penetration or excavation in rock or other unusually firm material.
- Obtain desired grades along the fence.

Set all posts vertical, except on curved alignment set posts slightly off vertical, as directed, to offset the pull of the fence fabric and wires.

For bridge protective fence only, set all metal end posts, intermediate end posts, and chain link fence posts as shown.

(1) Driven Posts - Posts which are set by driving shall be free of damage when set. Remove and replace any driven posts which are split, twisted or bent, or have a badly misshapen tops.

(2) Dug Holes - Where rock is encountered, set the posts to depths of not less than 18 inches and backfill with fine granular material. Do not exceed the post height shown by more than 3 inches.

When posts are set in dug holes, backfill in 6 inch layers with each layer separately and thoroughly tamped and compacted.

(3) Concrete Footings - Dimensions of footings shall not be less than shown and shall fill the excavated areas. Place the concrete with contact against firm soil at the sides and bottom and tamp around the posts and brace ends after the posts and braces have been brought to and firmly held in proper position. Strike off, slope or crown and smooth the surface of the concrete at the ground level to shed water. Allow to cure for at least ~~five~~ 5 calendar days before subjecting the posts and braces to strain.

(b) End Posts - Set end posts:

- At the beginning and end of new fence construction that is not terminating at gate posts.
- At the end of the intersecting line of existing fences just outside the line of the new fence.

(c) Intermediate End Posts - Set intermediate end posts in the line of the new fence:

- At each summit and at each valley in the grade of the fence where the algebraic difference in the grades of adjoining panels of fence exceeds 30~~%.~~ percent.

- At other points located along the new fence line to break the fence construction into approximately equal runs not exceeding the applicable lengths of runs shown.

(d) Corner Posts - Set corner posts as follows:

(1) Barbed and Woven Wire Fences - At angle of deflection exceeding 5° for fences with steel line posts or 15° for fences with wood line posts. Changes in line where the angle of deflection does not exceed the above limitations will be considered alignment angles. The adjacent line posts at alignment angles shall be made fast to the angle post by means of diagonal tension wires.

(2) Chain Link Fences - At angle points in fence alignment where the alignment of adjoining panels of fence changes direction by 20° or more.

(e) Gate Posts - Set gate posts at the beginning or end of runs of fence to provide openings for gates or gateways.

(f) Line Posts - Set line posts along the line of fence, between end, intermediate end, corner, and gate posts, and at the spacings shown. Line posts may be set at spacings not exceeding 25~~%~~ percent greater than specified or at closer spacings if approved. Set a line post in the new fence line at a point in alignment with each intersecting fence line approximately 1 foot from the end post of the intersecting fence line.

It is intended that the actual number of line posts will average to the number required for normal spacing.

(g) Braces - Construct braces before placing of fence fabric and wires on the posts.

(1) Metal Braces - Provide corner posts and intermediate end posts with two braces, one each direction from the post in the main fence lines. Provide end posts and gate posts with one brace in the line of the fence as shown.

Attach metal braces to the metal end, intermediate end, corner and gate posts and set in concrete footings.

(2) Wood Braces - Assemble and construct treated wood braces in conjunction with treated wood end posts, intermediate end posts, corner posts and gate posts to form units as shown. Fasten the wire brace guys to posts with three staples in each post. By means of a wood lever, twist together the four strands of wire between the posts until the entire assembly is taut and firm. Leave the lever in place. Drive the staples to provide contact with the wires without indentation of the posts.

01050.44 Barbed and Woven Wire Fence:

(a) Placing Fabric and Wire - Place fabric and wire on the face of the post which is away from the highway or as shown. On curved alignment, place the fabric and wire on the face of the post against which the normal pull of the fabric and wire will be exerted.

Attach fence fabric and barbed wire to each post according to recognized standard practice for fence construction and as shown or directed.

(b) Splicing Fabric and Wire - Splices of fabric and splices of separate lines of wire between posts will be allowed provided that not more than two fabric or separate wire splices, spaced at least 50 feet apart, occur in any one run of fence. Use wrap or telephone type splices for the

longitudinal woven wire and barbed wire with each end wrapped around the other wire for not less than six complete turns.

(c) Stretching Fabric - Stretch the barbed wire and woven wire fabric. Use care in stretching woven wire fabric, so the pull is evenly distributed over the longitudinal wires and not more than one-half of the original depth of the tension curves is removed.

(d) Fastening Fabric and Wire:

(1) At End, Intermediate End, Corner, and Gate Posts - Terminate the fence fabric and barbed wire at each end, intermediate end, corner, and gate post in the new fence line. Wrap each line of barbed wire and each longitudinal wire of the fence fabric around the post and then itself with at least four turns.

(2) At Line Posts - Fasten woven wire fabric to the post at top and bottom and at intermediate points not exceeding 12 inches apart. Fasten each line of barbed wire to each line post. Use approved wire ties or clamps to fasten the wires to metal posts. Drive staples, for use with wood posts, crosswise with the grain of the wood and pointed slightly downward. Drive the staples just short of actual contact with the wires to permit free longitudinal movement of those wires and to prevent damage to the protective coating.

(3) At Intersection of New and Existing Fence - Where existing fences intersect the new fence, cut the existing fence materials, or splice basically in kind new materials as necessary, and fasten each longitudinal wire of the fabric and each line of barbed wire to the new end post according to 01050.44(d-1).

(e) Swinging Panels at Waterway Crossings - At waterway crossings subject to floating debris, if directed, construct wood framed swinging panels of fence fabric, barbed wire or combinations. Attach the panels to the lower ~~wire(s)~~wires of the fence to provide fenced closure of the waterway so there will be no unfenced side or bottom openings exceeding 6 inches when the waterway is at its lightest flow or is dry.

(f) Additional Panels at Depressions - If depressions in the ground surface leave unfenced openings greater than 12 inches in height beneath the bottom line of the fence, provide additional panels of fence fabric, barbed wire, or combinations between line posts, as approved, across the opening so no side or bottom openings exceeds 6 inches. If the bottom line of the fence leaves an unfenced opening beneath it of 12 inches or less, pull the fabric and wires down between posts and anchor with pins or posts driven at least 18 inches into the ground so there will be no bottom opening at any point along the fence greater than 6 inches in height.

(g) Stay Wires and Final Adjustments - Free the fabric and barbed wire in final position from warp and sag with stay wires placed approximately vertical to the grade of the fence. Appearance shall reflect first-class work. Retighten brace guys and leave the lever restrained against the fence fabric or fence wires.

01050.45 Chain Link Fence:

(a) Concrete Footings - Construct concrete footings according to 01050.43(a-3).

(b) Chain Link Fence Rails and Tension Wires - Place longitudinal rails and longitudinal tension wires along the line of chain link fence, except at gates.

(1) Rails - Attach rails to end, gate and corner posts by clamps and sockets, and thread through loop caps on the end of line posts. Provide expansion sleeves or couplings at spacings not exceeding 200 feet in longitudinal top and bottom rails.

(2) Tension Wire - Attach tension wire to end, gate and corner posts by bands and clamps. Either thread the top tension wire through line post loop caps or hold in open slots in a manner to limit vertical movement. Tie or attach the bottom tension wire to the bottom of line posts by ties or clamps in a manner that prevents vertical movement. Provide tension wires with one turnbuckle or one ratchet take-up in each run of fence.

(c) Chain Link Fence Fabric and Wire - Assemble and install chain link fence fabric and wire according to 01050.44 and the following:

(1) Splicing Fabric - Use spiral pickets of specified chain link fabric material for fabric splices. Use wrap or telephone type splices for tension wire and barbed wire with each end wrapped around the other wire for not less than six complete turns.

(2) Fastening Fabric - Fasten fabric to end, gate and corner posts and to gate frames as shown. Attach fabric to line posts with wire ties at top and bottom and at intermediate spacings not exceeding 18 inches. Fasten fabric to top and bottom rails and to longitudinal tension wires with metal bands or tie wires spaced as shown, but in no case greater than 24 inches apart.

(3) Screening Pickets - If shown, insert the screening pickets vertically in each diamond.

For bridge protective fence only, assemble and install chain link fence fabric and wire according to paragraphs (1), (2), and (3) of this subsection.

01050.46 Protective Fence for Bridges - If welding of special connections for protective fence is required, pre-qualification of welders will not be required and inspection of welding will be visual.

01050.47 Fence Grounding:

(a) General - Except for bridge protective fence, provide at least one "ground" for each run of fence and place at any post within the run according to 00960.50(b). Fence grounding for bridge protective fence is not required.

Fasten each line of barbed wire, alternate longitudinal wires of fence fabric, and the rails and tension wire of chain link fences to the ground wire by clamps. Clamp the ground wires to the grounding rods.

(b) At Electrical Lines - Ground the fence directly below the point of crossing at each location where an electric transmission, distribution or secondary line crosses over the fence.

Ground the fence at each end or gate post or at intervals not to exceed 500 feet when an electric transmission, distribution or secondary line runs parallel or nearly parallel to and within 100 feet of the fence.

01050.48 Gate Installation:

(a) Metal Gates - Install metal gates and fittings between gate posts previously set as specified. Firmly attach the fittings to the posts and gates. Hinge each single gate in a manner which will prevent removal of the gate without tools. Set the gate in an approximately horizontal plane to swing freely inward and outward, and so it can be fastened securely in its latch holder, or in the case of double gates, in its latch holder and gate stops. Set double gates on their respective hinge pintles to provide a common horizontal plane in which each single gate swings.

Gates shall swing open at least of 90° in each direction.

(b) Gateways - Construct gateways of the same material as the fence and as shown. Construct wire splices according to 01050.44(b). Provide a taut and well-aligned closure of the opening, capable of being readily opened and closed by hand.

01050.49 Removing and Rebuilding Fence - Remove and rebuild existing fences as shown or directed. Construct fences to approximately the same condition as the original fence. Salvage the materials in existing fences to be removed and rebuilt and incorporate in the rebuilt fences. Replace fence materials damaged beyond reuse at no additional cost to the Agency. Firmly reset posts to the staked alignment. Post spacing and the number of wires to be strung and stapled to the posts shall be the same as the original fence. Furnish and use new staples or clips to fasten the wires to the posts.

Measurement

01050.80 Measurement - The quantities of fences, protective fences, gates, and associated items performed under this Section will be measured according to the following:

(a) Barbed and Woven Wire Fence and Gateways - Barbed wire fence, woven wire fence, and barbed and woven wire fence will be measured on the length basis. Gateways will be considered as fence of the type which adjoins them, and will be measured as a continuing part of that type of fence. Measurement will be from center to center of posts, measured along the line and grade of each separate continuous run of fence as constructed, exclusive of gates. Where existing fences are extended to intersect the new fence, the length of extension, from point of joining to the center of the new end post, will be measured and included for payment, if similar in design or type to a Pay Item, otherwise this work will be paid for according to 00140.60.

(b) Metal Gates for Barbed and Woven Wire Fence - Metal gates for barbed and woven wire fence will be measured on a unit basis of each size of single gate and of each size of double gate, respectively. The size designation of gates for barbed wire and woven wire fence gates will be by width. The width will be the width of opening the gate is to fit.

(c) Chain Link Fence - Chain link fence will be measured on the length basis. Measurement will be from center to center of posts, measured along the line and grade of each separate continuous run of fence as constructed, exclusive of gates.

(d) Metal Gates for Chain Link Fence - Chain link fence metal gates will be measured on a unit basis of each size of single gate and of each size of double gate, respectively. The size designation of chain link fence gates will be by width and height. The width will be the width of opening the gate is to fit.

(e) Protective Fence for Bridges - Bridge protective fence will be measured on the length basis. Measurement will be between beginning and ending locations as shown.

(f) Removing and Rebuilding Fence - Removing and rebuilding existing fence will be measured on the length basis, including gates. Measurement will be from center to center of posts, measured along the line and grade of fence removed and reconstructed.

Payment

01050.90 Payment - The accepted quantities of fences, protective fences, gates, and associated items performed under this Section will be paid for according to the following:

(a) Barbed and Woven Wire Fence - Barbed and woven wire fence and gates will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Type ____ Fence	Foot
(b) ____ Foot Single Gates	Each
(c) ____ Foot Double Gates	Each

In item (a) the type of fence will be inserted in the blank.

In items (b) and (c) the width of the gate opening will be inserted in the blank.

(b) Chain Link Fence - Chain link fence and gates will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) ____ Chain Link Fence	Foot
(b) ____ Chain Link Fence with _____	Foot
(c) ____ Foot x ____ Inch Chain Link Single Gates	Each
(d) ____ Foot x ____ Inch Chain Link Double Gates	Each

In item (a) the type of fence will be inserted in the blank.

In item (b) the type of fence will be inserted in the first blank and the type of material or pickets used for screening will be inserted in the second blank.

In items (c) and (d) the width of the gate opening will be inserted in the first blank and the height of gate be inserted in as the second blank.

(c) Protective Fence for Bridges - Bridge protective fence will be paid for at the Contract unit price, per foot, for the item "____ Foot Type ____ Protective Fence".

The height of the fence will be inserted in the first blank. The type of fence will be inserted in the second blank.

(d) Removing and Rebuilding Fence - Removing and rebuilding fence will be paid for at the Contract unit price, per foot, for the item "Removing and Rebuilding Fence".

New material necessary to complete the rebuilding of fence will be included in payment made for the removing and rebuilding fence item.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Payment for materials, equipment, and labor involved in constructing panels of fence additional to normal fence construction at waterways and at ground surface depressions, according to 01050.44(e) and (f), will be paid for according to ~~Section 00196~~00195.20.

Section 01070 - Mailbox Supports

Description

01070.00 Scope - This work consists of removing and maintaining mailboxes and supports at temporary locations during construction, and installing mailboxes and newspaper boxes affected by construction on new supports at permanent locations as shown or directed.

Materials

01070.10 Reinforcement - Furnish reinforcement for concrete collars meeting the requirements of Section 00530.

01070.11 Concrete - Furnish concrete for concrete collars meeting the requirements of Section 00440.

01070.12 Tube Support Frame - Furnish tube support frames meeting either of the following requirements:

- Requirements of ASTM A 500, Grade B, and galvanized according to AASHTO M 111 (ASTM A 123).
- Tensile requirements of ASTM A 53, Grade B, and galvanized with a minimum 0.9 ounce per square foot coating, as tested according to ASTM A 90, on the exterior surface followed by a chromate conversion coating and a cross link polyurethane acrylic coating. A zinc base corrosive resistant interior coating shall also be applied.

01070.13 Mounting Brackets and Hardware - Furnish mailbox mounting brackets, angles, adapter plates, and hardware as shown and galvanize according to AASHTO M 232 (ASTM A 153). Furnish mounting brackets for newspaper boxes as shown on the standard drawings.

01070.14 Post Mounting Socket - ~~Furnish Flush V-Wing Post Mounting Socket manufactured by Foresight Industries of Cheyenne, Wyoming, or an approved equal~~ Furnish post anchors from the QPL.

Construction

01070.40 General - Protect and maintain mailboxes and supports at locations accessible to the delivery agent and as convenient as possible for the public being served. This may require removing and relocating the mailboxes and supports more than once to maintain service. When roadway construction is completed, install the mailboxes and newspaper boxes on new supports in their permanent locations as shown or directed.

Repair damaged galvanized surfaces, such as the cut end of the tube support frame or drilled holes, according to 02420.10(d), except add 1 1/2 ounces of leafing aluminum powder to each quart of high zinc dust content paint.

Install mounting brackets of the proper size to fit each existing mailbox.

If multiple supports are furnished for fewer than five mailboxes, install on the support Size 1 mounting brackets for the empty spaces.

If property owners want to keep the original mailbox support, place the support on the owner's property adjacent to the work. Otherwise, dispose of the original mailbox support according to 00290.20.

Measurement

01070.80 Measurement - The quantities of mailbox supports and concrete collars will be measured on the unit basis of each kind of mailbox support and the number of concrete collars, regardless of size, installed in permanent locations.

Payment

01070.90 Payment - The accepted quantities of mailbox supports and collars will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Single Mailbox Supports	Each
(b) Multiple Mailbox Supports	Each
(c) Mailbox Concrete Collars	Each

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- removing existing mailbox supports
- providing temporary installations
- installing new supports in permanent locations
- installing owner-furnished mailboxes and newspaper boxes

Section 01090 - Gravel Beds and Blankets

Description

01090.00 Scope - This work consists of preparing areas for gravel beds and gravel blankets, and furnishing and placing soil sterilant, weed control geotextile, and gravel bed aggregates or gravel blanket aggregates at locations shown or directed.

Materials

01090.10 Soil Sterilant - Furnish products with current legal labels listing active ingredients, which may include simazine, diuron, bromacil, sulfometuron-methyl, or from the QPL. Submit a sample of the proposed soil ~~sterilant's~~sterilant's registered label to the Engineer for approval before using.

01090.11 Weed Control Geotextile - Furnish the following weed control geotextiles:

- "Weed-Chek Landscape Mat"
- 3 ounce, UV stabilized, non-woven, polypropylene fabric
- 3.75 ounce, UV stabilized, needle-punched, polypropylene fabric
- Weed control geotextile from the QPL

01090.12 Aggregates - Furnish clean, uncrushed, nearly round rock for gravel beds and gravel blankets meeting the following gradation requirements:

Sieve Size	Gravel Bed 3/4" - 1/2"	Gravel Blanket 1 1/2" - 1/2"
	Percent Passing (by Weight)	
2"		100
1 1/2"		80 - 100
1"	100	0 - 15
3/4"	80 - 100	–
1/2"	0 - 10	0 - 5

The Engineer may accept aggregates by visual inspection.

Construction

01090.40 General - Prepare gravel bed and gravel blanket areas, and furnish and place soil sterilant, geotextile, and aggregates as follows:

(a) Excavation - Excavate and shape the areas for gravel beds and gravel blankets as shown or directed and according to Section 00330.

(b) Soil Sterilant - Furnish and place the approved soil sterilant at a rate of application recommended by the Manufacturer. During use of soil sterilant strictly adhere to label cautions, especially those concerning existing plants or waterways in the immediate area.

(c) Geotextile - After the area has been treated with soil sterilant, place the weed control geotextile over the prepared ground surface according to 00350.41(a). Extend or lap the geotextile as follows:

- **Gravel Beds** - Extend the geotextile approximately 2 inches up the sides of the bed and overlap at least 12 inches.

- **Gravel Blankets** - Lap the ends of the sheets 18 inches and the sides 12 inches.

(d) Aggregates - Place aggregate cover as follows:

- **Gravel Beds** - Cover the geotextile with gravel bed aggregates to the depth specified then level and roll with a water-filled landscape roller for a minimum of two complete coverages.

- **Gravel Blankets** - Cover the geotextile with gravel blanket aggregates to the depth specified or directed.

Measurement

01090.80 Measurement - The quantities of gravel beds will be measured on the volume basis.

The quantities of gravel blankets will be measured on the area basis by surface measurement of the material in place, limited to the established neat lines and grades as shown or directed.

Payment

01090.90 Payment - The accepted quantities of gravel beds and gravel blankets will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Gravel Beds	Cubic Yard
(b) Gravel Blanket	Square Yard

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavation, soil sterilant, or weed control geotextile.

PART 01100 - WATER SUPPLY SYSTEMS

Section 01120 - Irrigation Systems

Description

01120.00 Scope - This work consists of installing irrigation systems and associated equipment at locations shown or specified and as directed.

01120.01 Qualifications - In order to install certain kinds of equipment or systems, manufacturer's certifications may be required, if described in the Special Provisions.

Materials

01120.10 General - Furnish only commercial quality materials and equipment. All items proposed for use will be subject to testing to ensure compliance with the Specifications. Provide materials of the same function that are of the same type and the same manufacturer.

Submit a list of proposed materials for approval as soon as practicable after Award and before arranging for procurement of any materials, especially those materials or products not shown or specified. If any initially proposed materials are not approved, submit substitutes for approval. Any materials installed without approval will be subject to removal and replacement with acceptable material at no additional cost to the Agency.

Materials may be designated by trade name or by manufacturer's catalogue information as shown or specified. The use of a substitute material may be allowed if a written request for substitution and proof of equivalent quality and suitability are furnished. Make any request for substitution with ample time for approval without delaying the work.

When alternate equipment, such as sprinkler heads, is proposed for use with hydraulic characteristics differing from that originally shown, the following will be required:

- A redrafted, legible plan that shows the redesigned layout, location, or sizes of every affected system element as required for proper operation as originally designed. Furnish a plan showing every relevant system element, site feature, and plan element that was shown on the original plan. A plan made by marking up the original plan will not be accepted.
- A hydraulic calculation table for the alternate equipment. At a minimum, show a complete calculation for one average sprinkler zone (section) and a complete calculation for the "worst case" sprinkler zone (i.e., the section that is farthest from the point of connection (P.O.C.), is the largest, or otherwise presents the most challenging hydraulics). Starting from the P.O.C., show the calculation with a step-down method with flow and loss at each piece of equipment and length of pipe run between equipment. Show the new total water required for each zone and the total for all zones to ensure that maximums for meter size, pipe sizes, and watering times will not be exceeded.
- Where any controller run-time change will be required, submit a separate page showing the total timing per controller required for each section, to show that timing changes will still allow all zones to be run within a reasonable time period.
- A cost page showing the Contractor's actual discount cost from the ~~supplier(s),~~suppliers, comparing the original plan costs versus the proposed equipment costs for each type of item, such as pipe by size, where there is a change required. Show the line total of each type of item and the grand total for the proposed change.

01120.11 Pipe, Tubing, and Fittings - Furnish galvanized iron or steel, PVC, or polyethylene pipe as shown or specified that meets the following requirements:

(a) Galvanized Pipe and Fittings - Furnish pipe of standard weight, hot-dip galvanized iron or steel, standard threaded, coupled, and that meets the requirements of ASTM A 53. Non-standard threaded fittings will be rejected.

(b) Polyvinyl Chloride Pipe and Fittings - Furnish PVC pipe and fittings of PVC compound Type 1, Grade 1, conforming to ASTM D 2241 and certified approved by the National Sanitation Foundation. Provide pipe and fittings free from defects caused by poor materials, low quality of work, or rough handling. Dimensional and quick burst tests of pipe and fittings may be required after arrival at the job site before materials will be accepted.

Furnish pipe and fittings as follows:

Used for	Class or Schedule
Main and lateral lines	Class 200 or Schedule 40 PVC
Irrigation sleeves	Schedule 40 PVC
Caps	Schedule 80 PVC
Direct bury pipe, not in sleeves, placed under road beds or other paved areas	Schedule 40 PVC

Unless otherwise specified, furnish entire Project with one pipe class or schedule type.

Furnish PVC threaded pipe of PVC 1120, schedule 80 material conforming to ASTM D 1785.

Provide PVC solvent-weld pipe of PVC 1120 materials having a 200 psi minimum pressure rating with SDR 21 walls that conform to ASTM D 2241.

Furnish PVC pipe fittings conforming to ASTM D 2466, Type I, Grades 1 or 2.

Pipe may be belled on one end with the dimensions of the tapered bell conforming to ASTM D 2672.

Install PVC pipe with walls heavier than SDR 21 when shown or specified.

(c) Non-Potable Colored Coded Pipe - Wherever non-potable, reclaimed or reuse water is used, furnish PVC pipe that is tinted purple and imprinted with the warning "Caution: Reclaimed Water - Do Not Drink". Provide pipe meeting the same AWWA and ASTM specifications as the potable water pipe sizes on which they are based.

(d) Polyethylene Pipe - Furnish polyethylene pipe of Class 80, SDR 15, medium density, meeting the requirements of ASTM D 2239, conforming to U.S. Commercial Standard CS-255, and approved by the National Sanitation Foundation (NSF).

(1) Micro Tubing and Fittings - Where drip emitters are not required, furnish a blank type and provide any connections necessary. Provide tubing consisting of nominal-sized linear, low-density, minimum 1/4 inch outside diameter (OD) polyethylene.

(2) Low Volume (Drip) Tubing - Furnish drip tubing manufactured from specially formulated, chemical-resistant, low to medium density, virgin polyethylene or polybutylene which is selected for excellent weatherability and stress cracking resistance, and is designed specifically for use in drip irrigation systems. Provide drip tubing having a minimum wall thickness of 0.044 inch.

01120.12 Automatic Controllers - Provide Underwriter's Laboratories (UL) approved ~~controller(s)~~controllers as shown or specified. Furnish each outdoor controller with either a pedestal or wall mount brackets when appropriate. Provide and install the controller in a weatherproof and vandal-proof cabinet of corrosion-resistant metal. Furnish the controller housing or cabinet with hasp and lock or locking device. Provide locks or locking devices that are master-keyed and include three sets of keys for the locks. If the irrigation system serves both lawns and planting beds, furnish a controller that has a dual programming capability. Provide controllers that are compatible with and capable of operating the irrigation system as constructed.

The following are definitions of some controller-associated equipment:

Rain Sensor - A sensor able to interrupt the power from the irrigation controller to the valves when the rainfall exceeds a pre-selected amount. Furnish rain sensors that are compatible with the system controller and are fully adjustable.

Soil Moisture Sensor - A sensor that interrupts programmed irrigation cycles until the soil moisture reaches a predetermined condition at the sensor's probe location.

Central Controller - A computer system programmable to receive data from and provide commands to multiple irrigation systems remotely located from the central system location.

Satellite Controller - A satellite controller similar to a normal stand-alone controller and able to operate as one, but designed to be operated by a central controller located off-site.

Flow Sensor - The hardware located in a pipeline that senses water flow and sends resulting data by electronic pulses to the pulse output transmitter.

Pulse Output Transmitter - A device that reads electronic pulses from the flow sensor and sends data to the pulse-decoding device.

Pulse Decoder - A microprocessor-based device designed to read electrical pulses originating at the flow sensor (or other type of monitoring device) and send the data to a central control system for analysis and action. When reading water flow data, the pulse decoder may also be referred to as a flow monitor.

Weather Station - A field station that collects and stores various weather data for access and use by a central control system in modifying an irrigation program for weather conditions. Typical data collected over a time period are wind speed, wind direction, relative humidity, rainfall, solar radiation and air temperature.

01120.13 Quick-Coupling Equipment - Furnish quick coupling equipment with a body of cast leaded semi-red brass alloy No. C84400 conforming to ASTM B 584, and a service rating not less than 125 psi for non-shock cold water. Provide couplers having standard male pipe threads at the top and standard female pipe threads at the base. Ensure that the valve is designed to open only upon inserting a coupler key and close completely after removing the key, with absolutely no leakage of water between the coupler and valve body. Provide valve bodies to receive couplers that are designed with double worm slots to allow smooth opening and closing action with a minimum of effort. Ensure that slots notched at the base will hold the coupler firmly in the open position. Furnish couplers of one piece construction with steel reinforced side handles attached, a locking top and of the same material as the valve body. The coupler shall have stainless steel double guide lugs to fit the worm slots. Furnish two couplers and two hose swivels for operation of the valves, and two keys for the locking caps if quick-coupling valves are required. For non-potable water systems, furnish a color-coded, purple tinted cap that bears the printed warning "Caution: Reclaimed Water ~~-~~ Do Not Drink".

01120.14 Hose Bibs - Furnish bronze or brass hose bibs, with angle-type thread to accommodate a 3/4 inch hose connection, and with a key- operated design that prevents operation by wrench or pliers.

01120.15 Cross-Connection Control Devices - Cross-connection control devices will be shown on the plans. Furnish and install cross-connection control devices meeting the requirements of the Oregon Health Division and the local water authority.

01120.16 Water Meter - Water meter procurement, installation, and associated costs will be the responsibility of the Agency. Be responsible for coordinating water meter needs in a timely fashion with the Agency.

01120.17 Valves:

(a) Gate Valves - Furnish gate valves of heavy-duty bronze conforming to the requirements of ASTM B 62. Provide valves of the same size as the pipes on which they are placed and install with union or flange connections. Service rating (for non-shock cold water) shall be 150 psi. Valves shall be of the double disk, taper seat type, with rising stem, union bonnet and hand wheel or suitable cross wheel for standard key operation. The valves shall have the manufacturer's name, type of valve, and size clearly cast on them.

(b) Drain Valves - Furnish bronze or brass drain valves, 1 inch or 3/4 inch in size, manual angle globe type, with rising stem, hex brass union, removable bonnet and stem, and adjustable packing gland. Ensure that valves are designed for underground installation with a suitable cross wheel operable with a standard key. The valves shall have a service rating of not less than 150 psi non-shock cold water. Furnish three standard operating keys.

(c) Check Valves - Furnish heavy duty bronze or steel check valves which function by means of a hinged disc suspended from the body, and which is able to close of its own weight. Furnish valves that are of the same size as the pipes on which they are placed, unless otherwise specified, and with union or flanged connections. Provide valves that are rated for non-shock cold water service of not less than 150 psi. The valves shall have the manufacturer's name, valve type, and size cast on them.

(d) Pressure-Reducing Valves - Furnish pressure-reducing valves with a minimum of 150 psi working pressure and an adjustable outlet range of 20 psi to 70 psi, rated for non-shock cold water service up to 175 psi. The valves shall be factory set as shown or specified.

(e) Isolation Valve - Furnish isolation valves as shown on the plans or Special Provisions. If no isolation valve is shown, furnish ball valves as shown below.

(f) Ball Valves - Furnish bronzed-bodied ball valves conforming to ASTM B 62 and with a hard, chrome plated ball conforming to ASTM B 124. The valve shall be non-shock cold water service-rated at not less than 400 psi. Plastic valves will not be accepted.

(g) Air Relief Valve - The air relief valve automatically relieves air pressure to break an air vacuum in the pipe section where it is located. Install air relief valves at the exact high point of each pipe section where relief is needed. (Note: air relief valves are not associated with backflow prevention).

(h) Control Valves:

(1) Manual Control Valves - Furnish manual valves of bronze or brass, angle type, with hex brass union, and with a service rating not less than 150 psi non-shock cold water. Provide

valves for underground installation designed with a cross wheel suitable for operation with a standard key. Furnish three suitable operating keys per irrigation system. Furnish valves that have removable bonnet and stem assembly, with adjustable packing gland housing for the long acme-threaded stem to ensure full opening and closing. Provide valves with discs that are full floating with replaceable seat washers.

(2) Automatic Control Valves - Furnish automatic control valves of a normally closed design, operated by an electric solenoid of the required rating, but not more than 6.5 W and operating on 24 V AC power. Ensure that solenoids directly attached to the valve bonnets or bodies have completely internal control parts. Provide bodies that are not less than 150 psi if brass or bronze and not less than 125 psi if plastic, with a manual control bleed cock to operate the valve without electric current. Ensure that the closing speed is not less than ~~five~~ 5 seconds and the opening speed is not less than ~~three~~ 3 seconds. Both shall be at a constant rate of opening and closing so the water flow is completely stopped when the valve is either manually or electrically closed. Provide valves having manual shutoff stems with cross handles that will adjust the valve from fully closed to wide open with the valve automatically operable in the adjusted position.

(3) Automatic Control Valves with Pressure Regulator - Furnish valves of the same manufacture as the automatic control valves, capable of reducing the inlet pressure to a constant lower pressure regardless of supply fluctuations, and which are fully adjustable.

01120.18 Valve Boxes and Protective Sleeves - Provide automatic control valves, flow control valves, pressure reducing valves, backflow preventers, filters and other serviceable fixtures with valve boxes that are extendable to obtain the depth required. Furnish boxes constructed of thermoplastic, with locking lids, green in color, and of the type shown or specified. Include a protective sleeve and cap with all manual drain valves and manual control valves.

01120.19 Electrical Wire and Splices - Unless otherwise specified, furnish electrical wiring used as a hot wire for each zone between the automatic controller and automatic valves of copper, minimum size AWG No. 14, and red in color. Furnish common wire that is a minimum AWG No.12 and white in color. Furnish type USE that is chemically cross-linked polyethylene or thermoplastic. Furnish Type UF that is color-coded or marked with number identification.

Make low voltage splices with one of the following:

- ~~Furnish a kit containing a "T" shaped open cell with a centering device and a plastic bag of urethane and hardener, which is mixed at the time of installation. The resin used with the "T" shaped centering device shall be a quick curing, flexible compound with a set-up time of about four minutes at 70 °F. Acceptable kits are "3-M DBY", "RainBird Snap-Tite", "Pen-tite PVC Socket and Sealing Plus" or approved equal.~~
- A waterproof sealed wire connector system that is sealed from moisture, securely joins two or more conductors both mechanically and electrically, is rated for direct burial according to the manufacturer's recommendations, and conforms to UL 486D for direct burial applications. Wrapping a splice in tape is not an acceptable method of waterproofing. Obtain approval of the sealed wire connector system from the Engineer before installation.
- Heat-shrinkable insulating tubing manufactured for use in irrigation electrical systems. Furnish heat-shrink tubing of a mastic-lined, heavy-wall, polyolefin cable sleeve.

Provide and install an extra wire with all wiring runs that is the same gauge, but of a different color than the hot wire and common wire. The extra wire will be reserved for future use or modifications to the system.

01120.20 Communication Cable - Furnish communication wire in central satellite control systems that is 18 gauge polyethylene (PE) 89, minimum 6 pair, or approved equal. Provide sufficient pairs to connect all decoding, sensing and monitoring devices to the Central Control Unit.

01120.21 Detectable Wire and Marking Tape - Provide a detectable wire using continuous No. 14 gauge, single strand locator wire that is blue in color. Provide marking tape consisting of inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents, and solvents likely to be encountered in the soil. Furnish color-coded tape with the type of line buried below and the word "Caution" imprinted continuously over its entire length in permanent black ink. Provide tape of the width recommended by the manufacturer for the depth of installation used.

Construction

01120.40 General - The irrigation plans are a schematic design and may require adjustment. Do not install the sprinkler system as shown if it is evident that obstructions, grade differences, or differences in area dimensions create conditions different than anticipated in the design. Bring all such obstructions or differences to the attention of the Engineer. In the event this notification is not performed before construction begins on a part of the system where discrepancies exist, any revisions necessary to make the system operate as designed will be the Contractor's responsibility.

(a) Plumbing - Install all parts of the irrigation system according to the Oregon Plumbing Code and State and local laws. Make water service connections as shown and specified. Conform to the requirements of the jurisdictional water authority. Ensure that water velocities in PVC pipe do not exceed 5 feet per second, unless approved in writing by the Agency. Bring any velocities exceeding 5 feet per second created by pipe sizes shown on the plans to the attention of the Agency before beginning construction. Correct excess velocities existing after construction, or caused by changes from the plans, at no additional cost to the Agency, unless a written agreement has been made authorizing otherwise.

(1) Double Check Valve Assembly ~~**(DCVA)**~~ - Install, inspect, and test the ~~DCVA~~double check valve assembly (DCVA) according to applicable regulations of the Oregon Health Division and the local water authority. Furnish test records on forms approved by the Oregon Health Division. Furnish forms filled out by a State-licensed Backflow Device Tester documenting that the DCVA is in good operating condition before any flushing and testing of downstream water lines. During the life of the Contract, test the DCVA annually, or more often if successive inspections indicate repeated failure. Repair or replace the DCVA whenever it is found to be defective.

(2) Reduced-Pressure Backflow Device ~~**(RPBD)**~~ - Install, inspect, and test the ~~RPBD~~reduced-pressure backflow device (RPBD) according to the applicable portions of the Oregon Plumbing Code and applicable regulations of the Oregon Health Division and the local water authority. Apply the same specific testing requirements as stated for the DCVA above.

(b) Electrical Service - Install electrical service according to 00960.49, the National Electrical Code, and all State and local laws. Power sources will be as shown or as directed. Be responsible for coordination and installation of electrical service. Furnish and install meter bases at the power source conforming to the requirements of the power supplier. Give the power supplier's representative notice before making any installation. Provide a separate, dedicated circuit for the controller.

01120.41 Layout of Irrigation System - Stake the irrigation system, following the schematic design on the plans, before construction begins. With prior approval, make alterations and changes in the layout to conform to ground conditions and to obtain adequate coverage of water. Comply with the requirements of 00150.50.

01120.42 Excavation - Excavate trenches no wider than necessary to lay the pipe or install the equipment. Keep the top 6 inches of topsoil, if applicable, separate from subsoil and replace this topsoil as the top layer when backfilling. Provide smooth trench bottoms of sand or other material, free from rocks and unsuitable material. Excavate trenches in rock or other unsuitable material at least 6 inches below the required depth and backfill with sand or other suitable material free from rocks.

Exercise care when excavating near existing trees. Where roots are 2 inches and greater in diameter, except in the direct path of the pipe, hand excavate and tunnel the pipe trench. When large roots are exposed, wrap them with heavy burlap for protection and to prevent excessive drying. When digging trenches by machine adjacent to trees having roots 2 inches and less in diameter, hand trim the sides of the trench, making a clean cut of the roots. Treat all cut and trimmed roots 1/2 inch or larger in diameter with an approved tree wound dressing. Backfill trenches having exposed tree roots within 24 hours unless protected by continuously moist burlap or canvas.

Place detectable marking tape and tracer wire in the trench directly above, parallel to, and along the entire length of all nonmetallic water pipes and all nonmetallic and aluminum conduits installed under existing or planned pavement. Use tape widths recommended by the manufacturer for the burial depth.

Pipe installation using a "pipe puller" may be approved if there is adequate topsoil depth and the topsoil is free of rock. Obtain the Engineer's approval before using a pipe puller. Include any resultant changes in material or design with the request for use of this method.

If unforeseen bedrock is encountered during excavation that prevents the pipe from being buried at the specified depth, immediately bring it to the attention of the Engineer.

01120.43 Piping - Backfill all pipe between the top of the pipe and finished grade with a minimum of 18 inches of fill according to 01120.49. Where possible, place mains and laterals or section piping in the same trench. Separate all pipes by at least 2 inches. Place all pipe lines a minimum of 3 feet from the edge of concrete sidewalks, curbs, guardrail, fences, traffic barriers or walls unless otherwise approved.

Place marking tape and tracer wire above all pressurized mainline, according to the manufacturer's instructions.

Place all live mains to be constructed under existing pavement in sleeves jacked under the pavement, unless otherwise shown. Place all PVC pipe installed under pavement in pipe sleeves of Schedule 40 PVC, unless steel sleeving is shown or specified. Furnish pipe caps of Schedule 80 PVC. Install sleeves 2 feet below subgrade when passing under roadways. Extend sleeves 2 feet beyond the edge of gravel, edge of sidewalk or back of curbs. Mark sleeves with a 2 feet piece of No. 4 rebar driven flush with the ground or other adjacent surface. Place PVC caps over both ends of sleeves but do not glue. Solvent-weld sleeve sections. Pipe bedding and backfill shall conform to Section 00405. Extend the sleeve a minimum of 12 inches beyond the edge of pavement. Perform all jacking operations according to an approved jacking plan. If obstacles are encountered during required jacking, notify the Engineer, who may authorize corrective measures according to 00140.60. Provide for complete drainage of all pipe lines with manual drain valves installed at section low points. Drain valves may not be shown on the plans.

01120.44 Pipe Jointing:

(a) General - During construction, plug or cap pipe ends to prevent entry of dirt, rocks and other debris.

(b) Galvanized Steel Pipe - Ensure that galvanized steel pipe has clean cut, well fitted standard pipe threads. Ream all pipe to its full diameter and remove burrs before assembly. Construct threaded joints using either a non-hardening, non-seizing multipurpose sealant, teflon tape, or paste as recommended by the pipe manufacturer. Make all threaded joints tight with wrenches, without using handle extensions. Clean and remake joints that leak with new material. Use of caulking or thread cement to make joints tight will not be allowed.

(c) PVC Pipe - Handle and install PVC pipe, couplings and fittings according to the manufacturer's recommendations. Chamfer the outside of the PVC pipe to a minimum of 1/16 inch at approximately 22 degrees. Join pipe and fittings by solvent welding. Use only solvents that penetrate the surface of both pipe and fitting with a result of complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer. On plastic to metal connections, work the metal connection first. Use a non-hardening compound on threaded connections. Thread connections between metal and plastic using only female threaded PVC adapters with threaded Schedule 80 PVC nipples.

(d) Polyethylene Pipe - Install polyethylene pipe and fittings according to the manufacturer's recommendations. Cut the ends of the polyethylene pipe square and insert the fitting to its full depth. Use stainless steel clamps for insert fittings.

01120.45 Installation:

(a) Sprinkler Heads - Position turf heads and other pop-up heads between 1/2 inch and 1 inch above finish grade, measured from the top of the sprinkler. Place sprinklers as close as practical to walks, curbs, pavement and lawn edges, but leave enough space to allow height adjustment. Do not place heads on risers in areas with any potential for pedestrian traffic, unless otherwise shown. Use swing riser assemblies that allow positioning for correct sprinkler height.

(b) Drip Emitters - Install emitters directly above the root mass of the plant being watered, according to the plans or the manufacturer's recommendations.

(c) Low Volume Drip Tubing - Install drip irrigation tubing as shown and the manufacturer's recommendations.

(d) Controllers - Install controllers according to the manufacturer's recommendations and as shown. Receive approval of the location before installing. Since the controller will need to be accessed frequently, install it at a height, position, and location that allow ease of access.

(e) Valve Boxes and Quick Couplers - Position the tops of valve boxes, capped sleeves, and quick coupler valves between 1/2 inch and 1 inch above finish grade or mulch.

(f) Valves - Install valves so that access for maintenance is maintained.

(g) Central Control Equipment - If shown or specified, install the following equipment according to the manufacturer's recommendations:

- Rain sensors
- Soil moisture sensors
- Flow meters
- Central control system with satellite controllers
- Weather stations

01120.46 Low Voltage Electrical Installation - Use direct burial wiring between the automatic controller and automatic valves. Install waterproof splices according to the manufacturer's recommendations. The wiring may share a common neutral. When more than one automatic controller is required, provide a separate common neutral for each controller and the automatic valves it controls. Run separate control conductors from the automatic controller to each valve. Provide and install an extra wire according to 01120.40.

Install wire adjacent to or beneath the irrigation pipe. Use plastic tape or nylon tie-wraps to bundle wires together at 10 foot intervals. Snake the wire from side to side in the trench to provide slack in the wire run. When it is necessary to run wire separate from the irrigation pipe, bundle and place the wire under detectable marking tape. Splices will be allowed only at junction boxes, valve boxes, pole bases, or control equipment. Leave a minimum of 2 feet of excess conductor at all splices, terminals and control valves to facilitate inspection and future splicing.

01120.47 Flushing and Testing:

(a) General - Provide gauges used in the testing of water pressures that are certified correct by an independent testing laboratory immediately before use on the Project. Retest gauges when directed. Test automatic controllers by actual operation for a period of ~~two~~ 2 weeks under normal operating conditions. If adjustments are required, adjust according to the manufacturer's direction and test until operation is accepted as satisfactory.

(b) Sprinkler Head Flushing - Flush all sprinkler heads as recommended by the manufacturer.

(c) Sprinkler Head Testing - Test for leaks in heads and connections and correct as required.

(d) Main Line Flushing - To remove debris that may have entered the line during construction, flush main supply lines twice with the supply valve fully open. Flush first before placing valves and again after placing valves and before pressure testing.

(e) Main Line Testing - Purge all main supply lines of air and test with static water pressure of at least 150 psi for 60 minutes without introduction of additional service or pumping pressure. Test with one pressure gauge installed on the line where directed. Install an additional pressure gauge at the pump when directed. Lines showing loss of pressure exceeding 5 psi at the end of the specified test period will be rejected. Correct rejected installations and retest for leaks.

(f) Lateral Line Flushing - Flush all lateral lines once with the supply valve fully open prior to placement of sprinkler heads, emitters and drain valves. Flush long enough to remove any debris that enters the lateral lines during construction.

(g) Lateral Line Testing - Purge all lateral lines of air and test under operating line pressures with risers capped and drain valves closed. Maintain operating line pressures for 30 minutes through open valves and pressure regulating devices. Lines showing leaks when visually inspected at the end of the specified test periods will be rejected. Correct and retest lateral line installations that have been rejected.

(h) Lateral Line Alternate Test Method - When conditions prevent effective visual inspection of lateral lines, the Engineer may require that the lines be tested by use of pressure gauges. In that event, maintain the static water pressure equal to the operating line pressure in the lines for 30 minutes, with valves closed and without introduction of additional service pressure. Lateral lines showing loss of pressure exceeding 5 psi at the end of the specified test period will be rejected. Correct and retest lateral line installations that have been rejected.

(i) Testing of Micro Tubing - Micro tubing will be tested by visual inspection while operating and before burial. Tubing that has obvious leaks or that doesn't operate as designed will be

rejected. To fully test micro tubing, a water collection procedure recommended by the manufacturer may be required. Correct all faults before retesting.

01120.48 Adjusting System - Before final inspection, adjust and balance all sprinklers to provide adequate and uniform coverage. Balance spray patterns by adjusting individual sprinkler heads with the adjustment screws or by replacing nozzles to produce a uniform pattern. Unless otherwise specified, water spray will not be allowed on pavement, walks or structures.

01120.49 Backfill - Do not start backfill until all piping has been inspected, tested and approved. Complete backfilling as soon as possible after approval. Ensure that backfill material placed within 6 inches of the pipe is free of rocks or other unsuitable material that might cut or otherwise damage the pipe. Backfill from the bottom of the trench to approximately 6 inches above the pipe with continuous compaction in a manner that will not damage the pipe or wiring, and proceed evenly on both sides of the pipe. Thoroughly compact the remainder of the backfill without using heavy equipment within 18 inches of any pipe. Ensure that the top 6 inches of the backfill is topsoil material or, if suitable, is the first 6 inches of material removed in the excavation.

Pipe bedding material conforming to 00405.12 may be authorized in quantities determined by the Engineer. When authorized to proceed, fill the bottom 2 inches of the trench with approved bedding before laying pipe. After the pipe is in position, add enough bedding material to bring the backfill height to 2 inches above the pipe. Continue backfilling as usual.

If sufficient suitable backfill material is not available from trench excavation or other sources on the Project, notify the Engineer. Provide an estimate of imported backfill required, if possible. Unless otherwise shown or specified, imported pipe bedding material will be authorized according to 00140.60.

Maintenance

01120.60 System Operation - Repair, flush and test all main and lateral lines that sustain a break or disruption of service. Upon restoration of the water service, bring the affected lines up to operating pressure. After pressurizing, conduct a thorough inspection of all sprinkler heads, emitters, and other fittings, located downstream of the break or disruption of service, and repair. This inspection is required to ensure that the entire irrigation system is operating properly.

Completely install and test the irrigation system, and make it automatically operable before planting in a unit area except where otherwise shown, specified, or approved. Be fully responsible for all maintenance, repair, testing, inspection and automatic operation of the entire system until Final Acceptance. (see 00150.95)

This responsibility includes, but is not limited to, draining the system before winter and reactivating the system in the spring and at other times as directed.

Be responsible for having annual inspections and tests performed on all cross connection control devices as required by the State Health Division until Final Acceptance. (see 00150.95)

In the spring, when the drip irrigation system is in full operation, make a full inspection of all emitters. This involves visual inspection of each emitter under operating conditions. Make all adjustments, flushing or replacements to the system at this time to ensure the proper operation of all emitters.

01120.61 Drip Line Warranty - ~~The~~ Furnish a 5 year manufacturer warranty ~~of 00170.85(b) applies to~~ for the drip tubing ~~installed under this Section. Provide a written warranty from the manufacturer~~ according to 00170.85(c-1) against defects in manufacturing, rot, electrolytic corrosion, and stress cracking ~~for at least five years from the time of installation~~.

Finishing and Cleaning Up

01120.70 As-Built Plans and System Orientation - Upon completion of the work, submit corrected working drawings, schematic circuit diagrams, or other drawings necessary for the Engineer to prepare corrected plans showing the work as constructed. Provide drawings on 8 1/2 inches by 11 inches, 11 inches by 17 inches, or 22 inches by 36 inches sizes. Prepare and present a training and orientation session covering the operation, adjustment and maintenance of the irrigation system. Review corrected drawings and explain all features. Show locations of drain valves, if any, on the drawings. At this session, provide the Engineer with parts lists and service manuals for all equipment. Notify the Engineer in writing ~~two~~ 2 weeks before the proposed date of the training and orientation session. The date and time of the session will be mutually agreed to.

Measurement

01120.80 Measurement - No measurement of quantities will be made for work performed done under this Section.

Payment

01120.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract lump sum amount for the item "Irrigation System".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for excavation, backfill, electrical service, and system orientation.

Section 01140 - Potable Water Pipe and Fittings

Description

01140.00 Scope - This work consists of constructing potable water pipe and fittings 16 inches and smaller in diameter within a public Right-of-Way or easement.

Materials

01140.10 Materials - Furnish materials meeting the following requirements:

Bolted, Sleeve-Type Couplings for Plain End Pipe.....02475.60
Commercial Grade Concrete in Thrust Blocks.....00440
Detectable Marking Tape and Wire 02470.60
Ductile Iron Pipe Fittings.....02475.20
Ductile Iron Pipe 02470.20
Polyethylene Encasement 02470.50
Polyvinyl Chloride (PVC) Pipe fittings - 4~~ inch~~" and larger.....02475.40
Polyvinyl Chloride (PVC) Pipe fittings - under 4~~ inch~~".....02475.45
Polyvinyl Chloride (PVC) Pipe - 4~~ inch~~" and larger 02470.40
Polyvinyl Chloride (PVC) Pipe - under 4~~ inch~~" 02470.45
Reinforcement 00530
Restrained Joints.....02475.50
Steel Pipe Fittings - 6~~ inch~~" and larger.....02475.30
Steel Pipe Fittings - under 6~~ inch~~" 02475.35
Steel Pipe - 6~~ inch~~" and larger 02470.30
Steel Pipe - under 6~~ inch~~" 02470.35
Tie Rods 02485.60

01140.11 Handling Pipe and Fittings - Handle pipe and fittings to prevent damage or contamination to the pipe, fitting, lining, or coating. Load and unload pipe and fittings using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped, skidded, or rolled against other pipe or fittings. If any part of the coating or lining is damaged, repair in a manner satisfactory to the Engineer. Damaged or contaminated pipe and fittings will be rejected. Immediately separate all damaged or contaminated pipe and fittings and remove from the job site.

(a) Thread Protection - Protect threaded pipe ends with couplings or other means until laid. Inspect the pipe and fittings for defects.

(b) Temporary Storage - Store pipe on cradles to prevent entry of dirt, other foreign material, or contamination. Keep the pipe or pipe joint free of dirt, other foreign material, or contamination during handling or laying operations. Remove, clean, and relay any pipe or fitting that has been installed with dirt, foreign material, or contamination in it. At times when pipe laying is not in progress, close the open ends of pipe with watertight plugs or by other approved means to ensure cleanliness.

01140.12 Cutting Pipe:

(a) General - Use short lengths of pipe supplied by the manufacturer whenever possible to provide the proper spacing of valves, tees or special fittings.

(b) Cutting Operation - Cut pipe with abrasive saws or by special pipe cutters. Square all pipe ends with the longitudinal axis of the pipe. Ream and otherwise smooth the cut ends so that

good connections can be made. Cut threads cleanly. Flame cutting of ductile iron pipe will not be allowed.

Construction

01140.40 Trench Work - Excavate trench, prepare bedding, install pipe zone material, backfill, and dispose of excavated material according to Section 00405 and the following:

(a) Dewatering Trenches - Remove water encountered in the trench during pipe laying operations and maintain the trench until the ends of the pipe are sealed and provision is made to prevent floating of the pipe. Do not allow trench water or other deleterious materials to enter the pipe at any time.

(b) Bedding and Pipe Zone - For the purpose of these Specifications, all potable water pipes are considered flexible pipes. Use bedding and pipe zone material for flexible pipes as described in 00405.12 and 00405.13.

(c) Extra Trench Excavation - Changes in the alignments or grades of the potable water pipes from those shown or specified may be necessary because of unplotted utilities, or for other reasons. If directed to adjust, correct, relocate, or in any way change the line and grade, make such changes according to these Specifications.

(d) Grade and Alignment Changes - When pipeline grade is lowered in excess of 12 inches below the grade shown, or when pipeline horizontal alignment is changed by more than 12 inches after the original trench has been excavated, the additional excavation and backfill so required will be classified as extra trench excavation. The additional backfill material shall match the class used in the original trench.

(e) Installation in Paved Areas - If pipe is installed within paved areas to be preserved, perform the installation according to Sections 00405 and 00495.

01140.41 Laying Pipe:

(a) General - Lay pipe to the lines and grades shown and established.

(b) Ductile Iron Pipe - Install ductile iron pipe according to AWWA C600 and the manufacturer's recommendations.

(1) Curves - Lay long radius curves, either horizontal or vertical, with standard pipe by deflecting the joints. If the pipe is shown curved in the plans and no special fittings are shown, assume that the curves can be made by deflecting the joints with standard lengths of pipe. If shorter lengths are required, the plans will indicate maximum lengths that can be used. Do not exceed 80~~%~~ percent of the manufacturer's printed recommendations for the amount of deflection at each pipe joint when pipe is laid on a horizontal or vertical curve. Where field conditions require deflection or curves not anticipated by the plans, the Engineer will determine the methods to be used.

(2) Pipe Laying Procedure - When ductile iron pipe is laid on a curve, join the pipe in a straight alignment and then deflect it to the curved alignment. On approval, make trenches wider on curves for this purpose.

(c) Polyethylene Encasement - Where shown, lay ductile iron pipe with a polyethylene encasement. Install polyethylene encasement according to AWWA C105 and the manufacturer's recommendations.

(d) Steel Pipe - Install steel pipe according to the manufacturer's recommendations. Lay steel pipe on curves in the same manner described above for ductile iron pipe.

(e) Polyvinyl Chloride ~~(PVC)~~ Pipe - Install polyvinyl chloride (PVC) pipe according to AWWA C605 and the manufacturer's recommendations.

(1) Bends - Bend PVC pipe 12 inches and smaller to allow for slight changes in direction. The minimum bending radius shall be according to AWWA C605. Axial deflection at the pipe joints will not be allowed.

(2) Large Diameter Pipe - For 14 inch and 16 inch diameter pipe, accomplish slight changes in direction by axial deflection of the pipe joint not to exceed 80~~%~~ percent of the manufacturer's recommendation. Use fittings for joint deflections greater than 80~~%~~ percent of the manufacturer's recommendation.

(f) Water and Sanitary Sewer Separation - Comply with OAR 333 regulations governing horizontal and vertical separation between water and sanitary sewer facilities for installation of new water lines and appurtenances. Submit any proposal for variance in writing. Include in the proposal the reason for the variance, type of material and condition of the sewer line, location of the water and sewer facilities, horizontal and vertical skin-to-skin clearances and the corrective measures proposed. The proposal will be reviewed and approved by the Engineer. Each variance will be addressed in a case-by-case basis.

01140.42 Jointing Pipe:

(a) General - Clean all parts of the pipe ends, couplings, fittings, and appurtenances to remove oil, grit, or other foreign matter from the joint. Keep the joint from contacting the ground. When assembling gasketed joints, apply an approved lubricant as specified by the pipe manufacturer.

Mark pipe not furnished with a depth mark before joint assembly.

(b) Steel Pipe Under 6 Inches - Brush-coat exposed threads after jointing with an approved asphalt coating.

01140.43 Polyethylene Encasement:

(a) Installation - Install polyethylene encasement according to AWWA C105 except as modified by these Specifications. Wrap polyethylene encasement loosely around the pipe, fittings, and couplings, and secure with 2 inch wide polyethylene adhesive tape. Cover joints or seams in the polyethylene encasement using 2 inch wide polyethylene adhesive tape. The polyethylene encasement need not be watertight, but do not expose any part of the pipe or coupling to the backfill. Exercise care during backfilling to prevent puncturing or otherwise damaging the polyethylene encasement.

(b) Connections - When connecting to existing polyethylene-encased pipe, cut the existing encasement within 1 foot of the connection couplings or fittings. After the connections are made, overlap the exiting polyethylene encasement a minimum of 3 feet and seal the overlaps with 2 inch wide polyethylene adhesive tape.

01140.44 Thrust Restraint:

(a) Concrete Thrust Blocks - Place concrete thrust blocks as shown, at bends, tees, dead ends, and crosses. Pour concrete thrust blocks in place against solid, undisturbed earth at the sides and bottom of the trench excavation. Shape the blocks so as not to obstruct access to the joints of the pipe or fittings.

(b) Restrained Joints - Where indicated or approved by the Engineer, restrain joints at bends, tees dead ends, crosses, and all pipe joints within the indicated or specified distance on each side of the bends, tees, dead ends, and crosses. Install joint restraint systems according to the manufacturer's recommendations.

01140.45 Marking Tape and Wire:

(a) Installation - Install marking tape and wire over all nonmetallic water lines, including service connections. Place a continuous solid copper wire along the top of all water pipe, including service lines. Secure to the top of the pipe at maximum 10 foot intervals using 6 inch strips of 2 inch wide duct tape. Tie all splices and make them electrically continuous and waterproof. Provide access to terminal ends of the wire at all valve boxes, meter boxes, fire hydrants, and vaults. The result of this installation shall be a continuous wire circuit electrically isolated from ground. Place the marking tape approximately ~~one~~1 foot above the top of the pipe for its full length.

(b) Accessibility - Make ends of wire accessible in water meter boxes, valve boxes or casings, or outside the foundation of buildings where the pipe enters the building. Provide wire access at locations no more than 1,000 feet apart.

(c) Testing - Test for continuity and isolation from ground in the wire after all work has been completed on the test section. Perform intermediate testing after backfilling operations and prior to surface restoration work. Test continuity between access locations by use of a temporary wire connecting test points in-line with an ohmmeter. Measure resistance with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms for each 500 feet of location wire being tested. Measure isolation from ground with an approved 1000 volt Megger, applied for ~~one~~ 1 minute. The isolation of a test section will be accepted if the isolation resistance of the test section is at least 10 megohms. Locate and repair all breaks or defects in the wire and re-test until specified results are obtained.

01140.46 Blowoff Assemblies - Construct blowoff assemblies as shown and at the locations shown.

01140.47 Connections to Existing Mains - Make necessary arrangements with the Engineer in advance of connections to existing water mains. Assemble all materials, equipment and labor necessary to properly complete the work before starting.

(a) Notification - If the connection to the existing system involves turning off the water, notify the residents affected by the shutoff. The Engineer will advise which property owners are to be notified.

(b) Permission - The work to perform the connection may need to be carried out during times other than normal working hours. Do not operate any valves on the existing system without specific permission of the Engineer.

(c) Connection Arrangements - Piping arrangements shown are suggestions. For connection by any other arrangement, furnish a detailed sketch for approval not less than ~~two~~ 2 weeks prior to the expected construction.

(d) Uninterrupted Service - Once work is started on a connection, proceed continuously without interruption, and as rapidly as possible, until completed. Shutoff of mains will not be allowed overnight, over weekends, or on holidays.

(e) Cutting Main Lines - Cut existing water mains according to 01140.12. Remove the portions of pipe to provide for the installation of the required fittings at the points of connection. Repair all damage to existing joints in piping to remain in-service. Determine the exact length of the existing water main that is to be removed. Bevel pipe ends to prevent damage to the transition coupling gasket during installation of the coupling. Clean the exterior of the existing pipe end to a sound, smooth finish before installation of the coupling.

01140.48 Maintaining Service:

(a) Service Transfer - Where existing services are to be transferred from old to new mains, plan and coordinate the work with that of the Utility so that service will be resumed with the least possible inconvenience to the public.

(b) Connections by Utility - Allow the Utility to make connections into the new pipe at such locations as the Utility may elect to supply customers with water, after the affected section of pipe has passed hydrostatic and bacteriological tests. The installation of any such connections by the Utility shall not be construed as an acceptance by the Agency of any part of the work required under the Contract.

01140.49 Backfilling - After the pipe is installed and inspected, backfill the trench according to Section 00405.

Field Testing

01140.50 Filling and Flushing - Fill pipes slowly with potable water at a maximum velocity of 1 foot per second while venting all air. Take all required precautions to prevent entrapping air in the pipes.

(a) Flush and Disinfect - Flush sections of pipe to be tested and disinfect to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, provide a tap large enough to develop a velocity of at least 2.5 feet per second in the main.

(b) Taps - Provide taps for temporary or permanent release of air, flushing, or chlorination.

(c) Disposal of Treated Water - Dispose of treated water flushed from mains. Neutralize the waste water for protection of aquatic life in the receiving water before disposal into any natural drainage channel. Dispose of disinfecting solution to the satisfaction of the Engineer and local authorities. If approved by the Engineer and the Utility, disposal may be made to any available sanitary sewer provided the rate of disposal will not overload the sewer.

01140.51 Hydrostatic Testing:

(a) General - Test all water mains and appurtenances in sections of convenient length under a hydrostatic pressure equal to one and one-half times the working pressure, but at least 150 psi, measured at the highest point of the test section. Furnish and operate all pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test. Provide certifications of accuracy for gauges used in the test from an approved laboratory.

(1) Backfill - Backfill the pipeline sufficiently to prevent movement of the pipe under pressure. Place all thrust blocks and allow time for the concrete to cure before testing. Where permanent blocking is not required, furnish and install temporary blocking and remove it after testing.

(2) Filling Pipe - Fill the mains with water and allow to stand under pressure a sufficient length of time to allow the escape of air and to allow the lining of the pipe to absorb water. The Agency will furnish the water necessary to fill the pipelines for testing, at a time of day when sufficient quantities of water are available for normal system operation.

(3) Time Test - Test by pumping the main up to the required pressure for at least ~~two~~ 2 hours. Provide additional pumping during the test period to continuously maintain pressure within 5 psi of that required. During the test, observe the section being tested to detect any visible leakage. Use a clean container to hold water for pumping up pressure on the main being tested. Sterilize this makeup water by adding chlorine to a concentration of 25 ppm.

(4) Measure Quantity - Accurately determine the quantity of water required to maintain and restore the required pressure at the end of the test period by pumping through an approved positive displacement water meter.

(5) Loss Formula - The quantity of water lost from the main shall not exceed the number of gallons per hour determined by the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

~~where~~Where:

L = allowable leakage in gallons per hour
S = length of pipeline tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in psi

(6) Pressure Loss - There shall be no appreciable or abrupt loss in pressure during the test period.

(7) Leakage - Correct all visible leakage regardless of the allowable leakage specified above. If the actual leakage exceeds the allowable amount, locate and repair the leaks and retest the pipeline.

(8) Use of Hydrant Valves - Make all tests with the hydrant auxiliary gate valves open and pressure against the hydrant valve. After the pipe test has been completed, test each gate valve in turn by closing it and relieving the pressure beyond. This test of the gate valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure beyond the valve is relieved. Verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

(9) Test Section Length - Limit sections to be tested to 1,500 feet, unless longer test sections are approved. The Engineer may require that the first installed section of pipe installed by each crew, not less than 1,000 feet in length, be tested. Do not continue pipe laying more than an additional 1,000 feet until the first section has been tested successfully.

(10) Test Equipment Readiness - Prior to calling out the Engineer to witness the pressure test, set up all equipment completely ready for operation and successfully perform the test to ensure that the pipe is in a satisfactory condition.

(11) Defective Materials or Workmanship - Replace defective materials or workmanship discovered during hydrostatic field testing. Whenever it is necessary to replace defective material or correct the workmanship, repeat the hydrostatic test until a satisfactory test is obtained.

(b) Testing Extensions from Existing Mains:

(1) Exceptions - When an existing water main is extended with new pipe to a new valve, and the distance from the existing pipe to the new valve is 18 feet or less, no hydrostatic test will be required if the section of new pipe between the new valve and the end of the existing main is installed with pretested, prechlorinated pipe. When the required hydrostatic tests are conducted in the new main section beyond the installed new valve in the closed position, the normal pressure of the existing main may be present against the other side of the new valve.

(2) Required Testing - Where the distance between the end of an existing water main pipe extension and the new valve is more than 18 feet, do not connect the new pipe to the existing pipe until after hydrostatic tests have been made to the required pressure in both directions against the new valve. Test after installing a temporary cap or plug on the end of the new pipe, beyond the new valve, as close as possible to the existing pipe. Make the final connection to the existing main with pretested, prechlorinated pipe.

(c) Testing Sections with Hydrants Installed - When hydrants are included with the section of main pipe to be tested, conduct three separate tests as shown in the following table:

	Water Main Gate Valves	Hydrant Auxiliary Gate Valves	Hydrant Operating Stem Valves	Hose Ports
Test No. 1	Closed	Closed	Wide Open	Wide Open
Test No. 2	Closed	Wide Open	Closed	Wide Open
Test No. 3 [1]	–	Closed	Wide Open	Closed

[1] Test each hydrant to the required test pressure. When testing a hydrant singly, pressure in the supply main beyond the hydrant auxiliary gate valve shall be 25 psi.

(d) Testing Hydrants Installed on Existing Mains - For hydrants installed and connected to existing mains, install the hydrant connection, including hydrant tee, connection pipe and auxiliary gate valves, with pretested materials.

Before the hydrant connection is made to the existing main, subject the hydrant installation to hydrostatic Test No. 3 in 01140.51(c).

01140.52 Disinfecting:

(a) General - Before placing new water mains in service, chlorinate new mains and repaired portions of, or extensions to, existing mains and obtain a satisfactory bacteriological report.

The initial chlorine content of the water shall be not less than 25 ppm. A chlorine residual of not less than 10 ppm shall remain in the water after standing 24 hours in the pipe.

(b) Chlorine Application - Apply chlorine by one of the following methods:

(1) Gaseous Chlorine - Apply a chlorine gas-water mixture by means of a solution-feed chlorinating device, or feed the dry gas directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, shall provide means for preventing the backflow of water into the chlorine.

(2) Calcium Hypochlorite - Apply a mixture of water and high-test calcium hypochlorite (65 - 70~~%~~ percent Cl). First mix the dry powder as a paste and then thin to a 1~~%~~ percent

chlorine solution by adding water to give a total quantity of 7.5 gallons per pound (water to dry powder).

(3) Sodium Hypochlorite - Apply sodium hypochlorite, commercial grade (12.5~~%~~ percent Cl) or in the form of liquid household bleach (5~~%~~ - 6~~%~~ percent Cl). This liquid chlorine compound may be used full strength or diluted with water.

(c) Point of Application - Apply the chlorinating agent at the beginning of the pipeline extension or any valved section of it, through a corporation stop inserted in the horizontal axis of the pipe. Supply the water injector for delivering the chlorine-bearing water into the pipe from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of applications may be used when approved.

(d) Rate of Application - Control water from the existing distribution system, or other source of supply, to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine application shall be in such proportion to the rate of water entering the newly laid pipe that the initial chlorine content of the water will be at least 25 ppm.

(e) Cross Connection Control - Make no connections between the existing distribution system and non-disinfected pipelines constructed under this Contract, unless a State Health Division approved backflow preventer is installed in the connecting line.

(f) Retention Period - Retain chlorinated water in the pipe at least 24 hours. After this period, the residual chlorine at pipe extremities and at other representative points shall be at least 10 ppm.

(g) Chlorinating Connections to Existing Water Mains - Follow the chlorinating procedure specified in AWWA Standard C651. Liberally treat the trench and exterior of existing main with hypochlorites. Swab or spray the interior of all closure fittings with a ~~one~~ 1 percent hypochlorite solution. Disinfect the existing main with a 100 ppm chlorine solution for 3 hours or a 300 ppm chlorine solution for 15 minutes and then thoroughly flush the line.

(h) Flushing and Testing - Following the retention period, flush all chlorinated water from the newly laid pipe until the replacement water throughout its length shows, upon test, an absence of chlorine or a residual no greater than that normally found in the source of supply.

(1) Sampling Tap - Install a sampling tap ahead of the flushing hose for convenient sanitary sampling.

(2) Service Resumption - Do not place the lines into service before a satisfactory report is received from the local or State health department on samples collected from representative points in the new system. Samples will be collected and bacteriological tests obtained by the Engineer.

(i) Repetition of Chlorinating and Testing - If the initial treatment results in a chlorine residual of less than 10 ppm at the end of the retention period or an unsatisfactory bacteriological test, repeat the original chlorination procedure until satisfactory results are obtained.

Measurement

01140.80 Measurement - The quantities of potable water pipe and fittings will be determined as follows:

(a) Pipe, Fittings and Couplings - The quantities of pipe of the various kinds, types, sizes and backfill classes will be measured on the length basis and will be horizontal measurement along the top of the finished trench, with no deduction for fittings, valves, and couplings.

In addition to measurement of the pipe, an allowance of 12 pipe diameters will be made for each factory-fabricated bend, sleeve, reducer or coupling, and an allowance of 18 pipe diameters of the larger diameter pipe will be made for each factory-fabricated tee or cross. The allowance will be added to the quantity for pipe of the same diameter.

(b) Extra Trench Excavation - The quantities of removal and backfill of extra trench excavation will be measured on the volume basis for each backfill class. The backfill classes are defined in Section 00405. The depth will be the actual depth removed for the changed line or grade as directed. The width will be the actual width removed for the changed line or grade, but in no case will the measured width exceed the allowable widths specified in 00405.41(c).

(c) Blowoff Assemblies - The quantities of blowoff assemblies will be measured on the unit basis.

(d) Connections to Existing Mains - The quantities of connections to existing mains will be measured on the unit basis.

Trench resurfacing will be measured according to 00495.80.

Installation under pavement by tunneling, jacking, or boring methods will be measured according to 00406.80.

Valves will be measured according to 01150.80.

Payment

01140.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	___ Inch Potable Water Pipe, Fittings and Couplings with Class ___ Backfill	Foot
(b)	___ Inch Potable Water Pipe, Fittings and Couplings with Restrained Joints and Class ___ Backfill	Foot
(c)	Extra Trench Excavation with Class ___ Backfill	Cubic Yard
(d)	Blowoff Assembly, ___ Inch	Each
(e)	____ Inch Connection to ____ Inch Existing Main	Each

The Contract unit price for the appropriate pay items reflects plan requirements or the Contractor's choice from the applicable options listed on the Pipe Data Sheets ~~(~~if shown~~)~~.

In items (a) and (b), the nominal diameter of pipe, fittings and couplings will be inserted in the first blank. The class of backfill will be inserted in the second blank. The quantities include the pipe plus the allowance for the fittings and couplings.

In item (c), the class of backfill will be inserted in the blank.

In item (d), the nominal diameter of assembly will be inserted in the blank.

In item (e) the nominal diameter of pipe will be inserted in the first blank and the nominal diameter of the main line will be inserted in the second blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Trench resurfacing will be paid for according to 00495.90.

Installation under pavement by tunneling, jacking or boring methods will be paid for according to 00406.90.

Valves will be paid for according to 01150.90.

No separate or additional payment will be made for:

- trench excavation
- bedding
- pipe zone material
- backfill work
- polyethylene encasement
- concrete thrust blocks
- detectable marking tape and wire
- flushing, hydrostatic testing and disinfection, and water for testing
- exposing and cleaning existing mains, cutting and removing existing pipe, draining existing mains, disinfecting existing mains, and refilling existing mains

Section 01150 - Potable Water Valves

Description

01150.00 Scope - This work consists of furnishing and installing valves in potable water systems at the locations shown or at other locations as directed.

Materials

01150.10 Materials - Furnish materials meeting the following requirements:

Backflow Prevention Devices	02480.70
Ball Valves	02480.23
Butterfly Valves	02480.22
Combination Air Release/Air Vacuum Valves	02480.60
Commercial Grade Concrete in Precast Concrete Blocks	00440
Commercial Grade concrete in Thrust Blocking	00440
Gate Valves	02480.20
Hydraulic Cushion Check Valves	02480.40(c)
Hydraulically Operated Valves	02480.50
Power-Actuating Devices	02480.24
Spring-Loaded Plug or Disc Check Valves	02480.40(b)
Swing Check Valves	02480.40(a)
Tapping Sleeve and Valve Assemblies	02480.30
Valve Boxes	02480.25
Valve Stem Extensions	02480.26

01150.11 Handling - Handle valves so as to prevent damage to the valve, lining or coating. Load and unload valves using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped or skidded. Damaged valves will be rejected. If damage is confined to the coating or lining, it may be repaired in a manner satisfactory to the Engineer. Immediately place all damaged valves apart from the undamaged and remove the damaged valves from the site as soon as possible.

01150.12 Connecting Ends - Furnish valves with connecting ends as shown and as required for connection to pipe and fittings furnished.

Construction

01150.40 General - Install valves according to the plans and the manufacturer's recommendations. Join to the pipe according to Section 01140 and AWWA Standards for the type of connecting ends furnished. Thoroughly clean and repair joints prior to installation.

(a) Valve and Valve Box Installation - Set valves and valve boxes plumb. Install valve stem extensions when required. Center the valve box over the operating nut of the valve. Place valve boxes over the valve or valve operator so that the valve box does not transmit shock or stress to the valve. Install the lower casting of the unit first, supported by backfill or by a closed-cell foam collar not less than 2 inches in thickness. Do not allow the casting to rest directly on the body of the valve or on the water main.

(b) Valve Operator Extensions - Install a valve operator extension with rock guard on any valve that has the valve nut operator installed 4 feet or more below finish grade. Hot-dip galvanize extensions after fabrication.

(c) Backfilling - Backfill around valves according to Section 00405. Carefully tamp backfill around the valve box to a distance of 3 feet on all sides or to the undisturbed face of the trench, whichever is closer. Set the cast iron valve box cover flush with the roadbed or finished paved surface.

01150.41 Combination Air Release/Air Vacuum Valves - Install combination air release/air vacuum valves as shown. Slope all piping to permit escape of any entrapped air. Perform trenching and backfilling according to 01170.40 and Section 00405.

01150.50 Field Testing - After installation, operate valves from full open to full closed to make sure valves do not bind during operation. Correct all malfunctions in the operation of the valves. Verify the number of turns from full open to full closed and provide to the Engineer for the Agency's records.

01150.51 Hydrostatic Testing - Subject valves to hydrostatic testing according to 01140.51. Correct all defects in design, materials or workmanship to the satisfaction of the Engineer.

01150.52 Disinfecting - Disinfect valves according to 01140.52.

Measurement

01150.80 Measurement - The quantities of valves will be measured on the unit basis.

Payment

01150.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	____ Inch ____ Valve	Each
(b)	____ Inch ____ Valve With ____ Actuator	Each
(c)	____ Inch ____ Check Valve	Each
(d)	____ Inch ____ Backflow Prevention Assembly	Each
(e)	____ Inch Hydraulically Operated Valve	Each
(f)	____ Inch Combination Air Release/Air Vacuum Valve Assembly	Each
(g)	____ Inch Tapping Sleeve and ____ Inch Valve Assembly	Each

In items (a) through (f), the size of the valve or assembly will be inserted in the first blank.

In items (a) through (d), the type of valve, check valve, or assembly will be inserted in the second blank.

In item (b), the type of actuator will be inserted in the third blank.

In item (g), the size of tapping sleeve will be inserted in the first blank. The size of valve assembly will be inserted in the second blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for earthwork not covered under other pay items, jointing, blocking of valves, protective coatings, valve boxes, valve stem extensions, and hydrostatic testing.

Section 01160 - Hydrants and Appurtenances

Description

01160.00 Scope - This work consists of furnishing and installing dry-barrel fire hydrants and appurtenances in potable water systems at the locations shown or at other locations as directed.

Materials

01160.10 Materials - Furnish materials meeting the following requirements:

Auxiliary Gate Valves	02480.20
Commercial Grade Concrete in Thrust Blocking	00440
End Connections	02485.20
Fire Hydrants	02485.10
Guard Posts	02485.70
Hydrant Dimensions	02485.30
Hydrant Extensions	02485.40
Tie Rods	02485.60
Traffic Flange	02485.50
Valve Boxes	02480.25
Valve Stem Extensions	02480.26

01160.11 Handling of Hydrants:

(a) Loading and Unloading - Handle hydrants to prevent damage to the hydrant, lining or coating. Load and unload hydrants using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped, skidded or rolled against other hydrants. Damaged hydrants will be rejected. If damage is confined to the coating or lining, it may be repaired in a manner satisfactory to the Engineer. Immediately place all damaged hydrants apart from the undamaged and remove the damaged hydrants from the site as soon as possible.

(b) End Caps - Provide factory applied end cap on pipe connection end. Maintain end cap through shipping, storage, and handling to prevent damage and prevent dirt and moisture from entering the hydrant.

Construction

01160.40 Setting Hydrants - Inspect all hydrants upon delivery in the field to ensure proper working order. Provide a minimum 5 foot radius unobstructed working area around all hydrants. Set the traffic flange 2 inches above finish grade. Allow the hydrant barrel drain to waste into a pit of porous gravel material situated at the base of the hydrant.

(a) Touchup Painting - After all installation and testing is complete, paint the exposed portion of the hydrant with one coat of the type and color coating designated by the Engineer.

(b) Out-of-Service Hydrants - Identify all hydrants not in service by covering with a burlap or plastic bag properly secured.

01160.41 Hydrant Laterals - Install hydrant laterals, consisting of 6 inch ductile iron pipe, from the auxiliary gate valve at the main to the hydrant, according to Section 01140 and as shown.

01160.42 Hydrant Restraints - Restrain the thrust created in the hydrant lateral as shown. If applicable, clean tie rods after installation and paint with two coats of coal tar epoxy or other approved bituminous coating.

01160.43 Auxiliary Gate Valves and Valve Boxes - Install auxiliary gate valves and valve boxes according to Section 01150, except that the end connections shall be provided with lugs for tie rods, or the bells shall provide sufficient clearance between the body of the valve and the hub to permit the installation of tie rods.

01160.44 Hydrant Guard Posts - Construct hydrant guard posts at the locations shown. Excavate holes 6 inches in diameter for hydrant guard posts to a depth of 36 inches. Install hydrant guard posts plumb, and center in the holes. Backfill the holes and fill the hydrant guard posts with commercial grade concrete. Paint the exposed portion of each guard post with one coat of the type and color coating designated by the Engineer.

01160.45 Resetting Existing Hydrants:

(a) Relocation - Where existing hydrants are shown for adjustments to conform to a new street alignment or grade, or both, relocate the hydrant without disturbing the location of the hydrant lateral tee at the main.

(b) Thrust Restraint - Determine the method for thrust restraint for the hydrant lateral according to the conditions found in the field, and construct as directed.

01160.46 Moving Existing Hydrants - Move existing hydrants where shown. When the existing hydrant lateral tee does not accommodate a new hydrant location, install a new hydrant lateral tee in the main. Remove the existing hydrant lateral tee from the main if the main is to remain active, and insert a new section of pipe into the water main in place of the existing hydrant lateral tee. Where the existing main to which the existing hydrant lateral tee is connected is to be abandoned or temporarily activated after the existing hydrant is moved, plug the open end of the hydrant lateral pipeline. Provide temporary thrust restraint if temporarily reactivated.

01160.47 Reconnecting Existing Hydrants - Reconnect existing hydrants where shown. Leave the location and elevation of the existing hydrant unchanged, but change the existing hydrant lateral to connect with a new auxiliary gate valve and hydrant tee provided in a new main. Install new hydrant lateral according to Section 01140 where the lateral extends to connect to the new main. Where existing hydrants were not restrained with tie rods to the old main, restrain the new connections with tie rods as shown, or by other joint restraint method as directed.

01160.48 Hydrant Extensions - Install hydrant extensions where required. Set the traffic flanges a minimum of 2 inches and a maximum of 6 inches above finish grade.

Field Testing Installations

01160.50 General - After installation, operate hydrants from full open to full closed to make sure they do not bind during operation. Correct all malfunctions in the operation of the hydrants.

01160.51 Hydrostatic Testing - Subject hydrants to hydrostatic testing according to 01140.51. Correct all defects in design, materials or workmanship to the satisfaction of the Engineer.

01160.52 Disinfecting - Disinfect hydrants according to 01140.52.

Measurement

01160.80 Measurement - The quantities of work performed under this Section will be measured on the unit basis.

New pipe for hydrant connections to existing mains and lateral tees will be measured according to 01140.80.

Payment

01160.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Hydrant Assemblies	Each
(b)	Resetting Existing Hydrants	Each
(c)	Moving Existing Hydrants	Each
(d)	Reconnecting Existing Hydrants	Each
(e)	Hydrant Guard Posts	Each
(f)	Hydrant Extensions	Each

Item (a) includes auxiliary gate valves, tie rods, concrete blocks, gravel, and painting.

Item (b) includes tie rods, painting, and reconnecting to the main.

Item (c) includes new hydrant lateral tee, tie rods, painting, reconnecting to the main, and plugging abandoned laterals if needed.

Item (e) includes excavation, backfill, and painting.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

New pipe for hydrant connections to existing mains and lateral tees will be paid for according to 01140.90.

Section 01170 - Potable Water Service Connections, 2 Inch and Smaller

Description

01170.00 Scope - This work consists of furnishing and installing service connections, 2 inch in diameter and smaller, from the main to the water meter, and furnishing and installing sampling stations. The water meter will be furnished and installed by others unless specified otherwise in the Special Provisions or on the plans.

Materials

01170.10 Materials - Furnish materials meeting the following requirements:

Bronze Nipples and Fittings	02490.60
Copper Tubing Service Pipe	02490.40(a)
Corporation Stops	02490.30
Meter Boxes	02490.70
Meter Setters	02490.50
Polyethylene Tubing Service Pipe	02490.40(b)
Saddles	02490.20
Sampling Stations	02490.80
Service Fittings	02490.40(c)

Construction

01170.40 General - Make all service connections to water mains, except to ductile iron pipe, Thickness Class 52 or thicker, using saddles as specified and of the size and type suitable for use with the water main and the pipe being installed. Direct tap ductile iron pipe, Thickness Class 52 or thicker, for corporation stops according to the recommendations of the Ductile Iron Pipe Research Association (DIPRA), unless direct taps are prohibited by the Special Provisions. Install service pipelines perpendicular to the main, unless shown otherwise.

(a) Trench Depth - Construct the depth of trench for service connection piping to provide a minimum of 30 inches of cover over the top of the pipe. Exercise care to ensure that the main is not damaged by the work undertaken to install the service. Excavate and backfill for service connections according to Section 00405, except install the service pipeline under pavement, curbs and sidewalks by boring methods approved by the agency having jurisdiction over the roadway.

(b) Installation - Make service connections to water mains according to pipe manufacturer's recommendations and appropriate AWWA standard for water main installation. Cut service pipes using tools specifically designed to leave a smooth, even and square end on the pipe. Ream cut ends to the full inside diameter of the pipe. Clean pipe ends to be connected using couplings that seal to the outside surface of the pipe to a sound, smooth finish before the couplings are installed. Adjust the meter box to the finished grade after the surface has been acceptably restored.

01170.41 Reconnecting Existing Services - Where shown, reconnect existing service connections to the new mains. Verify the location of existing service connections in the field. Notify affected customers of the service interruption at least 24 hours prior to service interruption. Use insulating couplings at all connections between existing galvanized steel or iron pipe and new copper pipe. All fittings, appurtenances, and other miscellaneous materials on the sections of existing pipe that have been removed become the property of the Contractor.

01170.42 Sampling Stations - Install sampling stations according to the manufacturer's recommendations and at the locations and depths shown or as directed. Perform trenching and backfilling according to 01170.40.

Field Testing Installations

01170.50 Flushing and Disinfecting - For installation of service connections and sampling stations to existing water mains, liberally treat the trench and exterior of existing main with hypochlorites. Swab or spray all service pipe, appurtenances, and sampling stations with a ~~one~~ 1 percent hypochlorite solution. Disinfect service connections and sampling stations with a 100 ppm chlorine solution for 3 hours or a 300 ppm chlorine solution for 15 minutes and then thoroughly flush the service connections and sampling stations. For installation of service connections and sampling stations concurrent with new water mains, flush and disinfect service connections and sampling stations according to Section 01140.

01170.51 Hydrostatic Testing - For installation of service connections and sampling stations to existing water mains, apply system pressure to new installation prior to backfilling and repair any visible leaks. For installation of service connections and sampling stations concurrent with new water mains, perform hydrostatic testing of service connections and sampling stations according to Section 01140. Correct all defects in materials or workmanship and retest until satisfactory results are obtained.

Measurement

01170.80 Measurement - The quantities of service connections, reconnecting existing services, and sampling stations will be measured on the unit basis.

Payment

01170.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	___ Inch Water Service Connections	Each
(b)	Reconnecting Existing Water Services, ___ Inch	Each
(c)	Water Sampling Stations	Each

In items (a) and (b), the size will be inserted in the blank.

Item (a) includes excavating, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, testing, flushing and disinfection of the service connection.

Item (b) includes excavation, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, testing, flushing and disinfection of the reconnected service connection.

Item (c) includes excavating, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, concrete pad, testing, flushing and disinfection of the sampling station.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

PART 02000 - MATERIALS

Concrete Materials and Additives

Section 02001 - Concrete

Description

02001.00 Scope - This Section includes the requirements for portland cement concrete (concrete) for structural, precast prestressed, or paving applications.

02001.01 General - Produce concrete according to these Specifications and referenced Sections of ASTM C 94, Standard Specification for Ready-Mixed Concrete. Provide quality control according to Section 00165.

02001.02 Abbreviations and Definitions:

ASTV - Actual Strength Test Value - average of test cylinder compressive strengths

cm - Cementitious Materials

f'_c - Minimum Specified Compressive Strength at 28 days

f'_{cr} - Average Compressive Strength Over-design. The average strength required to assure that, with normal variations, the concrete will meet f'_c

GGBFS - Ground Granulated Blast Furnace Slag

HPC - High Performance Concrete

HRWRA - High-Range Water-Reducing Admixture (super-plasticizer)

PPCM - Precast prestressed concrete member

w - Water

WRA - Water Reducing Admixture

Cementitious Materials - Included but not limited to portland cement, fly ash, silica fume, ground granulated blast furnace slag, and metakaolin.

High Performance Concrete - Concrete designed for enhanced durability and performance characteristics. High performance concrete is identified on the Plans by the letters "HPC" in front of the concrete class designation (for example, HPC4000 - 3/4).

Moderate Exposure - Elevations below 1,000 feet.

Modifiers - Pozzolans, ~~latex.~~ground granulated blast furnace slag, and latex.

Pozzolans - Fly ash, silica fume, and metakaolin.

Severe Exposure - Elevations 1,000 feet and above.

02001.10 Materials - Furnish materials meeting the requirements of the following:

Admixtures 02040
Aggregates 02690
Cement 02010
Modifiers 02030
Water 02020

02001.20 Concrete Properties, Tolerances, and Limits - Provide concrete that is a workable mixture, uniform in composition and consistency, and having the following properties;

(a) Strength - Provide concrete meeting the required Classes shown in the Contract Documents. The class of concrete designates the minimum required compressive strength, f'_c at 28 days, and the nominal maximum size of aggregate to be used in the concrete (for example, Class 3300 ~~-~~ 3/4: f'_c is 3,300 psi with a nominal maximum size aggregate of 3/4 inch).

Table 02001-1

Concrete Strength and Water/Cementitious Material (w/cm) Ratio		
Type of Concrete	**Strength (psi)**	**Maximum w/cm Ratio**
Structural	3300	0.50
	3300 (Seal)	0.45
	4000	0.48
	4000 (Deck)	0.40
	HPC4000	0.40
	5000 and above	0.40 [1]
	HPC5000 and above	0.40
Paving	4000	0.44
[1] PPCM's with cast-in-place decks and no entrained air may have w/cm as follows: 5000 psi - 0.48; 5500 psi - 0.44; 6000 psi and up - 0.42		

(b) Air Entrainment - Provide all concrete, except PPCM with cast-in-place decks, seal concrete, and drilled shaft concrete with entrained air in the amounts shown in Table 02001-2. Field measured entrained air content shall be within ± 1.5~~%~~ percent of target air entrainment values.

Table 02001-2

Air Entrainment		
Nominal Maximum Size Aggregate	**Severe Exposure (Percent)**	**Moderate Exposure (Percent)**
3/8"	7.0	6.0
1/2"	6.5	5.5
3/4"	6.0	5.0
1"	5.5	4.5
1 1/2"	5.0	4.5

(c) Slump - Provide concrete at the appropriate slump shown in Table 02001-3. Take corrective action to maintain a consistent slump at the point of discharge from the delivery vehicle.

Table ~~0201~~02001-3

Concrete Slump	
Condition	**Slump**
Concrete without WRA	4" max.
Concrete with WRA	5" max.
Concrete with HRWRA	5 1/2" ± 2 1/2"
Precast Prestressed Concrete with HRWRA	10" max.
Seal Concrete	8" ± 2"
Drilled Shaft Concrete	8 1/2" ± 1 1/2"

(d) Temperature - Provide concrete, at time of placement, at a temperature between a minimum of 50 °F and a maximum of 90 °F, except the maximum bridge deck concrete temperature shall be 80 °F.

Concrete Mix Designs

02001.30 Concrete Mix Design - Submit new or current mix designs, prepared by a CCT, for each required class of structural or paving concrete to the Engineer for review. Allow ~~14~~21 calendar days for the review. Design mixes by the volumetric method in ACI 211.1 to achieve the properties of 02001.20. Do not proceed with concrete placement until the Engineer has determined that the mix design complies with the Specifications. Review of concrete mix designs does not relieve the Contractor of the responsibility to provide concrete meeting the Specification requirements.

High performance concrete (HPC) mix designs shall ~~either~~ contain ~~cementitious~~any of the following:

- Cementitious material with 66~~%~~ percent portland cement, 30~~% Fly~~ percent fly ash, and 4~~% Silica~~ percent silica fume~~; or have~~.
- Cementitious material with modifiers proportioned according to 02001.31(c) and with trial batches performed to demonstrate that the proposed alternate mix design provides a maximum of 1,000 coulombs at 90 days when tested according to AASTHO T 277.
- Cementitious material with modifiers and with trial batches performed to demonstrate that the proposed alternate mix design provides a maximum of 1,000 coulombs at 90 days when tested according to AASTHO T 277.

02001.31 Concrete Constituents:

(a) Portland Cement - Use AASHTO M 85 or ASTM C 150, Type I or II cement for structural or paving concrete. Use AASHTO M 85 or ASTM C 150, Type III cement for precast prestressed concrete.

(b) Pozzolans - ~~Except for HPC, pozzolans~~Pozzolans or GGBFS may be used separately or in combinations up to 30~~%~~ percent of the total cementitious materials content.

(c) Modifiers - Modifiers may be used separately or in combinations as approved by the Engineer. Alternate HPC proportions may be:

Fly Ash	12%	-	18%
GGBFS	20%	-	35%
Silica Fume	3%	-	5%

For alternate HPC mix designs do not replace more than 50 percent of total cementitious material with modifiers.

When silica fume is added to truck mixed concrete, mix the batch a minimum of 100 revolutions at the mixing speed specified by the manufacturer before leaving the batch plant.

(d) Blended Hydraulic Cement - Blended hydraulic cement may be used subject to the limits of 02001.31(b) and 02010.20.

(e) Chemical Admixtures - Use chemical admixtures according to the manufacturer's recommendations. Use WRA in all seal concrete and in Class 5000 concrete or greater. Use HRWRA in all HPC.

Use a superset extender from the QPL in all concrete for bridge decks. Use an appropriate amount to extend the initial set time of the concrete by 90 minutes.

(f) Aggregate - If the nominal maximum size of the coarse aggregate is not included as a part of the class of concrete, or shown on the plans, any size from 1 1/2 inch to 3/4~~,~~8 inch nominal maximum size aggregate may be used according to ACI guidelines except:

- Use 3/4 inch nominal maximum size or larger aggregates in bridge deck concrete.
- Use 1 1/2 inch nominal maximum size aggregates in paving concrete unless otherwise indicated.
- Use 3/8 inch nominal maximum size aggregates in drilled shafts unless otherwise indicated.

Proportion all HPC for a minimum coarse aggregate absolute solid volume according to Table 02001-4:

Table 02001-4

Absolute Solid Volume	
Maximum Nominal Aggregate Size	**Cu. Yd. (aggregate) / Cu. Yd. (concrete)**
3/8"	0.36
1/2"	0.38
3/4"	0.40
1"	0.42
1 1/2"	0.46

Two or more aggregate products or sources meeting specifications may be blended to improve concrete properties. Blending non-specification aggregate materials, except for gradation, with specification materials is not allowed.

02001.32 New Mix Designs - Prepare new mix designs for submittal according to the following:

(a) Trial Batch - Make at least one trial batch for each concrete mix design. Prepare and test trial batches using the same materials and having the same plastic properties of concrete that will be used in the Project. Simulate haul time and mixing conditions to ensure proper workability at the jobsite.

(b) Plastic Concrete - For each trial batch, test the temperature, slump, density, and air content and compute the w/cm ratio and yield according to the following test methods:

Test	Test Method
Sampling Fresh Concrete	WAQTC TM 2
Slump	AASHTO T 119
Density	AASHTO T 121
Yield	AASHTO T 121
Air Content	AASHTO T 152
Concrete Temperature	AASHTO T 309
Molding Concrete Specimens	AASHTO T 23 or R 39 [1]
Water-Cement Ratio	[2]
Length Change	ASTM C 157
Permeability	AASHTO T 277

[1] Cast cylinders in single-use plastic molds
[2] Use ODOT's Field Operating Procedure for AASHTO T 121 in the MFTP

(c) Strength Tests - For each trial batch, cast at least three test cylinders in 6 inch x 12 inch or 4 inch x 8 inch single-use plastic molds. Cast and cure all cylinders according to AASHTO T 23 or AASHTO R 39, and test at 28 days according to AASHTO T 22.

Cast three flexural beams for paving concrete trial batches according to AASHTO T 23 or AASHTO R 39. Test flexural beams at 28 days according to AASHTO T 97.

(d) Length Change Tests - For all HPC mix designs, make at least three specimens from the trial batch for length change testing. Test samples according to ASTM C 157. Wet cure the samples until they have reached an age of 14 days, including the period in the molds. Store and measure samples according to ASTM C 157, section 11.1.2. Report length change results at 4, 7, 14, 28, and 56 day time intervals.

(e) Permeability Tests - For alternate HPC mix designs, make at least three specimens for permeability testing. Prepare, cure, dry and test according to AASHTO T 277. Report permeability in coulombs at 90 days.

Permeability tests are not required when HPC mix designs contain cementitious material with 66 percent portland cement, 30 percent fly ash, and 4 percent silica fume.

02001.33 Required Over Design Strength (f'_{cr}) for New Mix Designs - Provide test data and calculations demonstrating compliance of the trial batch cylinder's ASTV with the requirements of either (a) or (b) below.

(a) $f'_{cr} = f'_c \times 1.20$ Up to Class 6000 $f'_{cr} = f'_c \times 1.15$ Class 6000 and higher

(b) $f'_{cr} = f'_c + 1.34 \times S$ Up to Class 6000 $f'_{cr} = f'_c + 1.28 \times S$ Class 6000 and higher

Where: S is the standard deviation of 28 day cylinder strengths from a similar class (± 1,000 psi) mix design produced at the same plant. There shall be at least 15 sets of 28 day cylinders from this similar class mix design to use option (b).

(c) Flexural Beams - Flexural beams for paving concrete mix designs shall achieve 600 psi at 28 days.

02001.34 Current Mix Designs - Mix designs that meet the requirements for the specified class of concrete and are currently being used or have been used within the past 12 months on any project, public or private may be submitted for review.

For HPC mix designs, test according to the following and submit results:

Test	Test Method	Acceptance Value
Length Change	ASTM C 157	–
Permeability	AASHTO T 277	1,000 coulombs (max.) at 90 days

(a) Length Change Tests - For all HPC mix designs make at least three specimens for length change testing. Test samples according to ASTM C 157. Wet cure the samples until they have reached an age of 14 days, including the period in the molds. Store and measure samples according to ASTM C 157, section 11.1.2. Report length change results at 4, 7, 14, 28, and 56 day time intervals.

(b) Permeability Tests - For alternate HPC mix designs make at least three specimens for permeability testing. Prepare, cure, dry and test according to AASHTO T 277. Report permeability in coulombs at 90 days.

Permeability tests are not required when HPC mix designs contain cementitious material with 66 percent portland cement, 30 percent fly ash, and 4 percent silica fume.

02001.35 Required Submittals for Mix Designs - Submit the following information for each concrete mix design:

(a) Supplier's Unique Mix Design Identification Number

(b) Mix Design Constituent Proportions:

- Weight per cubic yard (pounds per cubic yard) of cementitious material, modifiers, fine and coarse aggregates (SSD), and mix water.
- Absolute volumes of cementitious material, modifiers, fine aggregates and coarse aggregates (SSD), and mix water.
- Dosage rates for chemical admixtures.

(c) Aggregates - Identify the aggregate source by the ODOT source number. Report current values of the following:

- Bulk specific gravities (SSD)
- Fine aggregate absorptions
- Coarse aggregate absorptions

- Dry-rodded density of coarse aggregates
- Fineness modulus of sand used in the mix design calculations

(d) Cementitious Material - For each cementitious material used, identify the following:

- Manufacturer
- Brand name
- Type
- Relevant Specification
- Source or location plant

(e) Modifiers - For each modifier used, identify the following:

- Manufacturer
- Brand name
- Source
- Relevant specification
- Class

(f) Admixtures - For each admixture used, identify the following:

- Manufacturer
- Brand name
- Design dosage rate

(g) Water - Identify the source of water to be used.

(h) Plastic Concrete Tests - Report the temperature, slump, density, air content, yield, and w/cm ratio of the trial batch or the average of these values for the cylinder sets presented for evaluation of a current mix design.

(i) Compressive Strength Test Results - Report the individual test results and the ASTV of cylinders from the trial batch or the average for the cylinder sets presented for evaluation of a current mix design.

(j) Strength Analysis - Provide an analysis, showing all calculations, demonstrating that the mix design meets the requirements of 02001.33.

(k) Quality Control Personnel - Provide the name and certification number of the CCT who prepared the mix design, the QCT who performed the plastic concrete tests and cast the test cylinders, the laboratory where the cylinders were tested, and the CSTT who tested the cylinders.

02001.36 Adjusting Concrete Proportions - After a mix design has been reviewed and accepted, submit any proposed adjustments to concrete proportions for review. Significant changes to the mix design (such as decreases in cementitious material content, increases in pozzolans that replaces cement, or the use of aggregates from a different source) may require verification of compressive strength performance by trial batch, according to 02001.32, or test results from field tests according to 02001.33. Aggregates from new sources shall meet aggregate source quality requirements according to Section 02690.

02001.37 Trial Batch Costs - Furnish all materials, equipment and work required for designing the mixes, testing materials, and making trial batches to verify the design for final use at no additional cost to the Agency.

02001.40 Concrete Production - Produce concrete according to the following sections of ASTM C 94, Standard Specification for Ready-Mixed Concrete:

ASTM Section	ASTM Title
9.	Measuring Materials
10.	Batching Plant
11.	Mixers and Agitators
12.	Mixing and Delivery

02001.50 Quality Control Personnel - Provide the following certified technicians:

(a) Certified Aggregate Technician (CAgT):

- **Duties:**
  - Sample and test aggregates.
  - Sample and test each stockpiled size according to the test procedures and at the frequencies shown in the Field Tested Materials Guide section of the MFTP.
  - Record and evaluate test results according to Section 00165.
  - Provide Stat-Spec results to the Engineer.

(b) Quality Control Technician (QCT):

- **Duties:**
  - Attend pre-placement meetings for bridge deck pours and paving.
  - Be at the concrete placement site when concrete placement is in progress.
  - Have a copy of the mix design on-site and available during concrete placement.
  - Obtain and check each batch ticket upon arrival of the concrete at the jobsite for the correct mix design.
  - Sample the concrete and test for ambient air temperature, plastic concrete temperature, slump, air content, density, w/cm ratio and yield at the frequencies required by and according to the tests listed in the MFTP, after concrete mixture proportions are adjusted in the field, and at such times as requested by the Engineer.
  - Notify the Contractor and the Engineer immediately when the concrete is not in compliance with the Specifications.
  - Be in direct contact with the CCT by telephone, radio or other means to convey information.
  - Notify the CCT of loads rejected and the reason for rejection.
  - Notify the CCT immediately whenever the density of the plastic concrete varies from the mix design target by more than ± 3 pounds per cubic foot.
  - Notify the CCT immediately whenever the w/cm ratio varies from the mix design target by more than ± 0.03.

(c) Concrete Control Technician (CCT):

- **Duties**
  - Prepare new concrete mix designs.
  - Adjust current mix designs.
  - Control production of the concrete.
  - Test the fine and coarse aggregates for total moisture content according to AASHTO T 255 before batching is started and when there is a significant change in the slump of the concrete. Moisture testing may be by an alternate method if approved by the Engineer. Provide moisture content test results to the Engineer upon request.
  - Visually inspect the coarse aggregate for changes in moisture content throughout the day. Perform necessary testing for total moisture, and make mixture adjustments if necessary.
  - Monitor concrete properties and compressive strength tests throughout the duration of the Project.
  - Make adjustments to maintain a satisfactory over-design f'~~cr~~ $_{cr}$.
  - Perform an analysis and make necessary adjustments whenever the unit weight of the plastic concrete varies from the mix design by more than ± 3 pounds per cubic foot. Submit a written analysis along with any recommendations to the Engineer by the middle of the following work shift.
  - Submit to the Engineer, in writing, adjustments made to the mix design.
  - Perform an analysis and verify the accuracy of coarse and fine aggregate moistures whenever the water-cementitious material ratio varies from the mix design target by more than ± 0.03 and submit to the Engineer by noon of the following workday.

(d) Concrete Strength Testing Technician (CSTT):

- **Duties:**
  - Receive concrete test cylinders
  - Record data
  - Strip cylinders
  - Store cylinders
  - Test Cylinders
  - Record test data
  - Report test data

02001.60 Delivery Tickets - Send a concrete delivery ticket with each load of concrete supplied to the Project. Each delivery ticket shall include the following information:

- Concrete ~~supplier's~~supplier's name, address and telephone number
- Address and telephone number of batch plant if different from above
- Date and time the concrete batch was produced
- ODOT mix design number
- Size of load batched
- Weights or volumes of constituents batched in the load
- Amount of water that can be added at the job site

02001

Record the amount of water added at the job site on the delivery ticket.

Section 02010 - Portland Cement

Description

02010.00 Scope - This Section includes the requirements for portland cement and blended hydraulic cement.

Materials

02010.10 Portland Cement:

(a) Types - Furnish one or another of the following types as elected:

- Type I
- Type II
- Type III

Do not mix or alternately use differing brands or types of cement, or the same brand or type of cement from different mills without prior written approval.

(b) Specifications - Portland cement shall conform to the requirements of AASHTO M 85 for low alkali cement except as follows:

- ~~Cement used west of the summit of the Cascade Mountains~~Cement shall have a total alkali content (sodium and potassium oxide calculated as Na_2O + 0.658 K_2O) not exceeding 0.~~80%.~~60 percent.
- Types I or III shall contain a maximum of 10~~%~~ percent tricalcium aluminate.
- The time-of-setting tests will be by either the Gillmore test or the Vicat test.
- The maximum fineness (specific surface) as determined by the air permeability test shall be 430 m^2/kg for any field-sampled check test. Results of field-sampled check tests will not be averaged.

(c) Acceptance - Portland cement shall be from the QPL.

02010.20 Blended Hydraulic Cement - Blended hydraulic cement shall be either Type IP portland-pozzolan cement or Type I (SM) slag-modified portland cement conforming to AASHTO M 240, modified as follows:

- The cement constituent of the blended cement shall conform to 02010.10.
- The pozzolan constituent of the blended cement shall be fly ash conforming to 02030.10 or ground granulated blast furnace slag (GGBFS) slag conforming to 02030.40.

Section 02015 - Portland Cement Concrete Repair Material

Description

02015.00 Scope - This Section includes the requirements for portland cement concrete repair materials.

Materials

02015.10 Materials - All PCC repair materials are acceptable for structural applications when used according to the manufacturer's recommendations.

02015.20 Portland Cement Concrete Repair - Furnish PCC repair material from the QPL.

02015.30 Portland Cement Concrete Repair, Polymer Modified - Furnish polymer modified PCC repair material from the QPL.

02015.40 Portland Cement Concrete Repair, High Performance - Furnish High Performance PCC repair material from the QPL.

Section 02020 - Water

Description

02020.00 Scope - This Section includes the requirements for water used in mixing concrete, mortar, grout, and other applications when specified or directed.

Materials

02020.10 Water:

(a) General - Water used in mixing or curing concrete, ~~for~~ mortar ~~and~~, grout, and in mixing cement-treated base shall be reasonably clean, and free of oil, sugar, organic matter, or other substances injurious to the finished product.

(b) Potable - Potable water may be used without testing if the Contractor provides a quality compliance certificate verifying that the water has met the limits and ranges of ~~this Section~~ASTM C 1602, according to tests made within the last ~~two~~ 2 years.

Water approved for public use by the Oregon Health Division may be accepted for use without testing.

(c) ~~Nonpotable or~~ Non-Potable, Unknown Quality~~ - Water of non~~, or Suspected Quality - Non-potable, unknown quality, or suspected quality water shall be tested at no additional cost to the Agency . Test according to ~~AASHTO T 26 before use in the Project and shall meet the following limits:~~

	~~Minimum~~	~~Maximum~~
~~pH~~	~~6.0~~	~~8.0~~
~~Chloride Ion, %~~	~~–~~	~~0.15~~
~~Sulphate Ion, %~~	~~–~~	~~0.50~~
~~Total Dissolved Solids, ppm~~	~~–~~	~~6,500~~
~~Total Suspended Solids, ppm~~	~~–~~	~~2,000~~

~~If any of the test data are outside these limits, the water may be accepted on the basis of an evaluation of the reduction in seven-day compressive strength, which shall not exceed 10.0%.~~

~~In marine environments, the chloride ion percentage shall be limited to a maximum of 0.10%.~~

~~**(d) Recycled Mix Water** - Water from mixer washout operations may be used in mixing concrete provided it is:~~

- ~~Within the limits of~~ ASTM C ~~94, Table 1, Acceptance Criteria for Questionable Water Supplies,~~ 114 and ASTM C ~~94, Table 2, Chemical Limitations for Wash Water. In addition the specific gravity maximum limit is 1.03.~~
- ~~Tested at a weekly interval for at least four weeks prior to use on the Project. The~~ 1603. Water from concrete production operations is considered unknown quality. Results of testing ~~frequency may be reduced to monthly thereafter providing no single test exceeds the limits set above. Required tests include the physical tests in Table 1~~shall comply with the limits and ranges of ASTM C ~~94, the chemical tests in Table 2 of ASTM C 94,~~ 1602 and ~~testing for specific gravity. The testing shall be at no additional cost to the Agency. The test results shall be provided to the Engineer prior to use on the Project.~~

- ~~Made up from a dilution process rather than a concentration process. (A dilution process in one in which the reclaimed water is extensively diluted and continuously agitated to keep solids in a state of suspension).~~
- ~~Free of coloring agents.~~
- ~~Not used when the ambient temperature is 85 °F or above.~~
- ~~Not used when the ambient temperature is 40 °F or lower.~~
- ~~Not used as more than 75% of the water added to the batch.~~

~~Not used in structure decks~~shall be available for review upon request.

Section 02030 - Modifiers

Description

02030.00 Scope - This Section includes the requirements for fly ash, silica fume, latex, and ground granulated blast furnace slag used in portland cement concrete.

Materials

02030.10 Fly Ash~~:~~ - Furnish Class C, Class F, or Class N fly ash from the QPL and conforming to AASHTO M 295 (ASTM C 618).

~~**(a) Types** - Fly ash shall be Class C, Class F, or Class N from the QPL, and shall conform to AASHTO M 295, including Table 2, except that:~~

- ~~Loss on Ignition (LOI) shall be 1.5% maximum.~~
- ~~Moisture content shall be 1% maximum.~~
- ~~Amount retained on the No. 325 sieve shall be 30% maximum.~~

~~**(b) Acceptance** - Fly ash will be accepted for immediate use if accompanied by a test results certificate according to 00165.35.~~

~~As a check on material conformance, fly ash may be sampled at the site of work for verification testing.~~

02030.20 Silica Fume:

(a) Types - Provide the silica fume admixture as a slurry containing silica fume, water, and a high range water reducer, or as a densified powder. The silica fume portion shall conform to AASHTO M 307~~, including Table 1a, Optional Chemical Requirements~~. Total alkalis, as equivalent Sodium Oxide (Na_2O), shall be 1.5 percent maximum.

(b) Acceptance - Silica fume will be accepted for immediate use if accompanied by a test results certificate according to 00165.35. If the silica fume admixture is supplied as a slurry, the certificate shall indicate the silica fume content of the slurry as a percent by weight. If the silica fume is supplied as a densified powder, do not allow the packaging to enter the concrete mixture.

02030.30 Formulated Latex Admixture - Formulated latex admixture shall be from the QPL and be a nontoxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture. It shall be homogeneous and uniform in composition, and meet the following requirements:

Polymer Type Stabilizers	**Styrene Butadiene**
Latex	Nonionic Surfactants
Portland Cement Composition	Polydimethyl Siloxane
Solids, % by weight, min.	46.0
Volume Density, lb/gal, min.	8.4 at 77 °F
pH	9.0 to 11.0
Color	White

Latex admixtures that have not been stored according to the manufacturer's recommendations will not be accepted.

02030.40 Ground Granulated Blast Furnace Slag (GGBFS) - GGBFS shall meet the requirements of AASHTO M 302.

02030.50 Metakaolin - Provide metakaolin from the QPL and conforming to AASHTO M 295 (ASTM C 618) Class N.

Section 02040 - Chemical Admixtures

Description

02040.00 Scope - This Section includes the requirements for air-entraining, water-reducing, retarding, and accelerating admixtures.

Materials

02040.10 Materials - Furnish admixtures from the QPL, except as follows:

An admixture that does not appear on the QPL may be used if, prior to use, the Contractor provides a test results certificate demonstrating the admixture has been tested and conforms to these Specifications. The Agency may sample and test admixtures according to 00165.35.

Chloride content of any admixture used in portland cement concrete in contact with embedded metals shall not exceed 0.5~~%~~ percent by weight of the admixture when tested according to ODOT TM 505.

Admixtures shall conform to the following requirements:

Admixture	Specification
Air-entraining	AASHTO M 154 (ASTM C 260)
Type A - Water-reducing	AASHTO M 194 (ASTM C 494)
Type B - Retarding	AASHTO M 194 (ASTM C 494)
Type C - Accelerating	AASHTO M 194 (ASTM C 494)
Type D - Water-reducing and Retarding	AASHTO M 194 (ASTM C 494)
Type E - Water-reducing and Accelerating	AASHTO M 194 (ASTM C 494)
Type F - Water-reducing, High Range	AASHTO M 194 (ASTM C 494)
Type G - Water-reducing, High Range and Retarding	AASHTO M 194 (ASTM C 494)
Type S - Specific Performance	AASHTO M 194 (ASTM C 494)

Section 02050 - Curing Materials

Description

02050.00 Scope - This Section includes the requirements for liquid compounds, evaporation reducers, polyethylene films, and curing blankets used to cover concrete and other surfaces to retain moisture and to cure.

Materials

02050.10 Liquid Compounds - Furnish liquid membrane-forming curing compounds from the QPL and meeting the requirements of AASHTO ~~M 148~~C 309, except that testing will be done according to ODOT TM 721. The specified drying time requirement will be waived. The test application rate shall be 1 gallon per 200 square feet.

All compounds shall be class A. Solvent-based compounds shall be Type 1-D.

Before using liquid compounds, submit one quart samples of each lot for testing except samples are not required for commercial grade concrete applications unless the liquid compound is a conditionally approved product.

02050.20 Polyethylene Films - Furnish clear or white polyethylene films for curing concrete meeting the requirements of AASHTO M 171.

02050.30 Curing Blankets - Furnish curing blankets from the QPL.

02050.40 Liquid Evaporation Reducer Compounds - Furnish evaporation reducer compounds from the QPL.

Section 02060 - Concrete and Crack Sealers

Description

02060.00 Scope - This Section includes the requirements for ~~epoxy cement~~concrete and crack sealers.

Materials

02060.10 ~~Epoxy Cement~~Low Modulus Concrete and Crack Sealer - Furnish ~~epoxy cement~~low modulus concrete and crack sealer from the QPL.

02060.20 High Modulus Concrete and Crack Sealer - Furnish high modulus concrete and crack sealer from the QPL.

02060.30 Water Repellent Concrete Sealer - Furnish water repellent concrete sealer from the QPL.

Section 02070 - Bonding Agents

Description

02070.00 Scope - This Section includes the requirements for epoxy and non-epoxy bonding agents.

Materials

02070.10 Epoxy Bonding Agents - Furnish epoxy bonding agents from the QPL.

02070.20 Non-Epoxy Bonding Agents - Furnish non-epoxy bonding agents from the QPL.

Section 02080 - Grout

Description

02080.00 Scope - This Section includes the requirements for epoxy, non-epoxy, keyway, and portland cement grout.

Materials

02080.10 Epoxy Grout - Furnish epoxy grout from the QPL.

02080.20 Non-Epoxy Grout - Furnish non-epoxy grout from the QPL.

02080.30 Keyway Grout - Furnish grout used in the keyways of precast prestressed concrete members that is non-shrink, nonferrous, non-epoxy grout with a minimum design strength of 5,000 psi in 28 calendar days. Furnish keyway grout from the QPL and use according to the manufacturer's recommendations.

02080.40 Portland Cement Grout - Furnish portland cement grout consisting of one part portland cement and three parts sand by weight, thoroughly mixed with a minimum amount of water to produce a thick, creamy consistency. Sand shall meet the requirements of 02690.30 and cement shall meet the requirements of Section 02010.

02080.50 Tendon Grout - Furnish tendon grout from the QPL that meets vertical rise requirements.

Section 02090 - Lime

Description

02090.00 Scope - This Section includes the requirements for granular quicklime and hydrated lime.

Materials

02090.10 Granular Quicklime - Furnish granular quicklime (CaO) that has a minimum calcium hydroxide content of 113~~%~~ percent and meeting the following grading requirements:

Grading Requirements

Sieve Size	Percent Passing (by Weight)
3/8"	100
No. 100	25 maximum

Determine grading and hydroxide content by testing according to AASHTO T 27 and AASHTO T 219.

02090.20 Hydrated Lime - Furnish hydrated lime meeting the requirements of ASTM C 1097.

02090.30 Acceptance - Provide a quality compliance certificate for lime according to 00165.35.

Wood Products

Section 02110 - Posts, Blocks, and Braces

Description

02110.00 Scope - This Section includes the requirements for wood posts and blocks for guardrail, median barrier, signs, fence posts, and braces for fencing.

Materials

02110.10 Guardrail Posts:

(a) General - Furnish posts for guardrail and median barrier of the size shown, manufactured from Douglas fir, Hem-fir, or Southern Yellow Pine. Wood for posts shall have a minimum extreme fiber bending stress (F_b) of 1,200 psi. Only treated posts from approved suppliers that are listed in the "Nonfield-Tested Materials Acceptance Guide" will be allowed.

(b) Grading - Grading of posts shall conform to the following:

- **Douglas Fir** - Conform to the requirements for No. 1 posts and timbers as specified in either paragraph 80.11 of the current WWPA Grading Rules, or paragraph 131-b of the current WCLIB Grading Rules.

- **Hem-fir** - Conform to the requirements for select structural posts and timbers as specified in either paragraph 80.10 of the current WWPA Grading Rules, or paragraph 131-a of the current WCLIB Grading Rules.

- **Southern Yellow Pine** - Conform to the requirements for No. 1 timbers as specified in section 402 of the current Southern Pine Inspection Bureau (SPIB) Grading Rules.

(c) Certificates - Furnish certificates of lumber inspection by a recognized inspection agency.

(d) Fabrication - Before preservative treatment, bore all holes and make all necessary cuts as shown.

(e) Preservative Treatment - Treat posts according to Section 02190.

(f) Seasoning and Checking - Each preservative treated post shall show evidence of reasonable amount of seasoning and/or conditioning having occurred prior to treatment, so that further shrinkage of treated posts will not create checking which would expose untreated wood.

At the time of inspection at the plant and at the time of installation each treated post will be subject to inspection for evidence of seasoning having occurred. The presence of checking on the surface of the post will not be cause for rejection unless the width of the widest check, shake, or split exceeds 1/2 inch (surface measurement).

If an otherwise acceptable treated post has a through check, shake, or end split in the same slope of grain or plane as the bolt hole and extending from the top of the post to within 3 inches of the bolt hole, the post will be rejected unless it is provided with a tight fastening across the separation, centered on the post, and 2 inches below the top. Fasten with a 1/2 inch diameter galvanized bolt and nut with a galvanized washer under the bolt head and under the nut after final curing of post is achieved. Treat holes for fastenings according to 00570.40.

(g) Inspection, Rejection and Marking at Plant - Posts shall be subject to inspection at the treating plant at any time before, during or after treatment. Normally, inspection of treated posts will be made by the Agency's inspector not later than 10 calendar days after treatment, provided the inspector is notified of the time that treating is to be done.

Inspection of treated posts for compliance with the requirements of 02110.10(e) will be according to applicable AWPA standards, except as follows:

- The inspector will choose the number of treated posts from any one charge of the treating cylinder for determining penetration of treatment.
- Each post selected for testing shall be representative as a basis of acceptance or rejection of a pro rata number of posts in the charge.
- If 20~~%~~ percent of the posts randomly selected for testing fail to conform to requirements, all of the posts in the entire charge from which they are selected may be classed as unacceptable.

At the ~~inspector's~~inspector's discretion, each treated post or a representative random selection of treated posts may be inspected for compliance with the requirements of 02110.10(f) "Seasoning and Checking".

Posts which fail to conform to requirements of this subsection will be subject to rejection at the treating plant singly, by partial lots, or by whole lots. (A "lot" comprises the posts in any charge of the treating cylinder.)

Each treated post shall bear a permanent mark or metal tag which identifies the supplier and year of treatment, placed by the supplier either:

- On the top of the post, or
- On the back of the post, 8 inches to 10 inches below the bolt hole.

(h) Field Inspection, Acceptance and Rejection - At the time of installation inspect each post for:

- Width of widest check, shake, or split.
- Damage to treated wood affecting soundness.
- Visible exposure of untreated wood.
- Conformance to the requirements of 02110.10(b) through 02110.10(f).
- Preservative visibly leaching from the post.

Posts that show a check, shake, or split exceeding 1/2 inch in width (surface measurement) on any surface will be rejected.

Posts that show surface damage may be repaired by field treating with preservatives according to AWPA Standard M 4. Repair posts that have splits or checks, or where shakes have opened or deepened sufficiently to expose untreated wood, by treating with a field preservative from the QPL applied to all opened or deepened wood separations and completely filling the separations to the surface of the post.

Remove treated wood posts that have been rejected for any one or more of the above deficiencies or faults and not repaired as stated above.

Acceptance of material will be according to 00165.35, 02110.10(g), and these Specifications.

02110.20 Guardrail Blocks:

(a) General - Furnish wood guardrail blocks of the dimensions shown. Blocks shall be either Douglas fir or Hem-fir meeting the requirements of 02110.10, or pine or Southern Yellow Pine meeting the requirements of 02110.20(b) and 02110.10 except for 02110.10(b). The requirements of marking and branding the treated blocks, according to the last paragraph of 02110.10(g), will be waived provided that the supplier of the treated blocks furnishes certification with each shipment stating that the blocks conform to Specifications and that the preservative treating was done under the inspection and with the approval of the Engineer.

(b) Grading - Pine guardrail blocks shall conform to the requirements of paragraph 80.11 of the current WWPA Grading Rules. Southern Yellow Pine guardrail blocks shall conform to the requirements for No. 1 timber as specified in section 402 of the current SPIB Grading Rules.

(c) Recycled Plastic - Recycled plastic guardrail blocks from the QPL may be used.

(d) Acceptance - Acceptance of material will be according to 00165.35 and this Section.

02110.30 Fence Posts and Braces - Fence posts and brace rails shall be of the sizes and dimensions shown and shall be of sound Douglas fir, western hemlock, or western pine free from decay, end splits, and multiple crooks. Seasoning checks of not more than 5/16 inch width (surface measurement) will be allowed. Allowable crooks may be in one plane only. A line drawn between the centers of the butt and tip of each post and brace rail shall not fall outside of the actual longitudinal centerline of the post or rail by more than 1.67~~%~~ percent of its length, with an allowable maximum of 2 inches.

Posts and brace rails may be square, rough, or dressed lumber, or may be peeled round posts, as the Contractor elects. Round members shall be free from bark, protruding knots and irregularities detrimental to a pleasing appearance.

Fabricate posts and brace rails before pressure treatment. Where field boring or field cutting of a treated member is required, field-treat the exposed untreated surface of the member according to 00570.40. The size of holes after treatment shall not exceed the size of the dowels or bolts to be inserted by more than 1/16 inch.

Posts intended to be driven may be machine-pointed on either the small end or the large end, before pressure treatment.

Pressure treat the posts and brace rails according to Section 02190.

Acceptance of material will be according to 00165.35 and these Specifications.

02110.40 Wood Sign Posts - Fabricate wood sign posts from ~~either~~ Douglas fir, surfaced four sides (S4S) and free of heart center ~~(FOHC) or Hem-fir (S4S)~~ (FOHC).

(a) Grading - Grading requirements for wood sign posts shall conform to the applicable paragraphs of either the current WCLIB Grading Rules or the current WWPA Grading Rules, as follows:

Species	4" x 4"	4" x 6"	6" x 6" and Larger
Douglas Fir	~~124-c WCLIB 42.12 WWPA~~	~~123-c WCLIB 62.12 WWPA~~	~~131-b WCLIB 80.11 WWPA~~ No. 1 No. 1 No.1

~~Hem-Fir~~	124-b WCLIB 42.11 WWPA ~~80.10~~11 WWPA	123-b WCLIB 62.11 WWPA~~62.11 WWPA~~	131-~~a~~b WCLIB

(b) Posts - Construct wood sign posts according to the applicable portions of Section 00570, modified or supplemented as follows:

(1) Length - The length of the posts shall be shown or, where not shown, each post shall be of sufficient length to provide proper sign mounting, a proper mounting height and the required foundation depth.

(2) Framing and Boring - Cut, frame and bore timber before pressure treating, to the extent practical.

(3) Preservative Treatment - Pressure-treat wood sign posts after fabrication according to Section 02190.

(4) Cuts and Abrasions - Treat cuts, abrasions and bolt-holes, prior to shipping, with the same preservative as originally used to treat the post, except that if the post was originally treated with pentachlorophenol - volatile petroleum solvent (LPG) solution, cuts, abrasions and bolt-holes shall be treated with pentachlorophenol - mineral spirits solvent solution according to AWPA Standard M4.

(5) Field Repair - Field treat damaged or drilled pressure-treated posts according to 00570.40.

(c) Acceptance - Acceptance of material will be according to 00165.35 and this Section.

Section 02120 - Poles and Piling

Description

02120.00 Scope - This Section includes the requirements for wood poles for use in illumination and signal installations, and timber piling for structures.

Materials

02120.10 Wood Poles - Furnish all wood poles meeting the current edition of ANSI O5.1, Specifications and Dimensions (for Wood Poles), for Class 4 machine shaved Douglas fir, and treated meeting the requirements of Section 02190. All poles shall be round, sound, well proportioned from butt to tip, and without short kinks or crooks.

02120.20 Timber Piling - Furnish timber piling meeting the requirements of ASTM D 25.

The butt or tip size, or whether the piling are to be friction or bearing piles, will be identified in the Special Provisions. All foundation piles shall be Douglas fir.

Treat timber piling according to Section 02190.

02120.30 Timber Pile Straps - Straps shall be approximately 1 1/4 inch wide and 0.03 inch thick, manufactured from cold-rolled, heat-treated steel having a minimum ultimate tensile strength of 150,000 psi. The strap shall encircle the pile once and be fastened with a clip that is crimped so that the joint will have a minimum tensile strength of 80~~%~~ percent of the tensile strength of the strap. Install the strap after pressure treating of the pile.

02120.40 Acceptance - Acceptance of poles and piling will be according to 00165.35 and this Section.

Section 02130 - Timber and Lumber

Description

02130.00 Scope - This Section includes the requirements for timber and lumber.

Materials

02130.10 Timber and Lumber - Unless otherwise shown or specified, all lumber and timber shall be S4S Douglas fir. Grading requirements shall be according to the Special Provisions.

All lumber shall be grade-stamped or have a mill certification by an American Lumber Standards certified inspection agency.

02130.20 Acceptance - Acceptance of material will be according to 00165.35 and this Section.

Section 02140 - Glued Laminated Timber Members

Description

02140.00 Scope - This Section includes the requirements for glued laminated timber members.

Materials

02140.10 General - Furnish all structural glued laminated lumber as shown and specified.

Manufacture of structural glued laminated work shall conform to the manufacturing requirements of the current ANSI/AITC A190.1 American National Standard, Structural Glued Laminated Timber.

Provide quality control according to the AITC 200 "Inspection Manual for Glued Laminated Timber".

Lumber shall be Douglas fir, southern pine, western larch, or other species, as shown or specified. Lumber used shall be of a stress grade to provide glued laminated members with the minimum stress values in bending and tension shown or specified.

Adhesives shall meet the requirements of the glued laminated lumber standards, and be waterproof.

Unless otherwise specified, appearance of members shall be architectural grade as defined in AITC 110 Standard Appearance Grades for Structural Glued Laminated Timber.

Seal surfaces of members with penetrating sealer and apply a coat of end sealer to the ends of all members as soon as practical after end trimming, according to AITC Standard for Preservative Treatment of Structural Glued Laminated Timber. Use a clear sealer compatible with the preservative treatment used according to Section 02210.

Bundle wrap members according to AITC Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.

Furnish shop details from the fabricator and obtain approval before commencing the work. Details shall conform to the current AITC Typical Construction Details.

02140.20 Acceptance - Glued laminated timber members will be accepted according to 00165.35 and this Section.

Section 02150 - Lumber and Timber Connectors

Description

02150.00 Scope - This Section includes the requirements for connectors, bolts, nuts, nails, and miscellaneous hardware for joining lumber and timber.

Materials

02150.10 Lumber and Timber Connectors:

(a) General - Galvanize connectors for treated structures, except those of malleable iron or lightweight connectors, according to AASHTO M 111 (ASTM A 123).

(b) Split Ring Connectors - Provide 2 5/8 inch and 4 inch inside diameter split rings manufactured from steel conforming to ASTM A 830 (AISI C1010, SAE 1010). Each ring shall form a closed true circle with the principal axis of the cross section of the ring metal parallel to the geometric axis of the ring. Bevel the metal section from the central portion toward the edges to a thickness less than the mid-section. Cut through the ring in one place in its circumference to form a tongue and slot.

Cut connector grooves in timber concentric with the bolt hole and conforming to the cross-sectional shape of the rings, to provide a snug fit. The inside diameter of the groove shall be larger than nominal ring diameter so that the ring can expand slightly during installation.

(c) Shear Pate Connectors:

(1) Pressed Steel Type - Provide 2 5/8 inch diameter pressed steel shear plates manufactured from steel conforming to ASTM A 830 (AISI C1010, SAE 1010). Each plate shall be a true circle with a flange around the edge, extending from one face of the plate only and at right angles to the face. The plate portion shall have a central bolt hole and two small perforations on opposite sides of the hole and midway between the center and circumference.

(2) Malleable Iron Type - Provide 4 inch diameter malleable iron shear plates manufactured according to ASTM A 47, Grade No. 32510, for malleable iron castings. Each casting shall consist of a perforated round plate with a flange around the edge projecting from one face of the plate only and at right angles to the face. The plate portion shall have a central bolt hole reamed to size with an integral hub concentric with the bolt hole and extending from the same face as the flange.

(d) Bolts, Nuts, Nails, and Miscellaneous Hardware - Provide machine bolts, drift bolts and dowels according to ASTM A 307 or ASTM A 36. Washers may be cast ogee or malleable castings, or they may be cut from steel plate.

Galvanize rough hardware, drive pins, expansion bolts, clamps, washers, anchors, joist hangers, bolts and nuts, lag screws, wood screws, spikes and nails according to AASHTO M 232 (ASTM A 153). Provide these items in standard type and make, or as shown.

(e) Lightweight Metal Connectors - Lightweight metal connectors are mass produced plate or sheet steel connectors with a maximum thickness of 0.25 inches used to connect wood members to wood, concrete or masonry. Provide lightweight metal fasteners as shown with the required minimum capacities as stated in the ~~special provisions.~~Special Provisions. Provide copies of the test reports from the International Code Council (ICC-ES) showing that the supplied fastener meets the minimum capacities listed in the Special Provisions. All lightweight metal connectors shall be galvanized according to ASTM A 653 (coating designation G185), ASTM A 123, or stainless steel.

02150.20 Acceptance - Lumber and timber connectors will be accepted according to 00165.35 and this Section.

Section 02190 - Preservative Treatment of Timber

Description

02190.00 Scope - This Section includes the requirements for preservative treatment of lumber, timber, round timber piling, ~~guard rail~~guardrail posts and blocks, sign posts, fence posts, and other items as specified.

Materials

02190.10 General - All preservative treatment shall be according to AASHTO M 133 and its referenced AWPA Standards, except ~~that only~~use the following ~~preservatives are allowed~~according to the AWPA Standard:

- ~~Creosote~~
- ~~Pentachlorophenol (any solvent)~~
- ~~Ammoniacal Copper Zinc Arsenate (ACZA)~~
- ~~Chromated Copper Arsenate (CCA), Type A, B, or C~~
- ~~Copper Naphthenate~~
- ~~Ammoniacal Copper Quat, Type B, C, or D~~
- Category UC4C, Commodity Specification Section E for round timber piling in fresh water and on land.
- Category UC5A, Commodity Specification Section G for round timber piling exposed to salt or brackish water.
- Category UC4B, Commodity Specification Section A for fence and sign posts.
- Category UC4B, Commodity Specification Section A for guardrail posts and blocks.

02190.20 Drying Time - When using ACZA, air-dry items as defined in AWPA P5, a minimum of 30 calendar days before installation. Kiln drying for ~~two~~ 2 calendar days may be substituted for 30 calendar days of air-drying. During the period September 1 through May 31, the air-drying shall be under cover at the treatment facility. During the 30 calendar day drying period and until the treated items are installed on the Project, separate each layer of treated items using spacers that are at least 1/2 inch thick. The maximum moisture content shall be 19~~%~~ percent prior to installation. Collect all spacers and other treated wood waste from the construction site and dispose of them according to 00290.20.

02190.30 Field Treatment - Field-treat damaged or drilled wood surfaces with a preservative listed in the QPL.

Coatings

Section 02210 - Coating Materials for Timber and Concrete

Description

02210.00 Scope - This Section includes the requirements for coating materials used on timber and concrete.

Materials

02210.10 General:

(a) Manufacturing - Furnish coating material meeting the following requirements:

- ~~Be prepared at the factory ready for application or mixing of multi-component coatings.~~ All coats in the coating system shall be from the same manufacturer.
- Multi-component coating materials shall be proportioned by the manufacturer with each component in its correct proportion and furnished in separate containers ready for field mixing.
- Be homogeneous, free of contamination, and of a consistency suitable for the specified use.
- ~~Include additives for control of sagging, pigment settling, leveling, drying, dryer absorption, skinning, or other properties that affect application and curing.~~
- ~~Not require a pretreatment chemical or material prior to application of the prime coat except as specifically stipulated in these specifications.~~
- ~~Include required tinting and coloring materials at the time of manufacture. When successive coats are specified, each coat shall be tinted to provide contrast between coats. The tinting material shall be compatible with the coating material and not detrimental to performance.~~
- Not vary in composition without prior notice by the manufacturer and approval of the Engineer. ~~No reformulation will be allowed.~~

- ~~All coats in~~The coating material is not reformulated.

Use the coating ~~system shall be from the same manufacturer.~~

~~Apply coating materials~~material before expiration of the manufacturer's recommended shelf life.

(b) Packaging - Package the material in containers meeting the following requirements:

- Be new steel or plastic of not more than 6 gallon capacity.
- ~~Have a lug type crimp lid with a ring seal, and shall be equipped with ears and bails.~~
- Meet U.S. Department of Transportation's Hazardous Material Shipping Regulations.
- ~~Be lined, if necessary, to prevent attack by the coating material. The lining shall not come off the container.~~
- Be original and unopened.
- Be labeled with ~~a quality compliance certificate according to 00165.35 showing~~ the following:
  - Manufacturer's name
  - Exact title of coating material
  - ~~Agency Specification number, if any~~

- Manufacturer's batch number
- Date of manufacture

- ~~Shelf life or expiration date~~
- ~~Identification of all toxic substances~~
- ~~Handling and application precautions~~

02210.20 Coating Materials for Timber - Furnish coatings for timber from the QPL under the category "Timber Coatings".

02210.21 Sealer for Timber - Furnish clear sealers for timber from the QPL under the category "Timber Sealers".

02210.30 Coating Materials for Concrete - Furnish coatings for concrete from the QPL under the category "Latex Emulsion Paint".

Geosynthetics and Slope Protection

Section 02320 - Geosynthetics

Description

02320.00 Scope - This Section includes the requirements for geosynthetics used in various applications.

02320.01 Definitions - Geosynthetic terms are defined in 00350.01.

Materials

02320.10 Acceptance:

(a) General Requirements - Furnish all geosynthetics meeting the following requirements:

- Free of defects, cuts or tears.
- Resistant to ambient temperatures, acid and alkaline conditions, micro-organisms and insects.
- For the intended purpose and have dimensional stability.

(1) Geotextiles - Furnish woven or nonwoven geotextiles meeting the following requirements:

- Be composed of long chain, synthetic polymeric filaments or yarns formed into a stable network that retains its relative structure during handling, placement and design service life. At least 95~~%,~~ percent, by weight, of the long chain polymers shall be a polyolefin or polyester.
- Meet or exceed the properties specified in 02320.20~~, Table 02320-1~~.
- Be free of any chemical treatment or coating which might significantly reduce permeability.
- Have the selvage finished so the outer fibers are prevented from pulling away from the fabric.

(2) Geogrids - Furnish geogrids meeting the following requirements:

- ~~A regular network of integrally connected, polymer, tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock.~~
- ~~Dimensionally stable and able to retain their geometry under manufacture, transport and installation.~~
- Geogrid reinforcements approved as Type 1 MSEW Geogrid on the QPL.
- Geogrid for subgrade reinforcement approved as Subgrade Reinforcement Geogrid on the QPL.

(b) Acceptance Requirements - The actual minimum average roll values furnished by the manufacturer shall be based on representative test results from the manufacturing plant which produced the geosynthetic, and shall meet or exceed each of the specified minimum values. All geosynthetics shall be clearly labeled as being part of the same production run certified as meeting all applicable requirements.

(c) ~~**Manufacturer's**~~**Manufacturer's Documentation** - Furnish a Level A or Level B certification, as indicated in the Special Provisions for the applicable geosynthetics.

(1) Level A - ~~**Manufacturer's**~~**Manufacturer's Test** ~~**Result Certificate**~~ **Certification** - Furnish a test result certificate according to 00165.35 from the geosynthetic manufacturer~~. The certificate shall:~~

~~Include~~ and the ~~minimum~~following:

a. Geotextiles - For geotextiles, include the following:

- Minimum average roll values and average roll values for each of the specified properties from the same production run as the delivered material.
- ~~Include test~~Test results for factory seams.
- ~~Include production~~Production run number, production plant name and location.

If the ~~geosynthetic~~geotextile material is modified, remanufactured, relabeled or sewn, furnish an additional certificate from the supplier making the changes that explain the altered properties, seam strength or relabeling.

b. Geogrids - For mechanically stabilized earth retaining wall geogrid, include the following:

- Minimum average roll values and average roll values for each of the specified properties from the same production run as the delivered material.
- Production run number, production plant name, and location.
- Manufacturer's name and address.
- Full product name and information.
- QPL Product Category and the Standard Specification subsection number.
- Retaining wall location referencing the drawing name, detail, and structure number.
- Polymer types for geogrid and coating, if present.
- Primary resin type, class, grade, and category for HDPE (ASTM D 1248) and PP (ASTM D 4101).

For subgrade reinforcement geogrid, include the following:

- Minimum average roll values and average roll values for each of the specified properties from the same production run as the delivered material.
- Production run number, production plant name and location.

(2) Level B - ~~**Manufacturer's**~~**Manufacturer's Quality Compliance Certificate** - As a basis of acceptance, furnish either a ~~manufacturer's~~manufacturer's brochure or a quality compliance certificate, according to 00165.35, with geosynthetic properties shown.

If the brochure or certificate lists typical or average roll values instead of minimum average roll values, then increase by 25~~%~~ percent the specified minimum values in ~~Table~~ 02320~~-1~~.20 for grab tensile strength, burst strength and puncture strength to determine compliance.

(d) ~~**Manufacturer's**~~**Manufacturer's** **Sampling/Testing** - The ~~manufacturer's~~manufacturer's reported property values shall be based on the following sampling and testing requirements:

(1) Sampling - Sample all geosynthetics according to ASTM D 4354. The production unit used for sampling shall be a roll or sheet.

(2) Geotextile Testing - Perform the specified tests to determine geotextile properties for the intended ~~application(s).~~applications. The tensile strength requirements shall be tested in both machine and cross-machine directions.

(3) Geogrid Testing - For mechanically stabilized earth retaining wall geogrid, provide laboratory test results that demonstrate the average roll value for each geogrid product is greater than or equal to the geogrid ultimate wide width tensile strength reported for the initial geogrid product evaluation and approval on the QPL. Determine the ultimate wide width tensile strength (T_{ult}) according to ASTM D 6637. If the average roll value for each geogrid reinforcement product is less than the geogrid ultimate wide width tensile strength identified on the QPL, the entire production run will be rejected.

(e) Agency Check Tests - The Agency reserves the right to sample and test products for compliance with pertinent requirements, according to 00165.02.

When the Agency performs check tests, the entire production run will be accepted or rejected according to 00150.25, if any of the average roll values of tested rolls are less than the specified minimum values.

02320.11 Seam Testing and Acceptance:

(a) Factory Seams - Where factory seams are made, the sheets of geotextile shall:

- Be sewn together using a lock type stitch Type 301 or 401 as shown.
- Be sewn with polymeric thread that is at least 95~~%,~~ percent, by weight, polyolefin or polyester, and as resistant to deterioration as the geotextile being sewn.
- Have test results showing that the seams meet or exceed 90~~%~~ percent of the specified tensile strength minimum values for the intended application.
- Nylon thread will not be allowed.

(b) Field Seams - Where field sewn seams will be used, furnish:

- The ~~manufacturer's~~manufacturer's test result certificate, according to 00165.35, that includes wide strip, tensile strength test results and verifies that seam tensile strength and seam grab tensile strength meet or exceed 90~~%~~ percent of the minimum specified tensile strength values for the geotextile.
- A field-stitched seam test sample.

02320.20 Geotextile Property Values:

~~Table 02320-1 Geotextile Property Values~~

~~Drainage[1]~~ Geotextile Property	~~Riprap[1] Geotextile~~ ASTM Test Method	~~Sediment Fence Geotextile~~ Unit		~~Filtration Subgrade~~ Geotextile Property Requirements		
				Type 1		Type 2
				Woven	Nonwoven	
	~~ASTM~~ D 4632	lb	~~80 80~~	~~180~~ 180	~~200 200~~115	
	~~ASTM~~ D 4632	%		~~15~~< 50	~~15~~≥ 50	~~—~~< 50
	~~ASTM~~ D ~~3786~~ 4533	~~psi~~lb		~~130~~67	~~290~~40	
	~~ASTM~~ D ~~4833~~ 6241	lb		~~35~~370	~~80~~220	
~~7.34~~	~~ASTM~~ D 4751 ~~(CW-02215 Corps of Engineers)~~	~~in~~ —		~~No. 70~~40	~~No. 70~~40	
	~~ASTM~~ D 4491	~~s~~sec^{-1}		0.5	0.5	
	~~ASTM~~ D 4355 ~~At~~(at 500 hours)	%		~~—~~50	~~70~~50	~~70~~
~~Asphalt retention (minimum)~~	~~ODOT TM 817~~					
~~Melting point (minimum)~~	~~ASTM D 276~~					

racter) are not acceptable.

Table 02320-2 Geotextile Property Values for Riprap Geotextile *

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements			
			Type 1		Type 2	
			Woven	Nonwoven	Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	250	160	315	200
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	90	56	110	80
Puncture Strength (minimum)	D 6241	lb	495	310	620	430

Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	40	40	40	40
Permittivity (minimum)	D 4491	sec^{-1}	0.5	0.5	0.5	0.5
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70	70
* Woven slit film geotextiles (geotextiles that are made from yarns of a flat, tape-like character) are not acceptable.						

Table 02320-3 Geotextile Property Values for Sediment Fence

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements		
			Supported	Unsupported	
			—	Elongation * ≥ 50%	Elongation * ≤ 50%
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	90 90	120 100	120 100
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70
* Measured according to ASTM D 4632.					

Table 02320-4 Geotextile Property Values for Subgrade Geotextile (Separation)

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements	
			Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	180	113
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	68	41
Puncture Strength (minimum)	D 6241	lb	371	223
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50

Table 02320-5 Geotextile Property Values for Embankment Geotextile

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements	
			Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	315	200
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	110	80
Puncture Strength (minimum)	D 6241	lb	620	430
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.02	0.02
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50

Table 02320-6 Geotextile Property Values for Pavement Overlay Geotextile

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements
			Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	100
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	≥ 50
Asphalt Retention (minimum)	D 6140	oz./sq.ft.	2.8
Melting Point (minimum)	D 276	°F	300

Section 02340 - Rock Gabion Baskets

Description

02340.00 Scope - This Section includes the requirements for rock gabion baskets of twisted or welded wire mesh.

Materials

02340.10 General - Provide wire mesh material free of breaks in the wire, breaks at weld points or other deficiencies. Individual wires of either style mesh shall meet the following minimum requirements:

Galvanizing ..... 0.80 oz. per sq. ft. minimum
Tensile strength [1]*.....60,000 psi minimum
Wire diameter tolerance limit ..... ± 0.004"

[1]* Tensile area includes galvanizing

Welded wire shall also conform to AASHTO M 55 (ASTM A 185) except that the weld shears shall be 600 pounds for 11 gauge, and 800 pounds for 9 gauge wires. All wire sizes are after galvanizing.

Tie wires and internal connecting wires shall be galvanized and no smaller than 13 1/2 gauge. Spiral binders may be used as an alternate to tie wire for basket assembly and basket-to-basket connections. Spiral binders shall be 9 gauge, galvanized, and have a 3 inch pitch. High tensile fasteners of the locking spring steel clip or clamp-on ring type may be used as alternates to tie wire for basket assembly only. High tensile fasteners shall be fabricated from 11 gauge steel wire with a minimum tensile strength of 240,000 psi. Provide a Class 3 zinc coating according to ASTM A 764. High tensile fasteners shall provide a closed position tensile strength of 600 pounds.

All wire shall be galvanized according to ASTM A 641.

02340.12 Twisted Wire Mesh Gabion Baskets - Furnish gabion panels of the twisted mesh style manufactured from 11 gauge with 9 gauge selvage wires. The mesh shall form a uniform hexagonal pattern and shall be formed with a non-raveling twist. The major axis (maximum line dimensions) of any hexagonal opening shall not exceed 4.75 inches. The area of the hexagonal opening, approximately 3.2 inches by 4.5 inches, shall not exceed 9.5 square inches.

02340.20 Welded Wire Mesh Gabion Baskets - Furnish gabion panels of the welded mesh style manufactured from 11 gauge or 9 gauge wire. The mesh shall form a nominal 3 inch by 3 inch grid pattern and conform to AASHTO M 55 (ASTM A 185). The maximum line dimension of any opening shall not exceed 4.75 inches. The 12 inch and 18 inch high mattresses shall be made from 11 gauge panels. Gabions of square cross section (cubical-celled units) may be made with either 9 gauge or 11 gauge panels, except that within the same unit, panels of dissimilar wire sizes may not be mixed.

Galvanized 9 gauge stiffeners, placed diagonally in the baskets at the vertical one-third points, as shown on the plans or as recommended by the manufacturer, may be used instead of perpendicular cross ties.

02340.30 PVC Coated Wire Mesh Gabion Baskets - The wire type used for PVC coated wire mesh gabions shall be either twisted wire mesh or welded wire mesh and shall conform to 02340.00 and 02340.12 or 02340.20.

The PVC coating for twisted wire mesh gabions shall be extruded onto the wire core before weaving the coated wire into a double twisted hexagonal mesh. The use and minimum diameter of the various wires is as follows:

- Gabion Panel wire core shall be manufactured from galvanized 12 gauge wire core. The overall minimum diameter of the galvanized wire core plus PVC coating shall be 0.136 inch.
- Selvage and reinforcing wire shall be of heavily galvanized 10 gauge wire core coated with PVC and having an overall minimum diameter (galvanized wire core plus PVC coating) of 0.165 inch.
- Lacing and connecting wire shall be of heavily galvanized 13 1/2 gauge wire core coated with PVC and having an overall minimum diameter (galvanized wire core plus PVC coating) of 0.120 inch.

02340.40 Fabrication - Fabricate gabions so that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the specified sizes. Dimensions for heights, lengths and widths of gabion baskets shall be as indicated on the plans with a tolerance of plus or minus 3~~%.~~ percent. Gabions shall be of single unit construction. Either connect the base, lid, ends and sides into a single unit or connect one edge of these members to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

If the length of the gabion exceeds its horizontal width, equally divide the gabion by diaphragms into cells whose length does not exceed the horizontal width. The diaphragm material shall be of the same mesh and size as the body of the gabions. Furnish the gabion with the necessary diaphragms secured in proper position on the base in such manner that no additional tying at this juncture will be necessary.

Assemble the wire mesh panels (base, ends, sides, diaphragms and lid) so strength and flexibility at connections is at least equal to that of a single panel.

02340.50 Acceptance - Provide a quality compliance certificate for gabion baskets according to 00165.35.

Section 02350 - Metal Bin Retaining Walls

Description

02350.00 Scope - This Section includes the requirements for galvanized steel sheets and hardware for the assembly of metal bin retaining walls.

Materials

02350.10 Base Metal, Galvanizing, and Thickness - Design all members, fittings and appurtenances as integral units or parts of the whole assembly. The galvanized sheets used in fabricating the members shall conform to the requirements of AASHTO M 218. Bolts, nuts and miscellaneous hardware shall be galvanized or otherwise protected with approved coatings and shall be of sizes and shapes suitable for use with the members furnished.

Fabricate the members from the specified base metal of the thickness shown. In the absence of given thickness or dimensions for any member, fitting or appurtenance, the thickness of metal or dimensions of the member shall be as required to fully develop the strength of the members whose thickness and dimensions are given, and which are used in structural combination.

02350.20 Fabrication - Fabricate all members so members of the same nominal size are fully interchangeable. Fabricate and punch the members so no drilling, punching or drifting to correct defects in manufacture will be required during field assembly. Any members having improperly punched holes will be rejected. Replace with a member with properly punched holes.

Drainage and Water Distribution Materials

Section 02410 - Concrete ~~and Plastic~~ Pipe

Description

02410.00 Scope - This Section includes the requirements for nonreinforced and reinforced concrete pipe~~,~~ and concrete drain pipe and tile~~, polyethylene pipe, and polyvinyl chloride (PVC) pipe~~.

Materials

02410.10 Concrete Pipe - Furnish concrete pipe meeting the following requirements:

(a) End Designs - Where rubber gasket joints are used, modify the design of the ends of the pipe sections according to AASHTO M 198 to accommodate rubber gaskets.

(b) Sloped or Skewed Ends - If the ends of pipe require sloped ends, skewed ends or both, fabricate the ends in a manner that provides good workmanship and a smooth finish, and protection to otherwise exposed reinforcement where applicable.

(c) Markings - Indent the markings required by AASHTO M 86 (ASTM C 14) in the outside surface of each section of pipe.

(d) Concrete Pipe Field Permeability Tests - The Engineer may require field permeability tests on a maximum of 5~~%~~ percent of each lot, class, or size of pipe according to ASTM C 497 on pipe 24 inches in diameter and smaller.

Provide all the necessary labor, equipment, water and materials at the site for performing field permeability tests.

At the option of the pipe supplier, and with the approval of the Engineer, individual field permeability tests may be performed at the point of manufacture.

(e) Concrete Pipe Plant Air Test - The Engineer may require that each length of concrete pipe 12 inches in diameter and smaller be given an individual air test at the point of manufacture. Use test equipment approved by the Engineer and a test pressure of at least of 10 psi. Each length shall show no appreciable loss of air after ~~five~~ 5 seconds.

When individual air testing is performed, no field or shop permeability tests will be required.

(f) Nonreinforced Concrete Pipe - Provide nonreinforced or plain circular concrete pipe and special sections conforming to the requirements of AASHTO M 86 (ASTM C 14) or ASTM C 985 and this Section.

(g) Reinforced Concrete Pipe - Provide reinforced concrete pipe and special sections conforming to the requirements of AASHTO M 170 (ASTM C 76) and this Section, except as follows.

(1) Special Sections - Furnish special sections such as elbows, wyes, tees, crosses, bends and reducers as shown, specified or directed. In the absence of any design or specifications, the special sections shall be of the design recommended by the manufacturer for the intended use. Generally the special sections shall conform to the requirements specified for the pipe with which it is to be used.

Fabricate special sections with components from tested and approved lots. Maintain production dates of components.

(2) Load Strength - Reinforced concrete pipe having the same D-load strengths as those specified to be furnished under AASHTO M 170 (ASTM C 76) may be furnished according to AASHTO M 242 (ASTM C 655).

(3) Acceptance - The basis of acceptance for reinforced concrete pipe manufactured according to AASHTO M 170 (ASTM C 76), and AASHTO M 242 (ASTM C 655) will be Paragraph 5.1.1 of AASHTO M 170.

(h) Concrete Drain Pipe - Use circular, nonreinforced perforated concrete pipe and special sections for subsurface drainage conforming to the requirements of AASHTO M 175 (ASTM C 444), Type 1, all applicable requirements of AASHTO M 86 (ASTM C 14), except indent the markings required by AASHTO M 86 (ASTM C 14) in the outside surface of each section of pipe.

(i) Concrete Drain Tile - Provide concrete drain tile conforming to the requirements of AASHTO M 178 (ASTM C 412).

02410.~~60~~ 80 Acceptance - Except as provided in 02410.10(g-3), acceptance of nonreinforced concrete pipe, reinforced concrete pipe, concrete drain pipe, concrete drain tile, and hardware will be according to 00165.35 and this Section.

Section 02415 - Plastic Pipe

Description

02415.00 Scope - This Section includes the requirements for polyethylene pipe, polypropylene pipe and polyvinyl chloride pipe.

02415.01 Definitions:

Corrugated Polyethylene Pipe - Pipe that is extruded to form a smooth inner wall and a corrugated external wall. The corrugations are hollow.

Polyethylene Pipe - Pipe using high density polyethylene (HDPE) resins are included in three specific sub-categories; corrugated, solid wall, and steel reinforced.

Solid Wall Polyethylene Pipe - Pipe that is extruded to form a solid pipe wall. The joint may be either butt fused or bell and spigot.

Steel Reinforced Polyethylene Pipe - Pipe that is extruded to form a smooth inner wall and a corrugated external wall. The corrugations are solid and contain a continuous steel reinforcement band.

Materials

02415.10 Corrugated Polyethylene Pipe - Furnish corrugated polyethylene pipe meeting the following requirements and listed in the QPL:

Corrugated polyethylene drain pipe..... AASHTO M 252
Corrugated polyethylene culvert pipe..... AASHTO M 294, Type S or D
Corrugated polyethylene storm sewer pipe ..... AASHTO M 294, Type S or D

The allowable nominal inside diameter of corrugated polyethylene pipe is as follows:

Corrugated polyethylene drain pipe..... Up to 10"
Corrugated polyethylene culvert pipe ..... 12" ~~-~~ 60"
Corrugated polyethylene storm sewer pipe ..... 12" - 60"

~~Watertight~~Furnish watertight joints for corrugated polyethylene pipe ~~shall meet~~meeting the requirements of ASTM D 3212 and ~~shall~~ be listed in the QPL.

~~**02410.65**~~**02415.20 Solid Wall ~~High Density~~ Polyethylene ~~(HDPE)~~ Pipe** - Furnish ~~pipe resin~~solid wall polyethylene pipe and fittings from the QPL or that meet the following requirements:

- Resin that has a hydrostatic design basis (HDB) of 1,600 psi when tested and analyzed according to ASTM D 2837~~,~~ and has a material designation code of ~~3408~~PE3608 or PE4710 as listed by the Plastic Pipe Institute. ~~The resin shall meet~~
- Resin meeting the requirements of ASTM D 3350 and ~~have~~has a minimum cell classification of ~~PE345444C~~PE345464C (Code D or E may also be used for pipe bursting and lining pipe and for slip lining pipe).
- ~~The polyethylene composition for code C classification shall contain a minimum of 2% and not more than 3% by weight of well-dispersed and finely divided carbon black when tested according to ASTM D 1603 and ASTM D 4218.~~ The pipe ~~shall~~does not contain ~~no~~ recycled compound except that generated in the manufacturer's own plant from resin of the same

specification from the same raw material pipe. ~~Pipe (~~Do not recycle pipe, excluding black colored pipe~~)~~, that is stored outside~~ shall not be recycled. Provide pipe~~.

- Pipe and fittings meeting the requirements of ASTM F 714 and ASTM D 3261 as modified for the specified material.

- ~~**02410.70 Polyvinyl Chloride (PVC)**~~With legible markings, by the pipe manufacturer, with the following information:
  - ASTM designation number
  - The letters PE followed by the material designation code
  - Nominal pipe size
  - Dimension ratio
  - Name and trademark of manufacturer
  - Production code from which the date and place of manufacture can be determined

02415.30 Steel Reinforced Polyethylene Pipe - Furnish ~~PVC~~steel reinforced polyethylene pipe meeting the following requirements and be listed on the QPL:

Steel reinforced polyethylene culvert pipe.....ASTM F 2562
Steel reinforced polyethylene storm sewer pipe.....ASTM F 2562

The allowable nominal inside diameter of steel reinforced polyethylene pipe is as follows:

Steel reinforced polyethylene culvert pipe..... 24" - 72"
Steel reinforced polyethylene storm sewer pipe..... 24" - 72"

Furnish steel reinforced polyethylene pipe joints and gaskets meeting the following requirements:

Bell and spigot couplings..... ASTM D 3212
Elastomeric gaskets .....ASTM F 447

For steel reinforced polyethylene pipe, provide either factory installed gaskets on the couplings or manufacturer installed gaskets on the pipes. Provide at least silt tight joints for culvert pipe and water tight joints for storm sewer pipe. Provide watertight joints meeting the requirements of ASTM D 3212 and be listed in the QPL.

02415.40 Polypropylene Pipe - Furnish polypropylene pipe and fittings meeting the following requirements and listed in the QPL:

Dual wall polypropylene pipe and fittings .....ASTM F 2736
Triple wall polypropylene pipe and fittings.....ASTM F 2764
Watertight joints ..... ASTM D 3212

The allowable nominal inside diameter of polypropylene pipe is as follows:

Dual wall polypropylene pipe..... 12" - 30"
Triple wall polypropylene pipe..... 30" - 60"

02415.50 Polyvinyl Chloride Pipe - Furnish polyvinyl chloride pipe (PVC) subsurface drain pipe and fittings meeting the requirements of ASTM D 2729.

Furnish PVC sanitary, storm, culvert, siphon, and irrigation pipe and fittings with 2 feet or more cover that have a minimum pipe stiffness of 46 psi or a minimum SDR of 35 and meet the requirements of sewer pipe ASTM D 3034, ASTM F 679, or ASTM F 794.

Furnish PVC sanitary, storm, culvert, siphon, and irrigation pipe and fittings with less than 2 feet but at least 1 foot cover meeting the requirements of AWWA C 900 or AWWA C 905.

~~02410~~02415.80 Acceptance - ~~Except as provided in 02410.10(g-3), acceptance~~Acceptance of ~~nonreinforced concrete pipe, reinforced concrete pipe, concrete drain pipe, concrete drain tile,~~ polyethylene pipe, polypropylene pipe, polyvinyl chloride pipe~~,~~ and hardware will be according to 00165.35 and this Section.

Section 02420 - Metal Pipe

Description

02420.00 Scope - This Section includes the requirements for corrugated steel pipe, helical rib pipe, arch type pipe, aluminum pipe, ductile iron pipe, and special sections intended for use for storm drainage, underdrains and culverts, and not intended for the conveyance of sanitary or industrial waste.

Materials

02420.10 Corrugated Steel Pipe and Pipe Arches - Furnish corrugated steel pipe, helical rib pipe, pipe arches and special sections meeting the requirements of AASHTO M 36 (ASTM A 760) Types I, IA, and II, except as follows:

(a) Shapes - Provide either full-circle or elliptical pipe, as the Contractor may elect, unless otherwise shown or specified. The shapes of pipe fabricated and furnished may include any of the following:

- **Full-Circle Pipe** - Fabricate helical rib pipe in full-circle cross section only.
- **Arch-Type Pipe**
- **Elliptical Pipe** - Full-circle pipe distorted 5~~%~~ percent out-of-round by shop fabrication to form an elliptical cross section with the major axis vertical.
- **Half-Circle Pipe** - Fabricate as half sections of full-circle pipe of the same diameter.
- **Nestable Pipe** - Fabricate in two separate half sections designed to fit and fasten together to form a full-circle cross section of specified diameter. Fasten the two half sections together by approved means which shall provide at least 90~~%~~ percent of the strength of a standard riveted longitudinal seam.

(b) Connecting Bands - Use connecting bands conforming to the details shown on the plans to make field joints for pipes and pipe arches not requiring watertight joints.

(c) Special Sections - Furnish special sections such as elbows, wyes, tees, crosses, bends, reducers and flared inlets as shown or as directed.

Generally, special sections shall conform to the requirements specified for the pipe with which they are used, and shall be connected to the pipe or to each other with connecting bands specified for use with the pipe to which they are connected.

For elbows of 30° or greater total angle, use three-piece sections of approximately equal length and equal-angle segments or pieces.

Weld joints according to recognized standard practice and repair any damaged zinc or aluminum coating according to 02420.10(d).

(d) Repair of Damaged Coating - In addition to the methods given in AASHTO M 36 (ASTM A 760) the Contractor may repair damaged zinc or aluminum coating by removing all loose or cracked coating, removing all welding flux, wire brushing the damaged area, and applying two coats (minimum 2 mils total thickness) of a high zinc dust content paint conforming to the general requirements of ASTM A 780.

Damaged zinc or aluminum coating within 3/8 inch of the ends of pipe sections caused by production cut-off of pipe need not be repaired. Coating damage on edges of connecting bands need not be repaired.

(e) Irrigation Pipe - In irrigation pipe installations, where Type D coating (AASHTO M 190) is not specified, the Contractor will be allowed to furnish pipe with Type D coating.

(1) Riveted Seams - If pipes are not furnished with Type D coating, do the following:

- Place a bead or strip of approved caulking compound, 1/8 inch minimum diameter or thickness, between the laps of all riveted seams.
- Rivet the annular seams of riveted pipe at spacings not greater than 3 inches. Rivet in a single row the longitudinal seams of pipes less than 42 inches in diameter. Place one rivet in each valley and one on each crest of the corrugations.
- Double rivet the longitudinal seams of pipes 42 inches and larger in diameter in each valley of the corrugations and place a single rivet on each crest of the corrugations.
- At the intersection of longitudinal and circumferential seams, close the gap caused by the three-sheet lap by special fabrication. Fabricate a special longitudinal seam at the ends of pipe sections for a sufficient distance to clear the coupling bands.

Spot welding of the seams of corrugated metal pipe used in irrigation pipe installations will not be allowed.

(2) Field Joints - Use connecting bands conforming to the details shown, and make the field joints watertight.

(f) Siphon Pipe - Fabricate corrugated steel pipe used in siphons with watertight seams.

Field joints shall provide circumferential and longitudinal strength to preserve the pipe alignment, prevent separation of pipe sections and provide a watertight joint. Attach the connecting bands so they lap a nearly equal portion of each pipe section to be connected.

(g) Sloped or Skewed Ends - If the ends of pipe culverts require sloped ends, skewed ends or both, fabricate the ends in a manner that provides good workmanship and a smooth finish. Restore zinc or aluminum coating as directed according to 02420.10(d), and bituminous protective coatings and linings when specified.

02420.11 Ductile Iron - Furnish ductile iron pipe conforming to the requirements of AWWA ~~C150~~C151. Use Pressure Class 150 - 350 or Special Thickness Class 50 - 56, as directed.

02420.20 Protective Coatings - If specified or shown, furnish corrugated metal pipes with protective coatings as follows:

(a) Bituminous Protective Coatings - Provide corrugated metal pipe and connecting bands with bituminous coatings conforming to the requirements of AASHTO M 190 and the following:

- Before immersion, the metal shall be free of grease, dirt, dust, moisture or other contaminants.
- Apply the initial bituminous coating by one of the processes under 02420.20(a-1) or 02420.20(a-2).
- If a second dip is required to meet the coating thickness requirements of AASHTO M 190, the time and temperature requirements of 02420.20(a-1) or 02420.20(a-2) need not be followed for the second dip.

- The paved invert for both Type B and Type C coatings on either circular or arch type pipe shall fill the corrugations for at least 40~~%~~ percent of the circumference of the pipe.

(1) Pipe Not Preheated - The temperature of the asphalt at the time of pipe immersion shall be 400 °F ± 5 °F and the duration of the immersion shall conform to the following schedule:

Metal Thickness (Inch) Steel	Aluminum	Minimum Immersion Time (Minutes)
0.064	0.060	2.5
0.079	0.075	3.0
0.109	0.105	5.0
0.138	0.135	6.5
0.168	0.164	8.0

(2) Pipe Preheated - At the time of pipe immersion the asphalt shall have a temperature of 380 °F ± 5 °F and the pipe shall be preheated to a temperature 300 °F to 350 °F.

(b) Type D, Fully-Bituminous Coated, Fully-Lined - The interior lining shall be smooth, uniform and free from sags and runs. Slight residual corrugations due to cooling and shrinkage of the lining will not be cause for rejection. At the three-sheet lap an interior nonuniformity equal to the thickness of the sheet will be allowed. Maintain the thickness of the lining to the ends of the pipe.

(c) Optional Paved Invert - If an asphalt coated pipe with a paved invert (Type C coating) is shown or specified, a centrifugally-applied interior lining conforming to Type D coating may be furnished as an alternate, providing the minimum thickness of bituminous coating over the crests of the corrugations is not less than 1/4 inch.

(d) Polymeric Coatings - If polymeric coating is shown on the pipe data sheet, use a coating from section 02420.20 of the QPL.

02420.30 Corrugated Steel Pipe for Underdrains - Furnish corrugated steel pipe for underdrains conforming to the requirements of AASHTO M 36 (ASTM A 760) Type III - Underdrain Pipes, except as modified in 02420.10(c) and 02420.10(d), and as follows:

(a) Class IV - Semicircular pipe may be used only as an alternate with the 6 inch size of perforated full-circle drain pipe.

(b) Connecting Bands - Connecting bands for underdrain pipe field joints shall conform to the designs shown.

02420.40 Corrugated Aluminum Alloy Pipe - Furnish corrugated aluminum alloy pipe, helical rib pipe, pipe arches and special sections conforming to the requirements of AASHTO M 196 (ASTM B 745), Types I, II and III, except as follows:

(a) Shapes - The shapes of the pipes to be furnished may include any of the shapes described in 02420.10(a).

(b) Connecting Bands - Use connecting bands conforming to the requirements of AASHTO M 196 (ASTM B 745) and the details shown to make field joints for pipes and pipe arches not requiring watertight joints.

(c) Special Sections - Furnish special sections such as elbows, wyes, tees, crosses, bends, reducers and flared inlets as shown or as directed.

Generally, special sections shall conform to the requirements specified for the pipe with which they are used, and shall be connected to the pipe or to each other with connecting bands specified for use with the pipe to which they are connected.

For elbows of 30° or greater total angle, use a three-piece section of approximately equal length and equal-angle segments or pieces.

(d) Irrigation Pipe - In irrigation pipe installations where Type D coating is not shown or specified, the Contractor will be allowed to furnish pipe with Type D coating.

If pipes are not furnished with Type D coating, all riveted seams shall conform to the applicable provisions of 02420.10(e-1).

Use connecting bands conforming to AASHTO M 196 (ASTM B 745) and the details shown, and make the field joints watertight for pipe installations used in irrigation.

(e) Siphon Pipe - Fabricate corrugated aluminum alloy pipe used in siphons with watertight seams.

Field joints shall provide circumferential and longitudinal strength to preserve the pipe alignment, prevent separation of pipe sections and provide a watertight joint. Fabricate the connecting bands from aluminum alloy conforming to AASHTO M 196 (ASTM B 745). Attach the connecting bands so they lap a nearly equal portion of each pipe section to be connected.

(f) Sloped or Skewed Ends - If the ends of pipe culverts require sloped ends, skewed ends or both, fabricate the ends in a manner that provides good workmanship and a smooth finish. Repair bituminous protective coatings and linings when specified.

02420.50 Corrugated Aluminum Alloy Pipe for Underdrains - Furnish corrugated aluminum alloy pipe for underdrains conforming to the requirements of AASHTO M 196 (ASTM B 745) Type III, except as follows:

(a) Special Sections - The provisions of 02420.40(c) apply.

(b) Connecting Bands - Connecting bands for field joints shall conform to the requirements of AASHTO M 196 (ASTM B 745) and the details shown.

02420.60 Acceptance - Acceptance of pipes, underdrains, and protective coatings will be according to 00165.35 and this Section.

Section 02430 - Structural Plate Pipe

Description

02430.00 Scope - This Section includes the requirements for steel and aluminum alloy plates and hardware for structural plate pipe.

Materials

02430.10 Galvanized Steel Plates:

(a) General - Furnish galvanized steel plates for structural plate pipe conforming to the requirements of AASHTO M 167 (ASTM A 761).

(b) Plates for Pipe Arches - The top ~~plate(s)~~plates shall form an arc between 180 and 155 degrees. The bottom ~~plate(s)~~plates shall form an arc between 50 and 10 degrees. Join the top ~~plate(s)~~plates at each end to the bottom ~~plate(s)~~plates with corner plates to form an arc with a radius between 16 inches and 21 inches or between 29 inches and 34 inches, as applicable, and forming an arc between 87.5 and 75 degrees.

(c) Forming and Punching Plates - Form plates to provide lap joints. Punch the bolt holes so that all plates with the same dimensions, curvature, thickness, and number of bolts per foot of seam are interchangeable. Curve each plate to the proper radius so that the cross-sectional dimensions of the finished structure will be as shown or as specified.

~~Unless otherwise specified, fabricate~~Fabricate bolt holes ~~as follows:~~

- ~~Two rows along longitudinal seams.~~
- ~~Center~~ according to ~~center spacing not more than 10 inches along circumferential seams.~~
- ~~Center of hole to edge of the plate at least 1.75 times the diameter of the bolt.~~
- ~~Longitudinal seam bolt holes shall not exceed the diameter of the bolt by more than 1/8 inch.~~

~~The above provisions are for standard punching~~ AASHTO M 167. Provide additional bolt holes for special conditions of installation when specified or shown.

(d) Sloped and Skewed Ends - Cut plates for forming sloped ends, skewed ends or both, to give the angle of slope or skew shown. Burnt edges shall be free from oxide and burrs. Legibly identify each cut plate to designate its proper position in the finished structure.

02430.20 Aluminum Alloy Plates - Furnish aluminum alloy plates for structural plate pipe conforming to the requirements of AASHTO M 219 (ASTM B 746). Fabricate according to 02430.10(b) through 02430.10(d).

02430.90 Bolts, Nuts, and Washers - Furnish bolts, nuts, and washers for use with galvanized steel structural plate pipe conforming to the requirements of AASHTO M 167 (ASTM A 761) and galvanized according to AASHTO M 232 (ASTM A 153).

Furnish bolts, nuts, and washers for use with aluminum alloy structural plate pipe conforming to the requirements of AASHTO M 219 (ASTM B 746) and galvanized according to AASHTO M 232 (ASTM A 153).

02430.95 Acceptance - Acceptance of structural plate pipe and hardware will be according to 00165.35 and this Section.

Section 02440 - Joint Materials

Description

02440.00 Scope - This Section includes the requirements for joint fillers, seals, gaskets and water stop for concrete pipe joints, manhole section joints, bridge joints, and miscellaneous concrete applications.

Materials

02440.10 Preformed Joint Fillers for Concrete - Furnish preformed joint fillers for concrete from the QPL conforming to the requirements of AASHTO M 153 or AASHTO M 213. ~~Fillers conforming to AASHTO M 213, except the binder, if other than bituminous material, may be used provided they otherwise meet this Specification and they have been demonstrated to be rot and vermin proof for a period of at least five years. Unless otherwise specified or indicated, the Contractor may elect to furnish either type specified in this subsection.~~

02440.11 Poured Joint Sealant - Furnish a two-component, low modulus, rapid-cure joint sealant from the QPL.

02440.14 Backer Rod - Furnish a closed-cell, non-gassing foam material backer rod from the QPL.

02440.15 Lubricant/Adhesive - Furnish a lubricant/adhesive that is recommended by the seal manufacturer.

02440.19 Steel Bridging Plate - Furnish a hot-dip galvanized, conforming to AASHTO M 111 (ASTM A 123), merchant quality steel bridging plate with a minimum thickness of 1/4 inch and a width of 8 inches, cut in lengths of 4 feet or more. Drill spike holes at 12 inch centers along the centerline of the plate before galvanizing. Repair galvanization according to ASTM A 780.

02440.20 Preformed Joint Seals - Furnish compression joint seals conforming to the requirements of AASHTO M 297. Use strip seals conforming to ASTM D 5973.

02440.21 Elastomeric Concrete - Furnish elastomeric concrete from the QPL.

02440.30 Hot Poured Joint Filler - Furnish hot poured joint filler from the QPL and conforming to the requirements of AASHTO M 324, Type II (ASTM D 6690, Type II).

02440.40 Gaskets for Concrete Pipe and Precast Manhole Section Joints:

(a) Preformed Flexible Joint Sealant - Furnish materials for tongue and groove or key lock manhole joints conforming to the requirements of AASHTO M 198 (ASTM C 990).

(b) Rubber Gaskets - Furnish materials for O-ring manhole and concrete pipe joints conforming to AASHTO M 315 (ASTM C 443).

02440.50 Joint Materials for Concrete Precast Manhole Section Joints:

(a) Mortar - Furnish mortar conforming to the requirements of ASTM C 387, or proportioned one part Type II portland cement to two parts clean, well-graded sand passing a No. 6 screen. Admixtures may be used not exceeding the following percentages by weight of cement:

Hydrated lime 10%
Diatomaceous earth or other inert materials 5%

The consistency of the mortar shall be such that it will readily adhere to the precast concrete if using the standard tongue-and-groove type joint.

(b) Non-Epoxy (Non-Shrink) Grout - Furnish a non-epoxy (non-shrink) grout from the QPL. Place or pack non-shrink grouts only with the use of a non-epoxy bonding agent from the QPL, applied to all cured concrete surfaces being grouted. Use a bonding agent compatible with the grout used.

02440.60 Plastic Compound for Precast Manhole Section Joints - Furnish a plastic compound that is specifically manufactured for the intended use and:

- Has a putty-like, preformed homogeneous blend of hydrocarbon resins and rubber or plasticizing materials with not more than 50~~%~~ percent by weight of inert mineral filler.
- Is pliable at temperatures between 32 °F and 135 °F. A specimen at 77 °F and 1/2 inch square in cross section shall stretch at least 1 1/2 inches before rupture when tested with the apparatus described in ASTM D 113.
- Adheres firmly and cohesively to the precast manhole sections when the compound-sealed joint is flexed to its maximum extent.
- Includes a primer solution recommended by the compound manufacturer.
- Conforms with Federal Specification SS-S-00210 (GSA-FSS).

02440.70 Water Stop - Furnish either plastic or rubber water stop, as the Contractor elects, manufactured to the dimensions shown and meeting the following requirements:

(a) Plastic - Polyvinyl chloride water stop shall be manufactured from virgin polyvinyl chloride (PVC) compound. No reclaimed PVC will be allowed. The water stop shall have the following properties:

Test	ASTM Test Method	Specification (Minimum)
Tensile Strength, psi	D 412	1,800
Elongation, %	D 412	350
100% Modulus, psi	D 412	760
Low Brittle Temperature	D 746	- 50 °F
Cold Bend Test [1]		No Failures

[1] Samples maintained at -70 °F for ~~two~~ 2 hours, then bent quickly around a 1/4 inch mandrel to 180 degrees.

(b) Rubber - Manufacture rubber water stop to the dimensions shown, in such a manner that the finished product has an integral cross section which will be dense, homogeneous, and free from porosity and other imperfections. The water stop shall have the following properties:

- **Hardness** - The Shore A Durometer hardness of 60 to 70 when tested according to ASTM D 2240.
- **Elongation** - Minimum of 450~~%.~~ percent.
- **Tensile Strength** - Minimum of 3,000 psi.
- **Water Absorption** - Maximum of 5~~%~~ percent by weight after immersion in water for ~~two~~ 2 days at 158 °F.

- **Tensile Strength after Aging** - The test specimen, after accelerated aging of ~~seven~~ 7 days at 158 °F, shall retain not less than 80~~%~~ percent of the original tensile strength. The tensile strength of the test specimen, after accelerated aging of 48 hours in oxygen at 158 °F and tensile stress of 300 psi, shall be not less than 80~~%~~ percent of the original tensile strength.

- **Compression Set** - Not more than 30~~%~~ percent when tested according to ASTM D 395, method B after 22 hours at 158 °F.

- **Specific Gravity** - 1.17 ± 0.03.

- **Defects** - Minor surface defects such as surface peel covering less than 1 square inch, surface cavities or bumps less than 1/4 inch in longest lateral dimensions and less than 1/16 inch deep will be acceptable.

02440.80 Acceptance - Acceptance of joint materials will be according to 00165.35 and this Section.

Section 02450 - Manhole and Inlet Materials

Descriptions

02450.00 Scope - This Section includes the requirements for precast manhole sump sections, metal frames, covers, grates, and ladders.

Materials

02450.10 Precast Concrete Manhole Sections - Furnish precast risers, cones, and cover slabs for precast concrete manholes conforming to the requirements of AASHTO M 199 (ASTM C 478).

02450.20 Precast Concrete Sump Sections - Furnish precast rings and lids for precast concrete sumps of portland cement concrete conforming to AASHTO M 199 (ASTM C 478).

02450.30 Metal Frames, Covers, Grates, and Ladders - Comply with the following:

Projects on State Highways

Item	AASHTO (ASTM) Designation	Grade
Manhole frames and covers	M 306	Class 35 B
Inlet frames and grates	M 306	Class 35 B
	M 227 (A 663)	65
	M 270 (A 709) (A 36)	36
	M 103 (A 27)	65 - 35
Manhole ladder rails	M 270 (A 709) (A 36)	36
	M 227 (A 663)	65

All Other Projects

Item	AASHTO (ASTM) Designation	Grade
Manhole frames and covers	M 105	Class 30 B
Inlet frames and grates	M 227 (A 663)	65
	M 270 (A 709) (A 36)	36
	M 103 (A 27)	65 - 35
Manhole ladder rails	M 270 (A 709) (A 36)	36
	M 227 (A 663)	65

Fabricate steps for manholes and rungs for manhole ladders from structural steel having a minimum yield strength of 28,000 psi and galvanized according to AASHTO M 111 (ASTM A 123).

As an alternate, steps for manholes may be steel-reinforced plastic conforming to AASHTO M 199 (ASTM C 478) and AASHTO T 280 (ASTM C 497). The steel shall be deformed reinforcing bar conforming to AASHTO M 31 (ASTM A 615) Grade 60, No. 4 minimum. The plastic material surrounding the reinforcing steel bar shall be injection molded, with a textured, non-slip surface and a minimum thickness over the steel of 1/16 inch. Voids in the plastic will be cause for rejection of the step.

Welding shall conform to AWS D1.1. Frames, covers and grates for use one with another shall have even and uniform bearings. Miscellaneous metal items and hardware shall conform to the appropriate requirements of Section 00560.

02450.40 Damaged Zinc or Aluminum Coating - Repair damaged zinc or aluminum coating according to 02420.10(d).

02450.50 Acceptance - Acceptance of manholes and inlets will be according to 00165.35 and this Section.

Section 02470 - Potable Water Pipe Materials

Description

02470.00 Scope - This Section includes the requirements for ductile iron, steel, and polyvinyl chloride (PVC) pipe 16 inches in diameter and smaller, for potable water systems.

Materials

02470.10 General - Clearly mark all pipe with the type, class, thickness, and ~~manufacturer's~~manufacturer's name, as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage. All materials in contact with potable water shall conform to ANSI/NSF Standard 61, Drinking Water System Components - Health Effects, or equivalent.

02470.20 Ductile Iron Pipe:

(a) General - Use centrifugally cast ductile iron pipe meeting the requirements of AWWA C151. Ductile iron pipe shall have a cement-mortar lining and seal coating meeting the requirements of AWWA C104. Ductile iron pipe to be joined using bolted flanged joints shall be Standard Thickness Class 53. All other ductile iron pipe shall be Standard Thickness Class 50 or the thickness class specified or indicated.

(b) Nonrestrained Joints - Nonrestrained joints shall be rubber gasket, push-on type, or mechanical type meeting the requirements of AWWA C111. Restrained joints shall conform to 02475.50.

02470.30 Steel Pipe 6 Inches and Larger - Steel pipe 6 inches in diameter and larger shall conform to AWWA C200, and shall have a minimum working pressure rating of 150 psi, or as shown. The type of protective coating and lining and other supplementary information required by AWWA C200 shall be as specified or indicated.

02470.35 Steel Pipe Under 6 Inches - Steel pipe under 6 inches in diameter shall be hot-dip galvanized inside and out and meet the requirements of ASTM A 53. Steel pipe thickness shall be Schedule 40 or the thickness class specified or indicated.

02470.40 Polyvinyl Chloride (PVC) Pipe 4 Inches and Larger:

(a) PVC Pipe Smaller Than 14 inch Diameter - PVC pipe 4 inches in diameter up to but not including 14 inches in diameter shall meet the requirements of AWWA C900, have the same outside dimensions as ductile iron pipe, and have a minimum dimension ratio (DR) of 18 or as specified or indicated.

(b) Large Diameter ~~PCV~~PVC Pipe - PVC pipe 14 inches in diameter to 16 inches in diameter shall meet the requirements of AWWA C905, have the same outside dimensions as ductile iron pipe, and have a minimum dimension ratio (DR) of 18 or as specified or indicated.

(c) Joints - Joints shall meet the requirements of ASTM D 3139 using a restrained rubber gasket conforming to ASTM F 477. Solvent-welded pipe joints are not allowed.

02470.45 Polyvinyl Chloride (PVC) Pipe Under 4 Inches - Polyvinyl chloride (PVC) under 4 inches in diameter shall meet the requirements of ASTM D 2241. Pipe material shall be PVC 1120, PVC 1220, or PVC 2120, and shall have minimum wall thickness equal to or greater than a standard dimension ratio (SDR) of 21, or as specified or indicated. Joints shall meet the requirements of ASTM D 3139 using a restrained rubber gasket meeting the requirements of ASTM F 477. Solvent welded pipe joints will only be allowed when specified or indicated.

02470.50 Polyethylene Encasement - Polyethylene encasement shall conform to AWWA C105.

02470.60 Marking Tape and Wire:

(a) Marking Tape - Marking tape shall consist of inert polyethylene plastic impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The width of the tape shall be as recommended by the manufacturer for the depth of installation. The tape shall be blue and imprinted continuously over its entire length in permanent black ink with the words "Caution - Water".

(b) Detectable Marking Wire - Detectable marking wire shall be No. 12 AWG, minimum, solid copper with blue colored polyethylene insulation. Joints or splices in wire shall be waterproof.

02470.70 Acceptance - Ductile iron pipe, steel pipe and polyvinyl chloride (PVC) pipe will be accepted according to 00165.35 and this Section.

Section 02475 - Potable Water Fitting Materials

Description

02475.00 Scope - This Section includes the requirements for fittings, restrained joints, and couplings for ductile iron pipe, steel pipe and polyvinyl chloride (PVC) pipe for potable water systems.

Materials

02475.10 General - Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A 307 for carbon steel, or ASTM F 593 for stainless steel. Nuts shall meet the requirements of ASTM A 563 for carbon steel and ASTM F 594 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A 536, grade 65-45-12. Galvanize carbon steel bolts, nuts and washers according to 02560.40.

All materials in contact with potable water shall conform to ANSI/NSF Standard 61, Drinking Water System Components - Health Effects, or equivalent.

02475.20 Ductile Iron Pipe Fittings - Fittings for ductile iron pipe shall meet the requirements of AWWA C110 or AWWA C153, and shall have a minimum working pressure rating of 250 psi. Joints shall meet the requirements of AWWA C111. Fittings shall be cement mortar lined and seal coated, meeting the requirements of AWWA C104. Gaskets for flat faced or raised faced flanges shall be 1/8 inch thick neoprene having a Durometer reading of 60, $\pm$ 5. The type, material and identification mark for bolts and nuts shall be provided.

02475.30 Fittings for Steel Pipe 6 Inches and Larger - Fittings for steel pipe 6 inches in diameter and larger shall conform to AWWA C200, have a minimum working pressure rating of 150 psi or as specified or indicated, and shall receive a protective coating and lining to match the steel pipe provided. Field couplings shall be compression type. When flanges are required, they shall meet the requirements of AWWA C207, and gaskets shall conform to 02475.20.

02475.35 Fittings for Steel Pipe Under 6 Inches - Fittings for steel pipe under 6 inches in diameter shall be malleable iron threaded type with a pressure rating of 150 psi or as specified or indicated. Dimensions shall meet the requirements of ANSI B16.3. Threading shall meet the requirements of ANSI B2.1. Material shall meet the requirements of ASTM A 47, Grade 22010. Fittings shall be banded and hot-dip galvanized inside and out.

02475.40 Fittings for Polyvinyl Chloride ~~(PVC)~~ Pipe 4 Inches and Larger - Fittings for PVC pipe 4 inches in diameter and larger shall be the same as specified for ductile iron pipe.

02475.45 Fittings for Polyvinyl Chloride ~~(PVC)~~ Pipe Under 4 Inches - Fittings for PVC pipe under 4 inches in diameter shall meet the requirements of ASTM D 2466.

02475.50 Restrained Joints - Restrain pipe, fittings, and valves by using an approved bolted or boltless system. Design the restraint system to operate at a working pressure equal to the hydrostatic test pressure identified in 01140.51(a) or as shown. No device utilizing round point set screws will be allowed. Restraint systems provided for pipe bells shall be certified for use by the pipe manufacturer.

02475.60 Bolted, Sleeve-Type Couplings for Plain-End Pipe - Bolted, sleeve type couplings, reducing or transition couplings, and flanged coupling adapters used to join plain end pipe shall meet the requirements of AWWA C219. Buried couplings to connect ductile iron, gray cast iron or PVC pipe shall be ductile iron. Buried couplings for connecting steel pipe to steel pipe shall be steel, coated and lined to match the steel pipe provided.

02475.70 Acceptance - Acceptance of fittings, restrained joints and couplings will be according to 00165.35 and this Section.

Section 02480 - Potable Water Valve Materials

Description

02480.00 Scope - This Section includes the requirements for gate valves, butterfly valves, ball valves, power actuating devices, valve boxes, valve stem extensions, tapping sleeve and valve assemblies, check valves, hydraulically operated valves, combination air release/air vacuum valves, and backflow prevention devices for potable water systems.

Materials

02480.10 General - Provide valves with operating nuts, hand wheels or power-actuating devices as specified or indicated. Where operating nuts are called for, furnish a standard 2 inch operating nut. Valves shall be non-rising stem type, open counterclockwise, and be equipped with an O-ring stuffing box. All materials in contact with potable water shall conform to ANSI/NSF Standard 61, Drinking Water System Components - Health Effects, or equivalent. When indicated, coat all interior and exterior ferrous surfaces of valves with a protective epoxy coating meeting the requirements of AWWA C550.

02480.20 Gate Valves:

(a) Minimum Pressure - Gate valves shall meet the requirements of AWWA C500, AWWA C509, or AWWA C515. The minimum design working pressure shall be 200 psi for pipe 2 inches to 12 inches in diameter, and 150 psi for pipe 14 inches to 16 inches in diameter.

(b) Arrangement - For 16 inch diameter pipe, arrange gate valves for operation with gear case in the horizontal position. Equip valves with bypasses and gate valves of the sizes adopted in the AWWA Standards. Equip bypass gate valves with standard 2 inch operating nuts.

02480.22 Butterfly Valves:

(a) Seats and Seals - Butterfly valves shall be rubber seated and shall meet the requirements of AWWA C504, Class 150B. Shaft seals shall be standard O-ring seals, designed for replacement under line pressure.

(b) Valve Operators - Valve operators shall be of the traveling nut or worm gear type, sealed, gasketed and permanently lubricated for buried service. Construct valve operators to the standard of the valve manufacturer to withstand all anticipated operating torques, and design to resist submergence in ground water.

02480.23 Ball Valves:

(a) Seats and Seals - Ball valves shall be double seated, with rubber seat materials mating with metal seating surface, and shall meet the requirements of AWWA C507. The minimum design working pressure shall be 150 psi. Shaft seals shall be standard O-ring seals, designed for replacement under line pressure.

(b) Valve Operators - Valve operators shall be of the traveling nut or worm gear type, sealed, gasketed and permanently lubricated for buried service. Construct valve operators to the standard of the valve manufacturer to withstand all anticipated operating torques and designed to resist submergence in ground water.

02480.24 Power-Actuating Devices - Power-actuating devices for valves shall meet the requirements of AWWA C540. The type of power-actuating devices to be furnished and the operating requirements will be as indicated.

02480.25 Valve Boxes - Install valve boxes on all buried valves. Boxes shall be of cast iron, two-piece, slip type standard design with a base corresponding to the size of the valve. Boxes shall be coal-tar painted by the manufacturer using its standard. The cover shall have the word "WATER" cast in it.

02480.26 Valve Stem Extensions - Valve stem extensions shall have a 2 inch square operating nut and self-centering rockplate support. Valves with an operating nut more than 4 feet below grade shall have a valve stem extension to raise the operating nut to within 3 feet of the ground surface.

02480.30 Tapping Sleeve and Valve Assemblies:

(a) Valve Assemblies - Furnish tapping valves with flanged inlet end connections. The outlet ends shall conform in dimensions to the AWWA Standards for hub or mechanical joint connections, except that the outside of the hub shall have a large flange for attaching a drilling machine. The seat opening of the valve shall permit a diameter cut no less than 1/2 inch smaller than the valve size. Valves specifically designed for tapping meeting the requirements of AWWA C500, and valves meeting the requirements of AWWA C509, will be allowed. Tapping valves shall be of the same type as other valves on the Project.

(b) Sleeves - Tapping sleeves shall be cast iron, ductile iron, stainless steel, epoxy coated steel or other approved material.

02480.40 Check Valves - Check valves shall conform to the following:

(a) Swing Check Valve - Swing check valves shall meet the requirements of AWWA C508, with rubber seat materials mating with metal seating surfaces. The minimum design working pressure shall be 175 psi for check valves with diameters of 12 inches and smaller, and 150 psi for check valves with diameters of 14 inches and 16 inches. Check valves shall be non-assisted, unless otherwise indicated.

(b) Spring-Loaded Plug or Disc Check Valves - Spring-loaded plug or disc check valves shall be bronze mounted with bronze, cast or ductile iron body, bronze plug or disc, stainless steel spring, and resilient seating suitable for potable water service. The valves shall provide drop-tight sealing. The plugs or discs shall be easily replaceable. The minimum design working pressure of the valves shall be 150 psi.

(c) Hydraulic Cushion Check Valves - Hydraulic cushion check valves shall be of bronze, cast or ductile iron, with bronze disc and disc faces, seat rings and pivot pins. The valves shall provide drop-tight sealing. The valves shall be fitted with adjustable speed, integrally mounted, oil dashpot mechanical snubber systems. The minimum design working pressure of the valves shall be 150 psi.

02480.50 Hydraulically Operated Valves - Hydraulically operated valves shall be pilot controlled and diaphragm operated, bronze or stainless steel mounted with bronze, cast or ductile iron body, globe or angle orientation as indicated. Provide valve position indicators. The minimum design working pressure of the valves shall be 175 psi. Pilot controls and piping shall be bronze, designed to operate the main valves as indicated, and shall include stop valves, strainers and adjustable closing speed controls.

02480.60 Combination Air Release/Air Vacuum Valves:

(a) Operational Design - Design combination air release/air vacuum valves to operate with potable water under pressure to permit discharging a surge of air from an empty line when filling, and relieve the vacuum when draining the system. The valves shall also release an accumulation

of air when the system is under pressure. This shall be accomplished in a single valve body designed to withstand 300 psi.

(b) Composition - Combination air release/air vacuum valves shall meet the requirements of AWWA C512. The body and cover shall be cast iron conforming to ASTM A 48, Class 30. Floats shall be stainless steel conforming to ASTM A 240 and designed to withstand 1,000 psi. Seats shall be buna-n rubber. Internal parts shall be stainless steel or bronze.

02480.70 Backflow Prevention Devices - Backflow prevention devices shall be capable of withstanding a minimum design working pressure of 150 psi, and shall conform to the following:

(a) Reduced Pressure Principle Backflow Prevention Assembly - Reduced pressure principle backflow prevention assemblies shall consist of a mechanical, independently operating, hydraulically dependent relief valve located between two independently operating, spring loaded check valves that are located between two tightly closing resilient seated shutoff valves, with four resilient seated test cocks, all meeting the requirements of AWWA C511 and the Oregon State Health Division.

(b) Double Check Valve Backflow Prevention Assembly - Double check valve backflow prevention assemblies shall consist of two spring loaded, independently operating check valves, located between two tightly closing resilient seated shutoff valves, with four resilient seated test cocks, all meeting the requirements of AWWA C510 and the Oregon State Health Division.

02480.80 Acceptance - Valves and appurtenances will be accepted according to 00165.35 and this Section.

Section 02485 - Hydrant and Appurtenance Materials

Description

02485.00 Scope - This Section includes the requirements for hydrants, hydrant appurtenances, and guard posts for potable water systems.

Materials

02485.10 Fire Hydrants - Fire hydrants shall be dry-barrel, conforming to AWWA C502, of standard manufacture and of a pattern approved by the Agency. Hydrants shall be designed for a minimum working pressure of 150 psi.

All materials in contact with potable water shall conform to ANSI/NSF Standard 61, Drinking Water System Components - Health Effects, or equivalent.

02485.20 End Connections - The end connections shall be mechanical joint or flanged, meeting the requirements of AWWA C110 and AWWA C111.

02485.30 Hydrant Dimensions and Nozzle Features:

(a) Hydrant Dimensions - Hydrant connection pipes shall be 6 inches inside diameter with 6 inch auxiliary gate valves. Barrels shall have a 7 inch minimum inside diameter. Hydrant length, measured from the bottom of the hydrant to the sidewalk ring, shall provide proper cover at each installed location. Valve openings shall have a minimum diameter of 5 1/4 inches.

(b) Nozzle Features - Hydrants shall have two 2 1/2 inch diameter hose nozzles and one pumper nozzle to match the ~~Agency's~~Agency's connection requirements.

Fit nozzles with cast iron threaded caps with operating nuts of the same design and proportions as the hydrant stem nuts. Thread caps to fit the corresponding nozzles and fit with suitable neoprene gaskets of positive water tightness under test pressures. The direction of opening shall be counterclockwise and shall be clearly marked on the operating nut or hydrant top. Hydrants shall have O-ring stem seals. Interior and exterior painting of the hydrant shall conform to AWWA C502.

02485.40 Hydrant Extensions - Hydrant extensions shall be gray cast iron or ductile iron with an inside diameter of at least 6 inches, and shall conform to the AWWA Standards for such castings. The drillings of the connecting flanges on the extensions shall match the drillings of the flanges on the hydrant.

Hydrant extensions shall also include the necessary hydrant operating stem extensions.

02485.50 Traffic Flange - Provide hydrants with a traffic flange. Hydrants shall be equipped with breaking devices at the traffic flange which will allow the hydrant barrel to separate at this point with a minimum breakage of hydrant parts in case of damage. Also provide, at this point, a safety stem coupling on the operating stem that will shear upon impact.

02485.60 Tie Rods - Tie rods shall be 3/4 inch diameter with threaded ends, galvanized according to 02560.40 and conforming to 02560.30.

02485.70 Guard Posts - Guard posts for hydrants shall be galvanized steel pipe, 6 inches in diameter, meeting the requirements of ASTM A 53, Schedule 40, filled with commercial grade concrete, and with the concrete domed at the top.

02485.80 Acceptance - Acceptance of hydrants and hydrant appurtenances will be according to 00165.35 and this Section.

Section 02490 - Potable Water Service Connection Materials, 2 Inch and Smaller

Description

02490.00 Scope - This Section includes the requirements for potable water service connections 2 inches in diameter and smaller, and sampling stations.

Materials

02490.10 General - Service line materials shall conform to AWWA C800 and these specifications. Design service line materials for normal pressure service applications for a working pressure of 100 psi. Where high pressure service materials are specified or shown, they shall be designed for a working pressure of 150 psi. Use high pressure service materials when service line is hydrostatically tested concurrent with the water main.

All materials in contact with potable water shall conform to ANSI/NSF Standard 61, Drinking Water System Components - Health Effects, or equivalent.

02490.20 Saddles - Saddles shall be ductile iron, bronze or stainless steel. Saddles used for 3/4 inch and 1 inch services shall be single strap saddles and have either AWWA tapered thread or female iron pipe thread outlet. Saddles used for 1 1/2 inch and 2 inch services shall be double strap saddles with female iron pipe thread outlet. Saddles used on asbestos cement or on PVC pipe shall be formed for the pipe and have flat, stainless steel straps.

02490.30 Corporation Stops - Make corporation stops of bronze alloy. Corporation stops for direct tapping shall have AWWA tapered thread inlet and outlet connections compatible with either copper or polyethylene tubing.

(a) Less Than or Equal to 1 Inch - Corporation stops used with 3/4 inch and 1 inch outlet saddles shall have either AWWA tapered thread or male iron pipe thread inlets and outlet connections compatible with either copper or polyethylene tubing. Thread patterns for the saddle outlet and corporation stop inlet shall be the same.

(b) Greater Than 1 Inch - Corporation stops used with 1 1/2 inch and 2 inch outlet saddles shall have male iron pipe thread inlets and outlet connections compatible with connecting service pipes, or have male iron pipe thread outlets.

02490.40 Service Pipe and Fittings:

(a) Copper Tubing Service Pipe - Copper tubing service pipe shall be annealed, seamless tubing conforming to the requirements of ASTM B 88, Type K.

(b) Polyethylene Tubing Service Pipe - Polyethylene tubing service pipe shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 200 psi rating. Tubing used for 3/4 inch and 1 inch shall be either SDR 7 (iron pipe size) or SDR 9 (copper tube size). Tubing used for 1 1/2 inch and 2 inch shall be SDR 9 (copper tube size).

(c) Service Fittings - Make fittings used for service connections of bronze alloy. Fittings used for copper tubing shall be either compression or flare type, insulated or noninsulated.

Fittings used for polyethylene tubing shall be either compression or stab type. Stab type fittings shall utilize an internal grip ring and O-ring seal. Use stainless steel liners when utilizing compression fittings on polyethylene tubing.

02490.50 Meter Setters - Meter setters shall be manufactured and tested according to all applicable parts of AWWA C800. Meter setters shall be 12 inches in height and shall have an angle meter stop with drilled padlock wing, an angle check valve, and inlet and outlet threads compatible with fittings connecting to service pipes.

Meter setters for 5/8 inch by 3/4 inch, 3/4 inch, and 1 inch services shall have meter saddle nuts for installation and removal of the meter. Meter setters for 1 1/2 inch and 2 inch services shall be equipped with a locking bypass.

02490.60 Bronze Nipples and Fittings - Bronze threaded nipples and fittings shall meet the requirements of ANSI B16.15, ASA 125 pound class.

02490.70 Meter Boxes:

(a) Nontraffic Areas - Construct meter boxes and covers located in the nontraffic areas of either reinforced concrete or high density polyethylene. High density polyethylene meter boxes and covers shall have a tensile strength conforming to ASTM D 638. Meter box covers shall include a reading lid.

(b) Traffic Areas - Construct meter boxes located in traffic areas of either reinforced concrete, cast iron or ductile iron. Construct traffic covers of aluminum, steel, cast iron or ductile iron. Meter boxes and covers shall be designed for continuous H-20 traffic loading.

02490.80 Sampling Stations - Sampling stations shall have a 3/4 inch inlet with the depth of bury indicated, and a 3/4 inch unthreaded nozzle. Enclose the sampling station in a lockable, non-removable, cast aluminum housing. When opened, the station shall require no key for operation, and the water shall flow in an all-brass waterway. All working parts shall also be of brass and be removable from above ground with no digging. Exterior piping shall be brass. Include at each station a copper vent tube with a ball valve to enable the station to be pumped free of standing water to prevent freezing.

02490.90 Acceptance - Materials for potable water service connections will be accepted according to 00165.35 and this Section.

Structures

Section 02510 - Reinforcement

Description

02510.00 Scope - This Section includes the requirements for bars, dowels, and strand reinforcement and tendon ducts.

Materials

02510.10 Deformed Bar Reinforcement - Deformed bar reinforcement shall conform to the requirements of ASTM A 706 or AASHTO M 31 (ASTM A 615). Unless otherwise specified or shown, all reinforcing bars shall be Grade ~~420 (Grade~~ 60~~)~~.

02510.11 Epoxy Coated Reinforcement:

(a) General - Epoxy coated reinforcement shall conform to the requirements of AASHTO M 284 (ASTM A 775) and (b), (c) and (d) below.

(b) Coating Voids - Patch visible voids in the coating, regardless of cause, according to 00530.45.

(c) Handling - All systems for handling coated bars shall have padded contact areas for the bars wherever possible. Pad all bundling bands and lift all bundles with strongbacks, multiple supports or platform bridges so as to prevent bar-to-bar abrasion from sags in the bar bundle.

(d) Coated Reinforcement Ties and Supports - Ties for coated reinforcement shall be nonmetallic coated. Where coated bars are tied to uncoated bars, the ties shall be nonmetallic coated.

(e) Prequalification, Sampling and Testing - Prequalify all epoxy coating and patching/repair material according to AASHTO M 284 (ASTM A 775). All testing shall be performed by a qualified private testing laboratory. The Agency's Materials Laboratory will review all test data to determine whether the material meets the pre-qualification requirements.

At the time of epoxy coated reinforcing bar shipment, furnish the Engineer a written certification that the coated bars were cleaned, coated and tested according to AASHTO M 284 (ASTM A 775) and according to (b), (c), and (d) above, and that the coating material used on the project is the same as that pre-qualified.

(f) Plant Certification - Epoxy coated reinforcement shall be produced in a Concrete Reinforcing Steel Institute (CRSI) Certified Epoxy Coating Plant.

02510.20 Mechanical Splices - Mechanical splices for reinforcing bars are systems which connect the bars without raising their temperature above 1,300 °F.

- Provide mechanical splices from the QPL that develop at least ~~135%~~the specified tensile strength or 135 percent of the specified minimum yield strength of the reinforcing bars in tension, whichever is less. Where bars of different sizes or strengths are connected, the governing strength shall be the strength of the smaller or weaker bar.
- The total slip of reinforcing bars within a splice sleeve shall not exceed 0.040 inch, measured between gauge points clear of the splice sleeve, when the reinforcing bars are loaded in tension to 67~~%~~ percent of the specified minimum yield strength of the reinforcing bar.

02510.25 Headed Bar Reinforcement - Furnish Class HA headed steel bar from the QPL for concrete reinforcement. The headed steel bar shall develop the specified minimum tensile strength of the reinforcing bars, according to ASTM A 970. Ferrous-filler coupling sleeves, forged headed steel bars, and welded headed steel bars are not allowed for concrete reinforcement.

02510.30 Galvanized Reinforcement:

(a) General - Galvanized reinforcement shall conform to the requirements of ASTM A 767, Class II, including Supplementary Requirement S3, and ASTM A 143.

(b) Fabrication - The bars may be fabricated before or after galvanizing. If the bars are fabricated after galvanizing, Supplementary Requirements S1 and S2 of ASTM A 767 shall apply.

(c) Handling - All systems for handling galvanized bars shall be according to 02510.11(c).

(d) Ties and Supports - Tie all mats of galvanized steel bars with galvanized ties. Precast concrete blocks that support galvanized reinforcement shall have galvanized ties.

02510.40 Welded Wire ~~Fabric~~Reinforcement - Welded wire ~~fabric~~reinforcement shall conform to the requirements of AASHTO M 55 (ASTM A 185). Deformed welded wire ~~fabric~~reinforcement shall ~~comply with~~conform to the requirements of AASHTO M 221 (ASTM A 497).

02510.50 Dowels - Dowels shall conform to the requirements of AASHTO M 31 (ASTM A 615), for Grades 40 and 60, or AASHTO M 227 (ASTM A 663) for Grades 70, 75, and 80.

02510.60 Wire Reinforcement - Wire reinforcement shall conform to the requirements of AASHTO M 32 (ASTM A 82). Deformed wire shall conform to the requirements of AASHTO M 225 (ASTM A 496).

02510.70 Acceptance - Acceptance of reinforcement will be according to 00165.35 and this Section.

Section 02515 - Prestressing Reinforcement

Description

02515.00 Scope - This Section includes the requirements for seven-wire strand, high tensile strength wire, high tensile strength steel alloy bars, tendon duct and couplings.

Materials

02515.10 Seven-Wire Strand - Seven-wire strand (bright wire) shall conform to the requirements of AASHTO M 203 (ASTM A 416), Grade 270, supplement 1 (low relaxation strand), minimum ultimate strength, 270,000 psi.

02515.20 Wire, High Tensile Strength - High tensile strength wire shall conform to the requirements of AASHTO M 204 (ASTM A 421).

02515.30 Bars, High Tensile Strength - High strength steel bars shall conform to the requirements of AASHTO M 275 (ASTM A 722).

02515.40 Seven-Wire Strand Epoxy Coated Reinforcement - Epoxy coated reinforcement shall conform to the requirements of ASTM A 882.

02515.50 Tendon Duct - Provide rigid galvanized steel ducts conforming to the requirements of ASTM A 653 with a coating weight of G90 for post-tensioned structures. Transition couplings connecting rigid ducts in anchoring devices need not be galvanized.

Rigid ducts may be fabricated with either welded or interlocking seams. Galvanizing of the welded seam is not required. Provide ducts with sufficient strength to maintain their correct alignment during placing of concrete and resist denting during construction.

Minimum wall thickness of ducts shall be 26 gauge for 2 5/8 inch diameter and smaller ducts, and 24 gauge for ducts that are larger than 2 5/8 inch diameter.

02515.60 Couplings - Provide couplings that develop at least 95~~%~~ percent of the minimum specified ultimate strength of the prestressing steel without exceeding anticipated set. The coupling of tendons shall not reduce the elongation at rupture below the requirements of the tendon itself.

02515.70 Shipping Protection - Package prestressing steel to protect the steel against physical damage and corrosion. Place a corrosion inhibitor that prevents rust or other results of corrosion in the package, or use a corrosion inhibitor type packaging material, or when allowed, apply directly to the steel. Provide a corrosion inhibitor that has no deleterious effect on the steel or concrete or bond strength of steel to concrete. Immediately replace or restore damaged packaging.

Mark the shipping package with the type of corrosion inhibitor used, and the date packaged.

02515.80 Acceptance - Acceptance of pre-stressing reinforcement will be according to 00165.35 and this Section.

Section 02520 - Steel and Concrete Piles

Description

02520.00 Scope - This Section includes the requirements for steel pipe, steel H-beams, steel sheets, and pre-stressed concrete used for piling.

Materials

02520.10 Steel Piles:

(a) General - All steel piles, except steel pipe piles, shall meet the requirements for camber and sweep specified in AASHTO M 160 (ASTM A 6).

(b) Steel Pipe Piles - Steel pipe piles shall be either spirally welded or longitudinally welded, constant in section and conforming to ASTM A 252, Grade 2. Seal tips with a 1 inch thick steel plate or an approved cast steel point welded in place, when specified. Concrete used to fill steel pipe pile shall be Class 3300 - 1 1/2, 1, or 3/4.

(c) Steel H-Piles - Steel H-piles shall be rolled steel pile sections of the size and weight shown. Steel shall conform to the requirements of ASTM A 36~~.~~ or ASTM A 572, Grade 50. The manufacturer's name, brand or trademark may be shown by die stamping in the web at intervals not exceeding 20 feet along the length of the pile.

(d) Steel Sheet Piles - Steel sheet piles shall conform to AASHTO M 202 (ASTM A 328).

(e) Reinforced Pile Tips - Steel pile tip reinforcement includes H-pile points, pipe pile shoes or points or any other proprietary steel pile tip reinforcement. Legibly mark or tag each cast steel point or shoe delivered to the project site with the heat or lot number. Submit certified mill test reports showing the physical and chemical properties of each heat or lot number. If the heat or lot number cannot be read on the point or if the mark or tag is missing, the point or shoe will be rejected.

Provide reinforced tips for steel H-piles from the QPL. In addition, all cast steel points or shoes shall conform to the following:

ASTM A 27, Grade 65 - 35
ASTM A 27, Grade 70 - 36
ASTM A 27, Grade 70 - 40
ASTM A 148, all grades

For steel H-piles provide no less than a 5/16 inch fillet weld full width of each flange.

(f) Sampling and Field Testing Pile Tips - The Engineer may randomly sample from each heat or lot number, at least one pile tip or up to 10~~%~~ percent of the tips for larger projects, of the pile tips delivered for incorporation into the project.

The selected ~~tip(s)~~tips shall be tested as follows:

- Grind five smooth spots on each randomly selected tip. The Engineer will test each smooth spot on each tip with a portable hardness tester or in a laboratory. If three or more of the five spots tested have a reading below 74 on the "B" scale, the tested tip and the entire lot shall be rejected.

- For steel H-piles, determine the weight of the ~~tip(s).~~tips. Each cast steel H-pile point shall have a weight not less than 30~~%~~ percent of the weight of a 1 foot section of the H-pile to which it will be attached. If any of the tested tips fail to pass the minimum weight criteria the entire lot shall be rejected.

Pile tips that are supplied unattached to the pile may be selected for nondestructive testing as described above. Pile tips passing the field test may be incorporated into the project. Pile tips selected for testing that are supplied already attached to the pile will be destructively tested as determined by the Engineer. Provide replacement tips for the tips that are destructively tested at no cost to the Agency. Replace rejected tips with new tips and rejected lots with new lots at no additional cost to the Agency. No time extension or other compensation will be granted for materials or work required in testing pile tips, replacing rejected pile tips or for replacing tips that are destructively tested. New tips and new lots may also be tested according to the requirements above.

02520.20 Prestressed Concrete Piles:

(a) General - Prestressed concrete piles shall be manufactured according to Section 00550 and as shown.

(b) Concrete - Concrete in precast, prestressed piles shall be Class 5000 - 1 or 3/4. Minimum concrete strength at transfer of prestressing force shall be 4,000 psi. Concrete in pile extensions or "build-ups" shall be Class 3300 - 1 1/2, 1, or 3/4.

(c) Prestressing Reinforcement - Prestressing reinforcement steel shall consist of seven-wire, low-relaxation strands conforming to 02515.10.

(d) Mild Steel Reinforcement - Spiral reinforcement shall be plain reinforcing steel meeting the requirements of 02510.10 or cold-drawn wire meeting the requirements of 02510.60. All other mild reinforcing steel shall meet the requirements of AASHTO M 31 (ASTM A 615), Grade 60.

(e) Forms - The use of steel forms on concrete founded casting beds is required. Forms shall enclose all except the top horizontal surface, and shall be mortar-tight. Forms for piles shall not cause the formation of fins at the intersection of surfaces.

(f) Tolerances - The maximum sweep (deviation of straightness measured along two perpendicular faces of the pile, while not subject to bending forces) shall not exceed 1/8 inch in any 10 feet of length, 3/8 inch in 40 feet, or 3/16 inch x total length in feet per 20 feet.

(g) Finish - The tops of concrete castings shall be given a uniformly smooth finish to match the finish surface of the formed sides.

02520.30 Acceptance - Material for piles will be accepted according to 00165.35 and this Section.

Section 02530 - Structural Steel

Description

02530.00 Scope - This Section includes the requirements for structural steel used in the fabrication of bridges and non-bridge structures.

Materials

02530.10 Structural Steel for Bridges - Structural steel for bridges shall conform to the following, as shown or specified:

- AASHTO M 270, Grade 36 (ASTM A 709, Grade 36)
- AASHTO M 270, Grade 50 (ASTM A 709, Grade 50)
- AASHTO M 270, Grade 50W (ASTM A 709, Grade 50W)
- AASHTO M 270, Grade HPS 70 (ASTM A 709 Grade HPS 70)
- AASHTO M 270, Grade HPS 70W (ASTM A 709 Grade HPS 70W)

Supplementary Requirement S4 (AASHTO M 270 (ASTM A 709)) Fracture-Critical, *F*, Material; Toughness Testing and Marking, is mandatory for all fracture critical steel. Toughness requirements for all areas of Oregon shall be according to Zone 2 requirements.

Supplementary Requirement S6, Limitation on Weld Repair, is mandatory for all fracture critical steel.

Supplementary Requirement S2, Product Analysis, of AASHTO M 160 (ASTM A 6) is mandatory for all steel plate that will be welded. The product analysis shall be on a heat frequency. It shall include all elements listed in Table A of AASHTO M 160 (ASTM A 6), regardless of the material specification, except that nitrogen need not be reported unless specified in the product specification. The product analysis shall be submitted to the Engineer immediately upon receipt of the steel.

02530.20 Structural Steel for Non-Bridge Structures - Structural steel for metal sign structures and other non-bridge structures shall conform to the following, or as shown or specified:

- AASHTO M 270, Grade 36 (ASTM A 709, Grade 36)
- ASTM A 36
- AASHTO M 270, Grade 50 (ASTM A 709, Grade 50)
- ASTM A 572

Notch toughness of all structural steel members and plates greater than 1/2 inch thick in load carrying members of sign bridges and cantilever sign supports shall conform to Zone 2 requirements of AASHTO M 270.

02530.40 Ultrasonic Inspection of Plate - Ultrasonically inspect flanges 2 inches and thicker for welded plate girders before fabrication according to ASTM A 578 except as follows:

- Section 7, Acceptance Standard - Level A, and Section 8, Acceptance Standard - Level B, do not apply. Use Supplementary Requirement S2.1 for acceptance standard.
- Inspection of flanges of rolled shapes with flanges thicker than 1 3/4 inches.

02530.50 Universal Mill Plate - Universal mill plate shall not be used.

02530.60 Rolled Shapes - With the approval of the Engineer, rolled shapes having equal or greater section properties and meeting minimum flange and web thickness requirements may be substituted for members specified on the plans, at no additional cost to the Agency.

02530.70 Galvanizing - Galvanizing shall be by the hot-dip process according to the following, as applicable:

- AASHTO M 111 (ASTM A 123)
- AASHTO M 232 (ASTM A 153)

Steel that will be finished by hot-dip galvanizing for use as sign bridges, illumination poles, traffic signal poles, sign supports, bridge rail and items designated on the plans as "Galvanize - Control Silicon" shall have controlled silicon content. The silicon content shall be in either of the ranges 0 - 0.04~~%~~ percent or 0.15~~%~~ percent - 0.25~~%.~~ percent. Before galvanizing, submit mill test certificates verifying silicon content to the Engineer and the galvanizer.

02530.71 Repair of Hot-Dip Galvanizing - Repair damaged hot-dip galvanizing according to ASTM A 780 and ASTM A 123. Minimum dry film thickness is 3 mils. Minimum zinc content for Method A2 is ~~94%~~92 percent on the dry film.

02530.80 Acceptance - Acceptance of structural steel will be according to 00165.35 and this Section.

Section 02540 - Forgings, Shafting, Castings, and Nonferrous Materials

Description

02540.00 Scope - This Section includes the requirements for forgings, shafting, castings, and nonferrous materials except those used in potable water systems. For potable water system requirements, see Sections 02470, 02475, 02480, and 02490.

Materials

02540.10 Steel Forgings - Steel forgings shall conform to the following:

Carbon steel forgings ..... AASHTO M 102 (ASTM A 668), Class C
Alloy steel forgings ..... AASHTO M 102 (ASTM A 668), Class G

02540.20 Steel Shafting - Steel shafting shall be cold-finished and shall conform to AASHTO M 169 (ASTM A 108), Grades 1016 - 1030, inclusive.

02540.30 Steel Castings - Steel castings shall conform to the following:

Carbon steel castings.....AASHTO M 103 (ASTM A 27), Grade 70-36
Alloy steel castings.....AASHTO M 163 (ASTM A 743), Grade CA-15

Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended. Allowance will be made in dimensions for reasonable pattern draft.

Castings shall be boldly filleted at angles and the arises shall be sharp and perfect.

Sandblast castings or otherwise effectively clean of scale and sand to present a smooth, clean and uniform surface.

02540.40 Iron Castings - Iron castings shall conform to the following:

- **Gray Iron Castings** - AASHTO~~ M 105, Class 35 with the test bar size, A, B, C, or S as appropriate to the dimensions of the casting~~ M 306.

- **Ductile Iron Castings** - ~~ASTM A 536, Grade 60-40-18, or as specified~~ AASHTO M 306. In addition to the specified test coupons, test specimens from parts integral with the castings, such as risers, shall be tested for castings weighing over 1,000 pounds.

- **Malleable Iron Castings** - ASTM A 47, Grade 32510.

Finish iron castings according to 02540.30.

Clean iron castings according to 02540.30.

02540.50 Nonferrous Materials - Nonferrous materials shall conform to the following:

Bronze castings.....AASHTO M 107 (ASTM B 22) Copper Alloy UNS No. C91100
Copper alloy plates .....AASHTO M 108 (ASTM B 100) Copper Alloy UNS No. C51000

02540.60 Acceptance - Acceptance of forgings, shafting, castings, and nonferrous materials will be according to 00165.35 and this Section.

Section 02560 - Fasteners

Description

02560.00 Scope - This Section includes the requirements for fasteners.

Materials

02560.10 Carbon Steel Fasteners:

(a) Bolts - Carbon steel bolts shall conform to ASTM A 307, Grade A or B.

(b) Nuts - Nuts for carbon steel bolts shall conform to the requirements of the following, or equivalent:

Plain (Noncoated) Bolts:

- 1/4" - 1 1/2" - AASHTO M 291 (ASTM A 563), Grade A, hex
- Over 1 1/2" - 4" - AASHTO M 291 (ASTM A 563), Grade A, heavy hex

Galvanized Bolts:

- All - AASHTO M 291 (ASTM A 563), Grade A, C, D, or DH, heavy hex

(c) Washers - Washers for carbon steel bolts shall conform to ASTM F 436.

02560.20 High-Strength Fasteners:

(a) Bolts - High-strength bolts shall conform to AASHTO M 164 (ASTM A 325). High-strength bolts used in noncoated weathering steel connections shall be Type 3.

(b) Nuts - Nuts for high-strength bolts shall conform to the requirements of the following, or equivalent:

Type 1 Plain (Noncoated) Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade C, D, or DH

Type 1 Galvanized Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade DH

Type 3 Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade C3 or DH3

(c) Washers - Washers for high-strength bolts shall conform to ASTM F 436. Use Type 3 washers with Type 3 bolts.

(d) Direct Tension Indicators - Direct tension indicators shall be the compressible-washer type, mechanically galvanized, conforming to ASTM F 959. Adjust bolt lengths to accommodate both direct tension indicators and hardened washers.

(e) Markings - All bolts, nuts, washers and direct tension indicators shall be marked according to the appropriate AASHTO/ASTM specifications and with a symbol identifying the manufacturer.

(f) Lock-Pin and Collar Fasteners - The shank and head of high-strength steel lock-pin and collar fasteners shall meet the requirements of 02560.20(a) and the chemical composition and mechanical property requirements of AASHTO M 164 (ASTM A 325) types, as specified. Each fastener shall have the following:

- A solid shank body of sufficient diameter to provide tensile and shear strength equivalent to or greater than the bolt specified.
- A cold-forged round head on one end, of type and dimensions as approved.
- A shank length suitable for the thickness of the material fastened.
- Annular locking grooves.
- A breakneck groove (annular).
- Annular pull grooves (all annular grooves) on the opposite end.
- A steel locking flange type collar, of proper size for the shank diameter used. The collar shall be cold-swaged into the locking grooves by means of suitable installation tools, approved by the fastener manufacturer, to form a head for the grooved end of the fastener after the pull groove section has been removed. The steel locking collars shall be equipped with tab locks to prevent slippage during installation and shall be a standard product of an approved, established manufacturer of lock-pin and collar fasteners.

Where lock-pin and flange type collar fasteners are used, flat washers will not be required.

Clean the exposed end of the pin, where the pintail breaks away from the pin, with a wire brush and solvent. After cleaning, coat the exposed end with a zinc and micaceous iron oxide-filled single-component moisture-cured urethane primer, followed by micaceous iron oxide-filled single-component top coat colored to match the work. On galvanized fasteners, the exposed end of the pin may also be repaired according to ASTM A 780.

Type 3 fasteners do not require coating.

02560.30 Tie Rods and Anchor Bolts:

(a) Carbon Steel Tie Rods and Anchor Bolts - Carbon steel tie rods and anchor bolts shall conform to: AASHTO M 314, Grade 36 or 55; ASTM F 1554, Grade 36 or 55; or ASTM A 307, Grade C.

(b) High-Strength Tie Rods and Anchor Bolts - High-strength tie rods and anchor bolts shall conform to: AASHTO M 314, Grade 105; ASTM F 1554, Grade 105; or ASTM A 449, Type 1.

(c) Nuts - Nuts for tie rods and anchor bolts shall conform to the requirements of the following, or equivalent:

Plain Carbon Steel Tie Rods and Anchor Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade A

Galvanized Carbon Steel Tie Rods and Anchor Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade A, C, D, or DH

Plain Or Galvanized High-Strength Tie Rods or Anchor Bolts:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade DH

(d) Washers - Washers for anchor bolts shall conform to ASTM F 436, Type 1.

02560.40 Galvanizing and Coating of Fasteners, Tie Rods, and Anchor Bolts:

(a) Galvanizing of Fasteners, Tie Rods, and Anchor Bolts - Hot-dip galvanize fasteners, tie rods, anchor bolts, nuts and washers according to AASHTO M 111 (ASTM A 123) or AASHTO M 232 (ASTM A 153) as appropriate to the product.

When specified, mechanically galvanize fasteners according to ASTM B 695, Class 50, Type 1.

Match galvanized bolts, tie rods, and anchor bolts with appropriate galvanized nuts for assembly. Ship nuts in the same container consisting of bolts, tie rods, or anchor bolts.

Overtap nuts for galvanized fasteners, galvanized tie rods, and galvanized anchor bolts according to AASHTO M 291 (ASTM A 563).

Measure the zinc thickness on the wrench flats or top of bolt head of galvanized bolts and on the wrench flats of galvanized nuts.

(b) Galvanizing of Direct Tension Indicators - All galvanized compressible washer type direct tension indicators shall be mechanically galvanized according to ASTM B 695, Class 50, Type 1, by the manufacturer.

(c) Repair of Hot-Dip Galvanizing - Repair damaged hot-dip galvanizing according to ASTM A 780. Minimum zinc content for Method A2 is 94~~%~~ percent on the dry film.

Testing

02560.60 Testing:

(a) Rotational Capacity Test - Test all high-strength fasteners, except anchor bolts and tie rods, according to Method 1 or 2 below, as applicable. Perform the test on coated or galvanized fasteners after coating, galvanizing, oversize tapping and lubricating. Use nuts from those supplied with the bolts for the job. Use washers for this testing. Repeat the rotational capacity test at the job site prior to installation to verify the effectiveness of the lubricant. The rotational capacity test is not required for lock-pin and collar fasteners. Use Method 1 for long bolts and Method 2 for short bolts.

Test each combination of bolt production lot, nut lot and washer lot as an assembly. Assign a rotational capacity lot number to each combination of lots tested. The minimum frequency of testing shall be two assemblies per rotational capacity lot. The test shall meet one of the following requirements:

(1) Method 1 - Place the lubricated fastener, including a washer, in a device capable of indicating direct bolt tension. Use spacers and/or washers with the hole size the same nominal diameter as the hole in the washer for the fastener to be tested. Allow three to five full threads of the bolt to be exposed between the bearing surfaces of the bolt head and the nut. Tighten the nut to a snug-tight condition to produce an initial load in the bolt equal to 10~~%~~ percent of the tension required in Table 00560-1 of Section 00560. Mark the nut's position relative to the fixed bolt for this snug-tight position. Tighten the nut using a calibrated torque wrench and record the measured torque with the nut in motion to reach the tension required by Table 00560-1.

The above measured torque to produce the required bolt tensions shall not exceed the torque value calculated by the following equation:

$$T = 0.25\ PD$$

Where: T = Torque in foot pounds
P = Measured Bolt Tension in pounds
D = Nominal Bolt Diameter in feet

Reject assemblies with torque values exceeding the calculated value.

Continue to tighten the nut until the nut has turned twice the rotation shown in Table 00560-3 of Section 00560 from its snug-tight position mark. Record the measured bolt tension. The tension shall not be less than 1.15 times the tension shown in Table 00560-1. Reject assemblies not meeting this tension.

Loosen and remove the nut. Examine the threads on the nut and bolt. Reject assemblies showing evidence of thread shear failure, stripping or torsional failure of the bolt.

(2) Method 2 - Bolts that are too short to be tested in a direct bolt tension indicating device shall be tested in a steel joint.

Place the lubricated fastener including a washer in one or more flat structural steel plates. The total thickness including the washer shall be such that three to five full threads of the bolt are located between the bearing surfaces of the bolt head and the nut. The hole in the joint shall have the same nominal diameter as the hole in the washer. Using a calibrated torque wrench, tighten the nut to a snug-tight condition to produce an initial torque in the bolt equal to approximately 10% percent of the torque calculated using the equation given in Method 1 above where P shall be the minimum tension in the bolt according to Table 00560-1 of Section 00560. Mark the nut's position relative to the fixed bolt for this snug tight position.

Using the calibrated torque wrench, further tighten the nut until the nut has turned the rotation shown in Table 00560-3 of Section 00560 from its snug-tight position mark. Prevent the bolt head from turning during the tightening process. Record the measured torque with the nut in motion. The measured torque shall not exceed 1.15 times the torque value calculated in the preceding step of Method 2. Reject assemblies with torque values exceeding the calculated value.

Tighten the nut further until the nut has turned twice the rotation shown in Table 00560-3 from its snug-tight position mark. Reject assemblies which fail this rotation either by stripping or fracture.

Loosen and remove the nut. Examine the threads on the nut and bolt. Reject assemblies showing evidence of thread shear failure, stripping or torsional failure of the bolt.

(3) Shipping - Ship bolts, nuts and washers from each rotational capacity test lot in the same container. If there is only one rotational capacity test lot for each size of bolt, the bolts, nuts and washers may be shipped in separate containers. Permanently mark each container with the rotational capacity test lot number to enable identification at any stage before installation.

(b) Other Test Requirements - Proof load testing on all high-strength bolts and nuts is mandatory. Test bolts according to ASTM F 606, Method 1, and nuts according to ASTM F 606, paragraph 4.2, with frequency of tests according to paragraph 9.3 of ASTM A 563. Test galvanized bolts, rods, and nuts after galvanizing, overtapping and lubricating. Coated bolts, rods, and nuts may be tested before coating.

Wedge test all bolts according to ASTM F 606, paragraph 3.5, with frequency of testing according to AASHTO M 164 (ASTM A 325). Test galvanized bolts after galvanizing. Coated bolts may be tested before coating.

Perform other tests called for on the plans.

Provide certified test results for all tests required by these Specifications or the individual product specifications.

Provide three extra high strength bolt assemblies per size per lot for check testing.

Provide one extra high strength tie rod and anchor bolt per size per lot for check testing.

02560.70 Lubricating Fasteners - ~~Lubricate~~ Furnish all galvanized and coated fasteners with a ~~lubricant containing~~factory applied commercial water-soluble wax that contains a visible dye of ~~any~~a color that contrasts with the color of galvanizing or coating~~ so a visual check can be made for the lubricant at the time of field installation~~. Black fasteners shall be "oily" to the touch when installed.

~~Lubricate galvanized fasteners using commercial wax and coated fasteners using commercial water-soluble wax. Lubricants for galvanized and coated fasteners shall be from the QPL.~~

Field lubricate galvanized bolts in tapped holes, galvanized anchor rods, and galvanized tie rods with a lubricant from the QPL. Apply lubricant to threads and to bearing surfaces that will turn during installation.

Protect fasteners from dirt and moisture at the job site. Clean, ~~lubricate~~relubricate with a lubricant from the QPL, and retest ~~weathered or rusted~~ fasteners that do not pass the field rotational capacity test. Obtain the Manufacturer's approval before ~~installing. Do not relubricate~~ relubricating tension control fasteners that are designed to automatically provide the tension~~ without consulting with the manufacturer~~.

~~The~~Coat the outer surface of the collar in lock-pin and collar fasteners ~~shall be coated~~ with ~~a~~an approved Manufacturer lubricant~~ as approved by the manufacturer. This lubricant allows the installation tool to swage the collar without removing the corrosion protection from the outer surface~~.

02560.80 Acceptance - Acceptance of fasteners will be according to 00165.35 and this Section.

Section 02570 - Composite Bearings

Description

02570.00 Scope - This Section includes the requirements for composite bearings.

Materials

02570.10 Materials - Provide materials meeting the following requirements:

Structural Steel 02530.20
Stainless Steel Sliding Surfaces ..... ASTM A 240, Type 304 or Type 316
Flat Brass Rings for Pot Bearings .....ASTM B 36, half hard
Cap Screws ..... ASTM A 574 or ASTM F 835
Bolts and Nuts .....AASHTO M 164 (ASTM A 325) and Section 02560
Galvanized Bolts, Nuts, Washers, Cap screws,
Sole Plates and Base Plates .....02530.70 and 02560.40
Woven Polytetrafluoroethylene (PTFE) ..... section 18 of the current AASHTO LRFD Bridge Construction Specifications

Welded Stainless Steel Overlay - Produce welded stainless steel overlay for the convex rotational surface of spherical bearings using Type 309L electrodes.

Elastomer - Elastomer for elastomeric discs of pot bearings shall be 100~~%~~ percent virgin natural polyisoprene (natural rubber) or 100~~%~~ percent virgin chloroprene (neoprene) meeting the following requirements:

NATURAL POLYISOPRENE (Natural Rubber):

Physical Properties	**ASTM Test Method**	**Value**
Hardness, Durometer D	D 2240	50 ± 5
Tensile strength, minimum, psi	D 412	2,250
Ultimate elongation, minimum, %	D 412	450
Heat Resistance		
Change in durometer hardness, maximum points	D 573 70 hour at 158 °F	+ 10
Change in tensile strength, maximum, %		- 25
Change in ultimate elongation, maximum, %		- 25
Compression Set		
22 hours at 158 °F, maximum, %	D 395, Method B	25
Ozone		
25 pphm ozone in air by volume, 20% strain, 100 °F ± 2 °F 48 hours mounting Procedure D518, Procedure A	D 1149	No Cracks

Adhesion		
Bond made during vulcanization, lb/in	D 429 Method B	40
Low Temperature Test		
Brittleness at -40 °F	D 746 Procedure B	No Failure

VIRGIN CHLOROPRENE (Neoprene):

Physical Properties	**ASTM Test Method**	**Value**
Hardness, Durometer D	D 2240	50 ± 5
Tensile strength, minimum, psi	D 412	2,250
Ultimate elongation, minimum, %	D 412	400
Heat Resistance		
Change in durometer hardness, maximum points	D 573 70 hour at 212 °F	+ 15
Change in tensile strength, maximum, %		- 15
Change in ultimate elongation, maximum, %		- 40
Compression Set		
22 hours at 212 °F, maximum, %	D 395, Method B	35
Ozone		
100 pphm ozone in air by volume, 20% strain, 100 °F ± 2 °F 100 hours mounting Procedure D518, Procedure A	D 1149	No Cracks
Adhesion		
Bond made during vulcanization, lb/in	D 429 Method B	40
Low Temperature Test		
Brittleness at -40 °F	D 746, Procedure B	No Failure

When test specimens are cut from the finished product a 10~~%~~ percent variation in physical properties will be allowed.

Polyether Urethane - The properties of polyether urethane for polyether urethane discs of disc bearings shall meet the values of the following tests:

Property	Test Method	Range of Values
Hardness, Durometer D	ASTM D 2240	~~62 ± 2~~65 ± 5
Tensile stress, psi		
at 100% elongation	ASTM D 412	2,300 min.
at 200% elongation		4,000 min.
Tensile strength	ASTM D 412	6,000 min.
Ultimate elongation %	ASTM D 412	220 min.
Compression set, 22 hrs.		
at 158 °F	ASTM D 395	40 max.

Fabric Pads - Make preformed fabric pads for fabric pad bearings of multiple layers of duck, impregnated and bound with high quality oil resistant synthetic rubber compressed into resilient pads of uniform thickness according to the following:

- Cotton duck reinforcement shall be either a two-ply cotton yarn or a single-ply 50-50 blend cotton polyester ~~weighing~~with a minimum of 8 ounces per square yard.
- The fabric shall have a minimum tensile strength of 150 pounds per inch width when tested by the grab method.
- The filling count of the duck shall be 40 ± 2 threads per inch.
- The warp count of the duck shall be 50 ± 1 threads per inch.
- The number of plies shall produce the specified thickness after compression and vulcanizing.
- The finished pads shall withstand compression loads perpendicular to the plane of the laminations of not less than 10,000 psi without any sign of distress after the load is removed. The tested pad shall have a shape factor greater than 2.5. The preformed fabric pad shall have a Shore A hardness of 90 ± 5.

02570.20 Testing - ~~The manufacturer shall have~~ Test all bearings except where lot testing is permitted. A lot is defined as 25 bearings per type and size. Where lot testing is required, previous test results on a typical bearing of equal or greater capacity is acceptable provided the data is no more than 2 years old. Test typical bearings either ~~tested and certified~~ by an independent testing laboratory, or ~~shall test a typical bearing with the test~~have the testing witnessed and attested to by an independent testing laboratory, for compliance with specified performance requirements as listed below. ~~Tests shall have been performed within five years before Award of the Contract.~~ Provide a test results certificate according to 00165.35 with the submittal of shop drawings. Perform the following tests:

(a) Clearance Test - Move the components of the bearing through their design displacements or rotations to verify that the required clearances exist. If the test is conducted on a rotational component which is not under simultaneous full vertical load, make allowance for the displacements which would be caused by that load.

(b) Long-Term Deterioration Test - Conduct test on one full scale bearing per lot. Load the bearing in compression to a stress corresponding to 100 percent of the maximum dead plus live service load while subjected to plus and minus the design rotational displacement amplitude for 5,000 cycles. Flat sliding systems shall be displaced through at least 1,000 cycles with an amplitude of at least ± 1.0 inch (2.0 inch peak to peak). The sliding may take place at up to 10.0 inch per minute, except when readings of the coefficient of friction are taken, at which time the sliding speed shall be 2.5 inches per minute.

Bearings will be rejected when:

- There are visible cracks, splits, or excessive wear on disassembly of the bearing.
- The coefficient of friction exceeds two-thirds the value used in design.

(c) Friction Test - Conduct test on one full scale bearing per lot. The coefficient of friction between the sliding surfaces shall not be greater than 0.06 when the maximum working stress for the polytetrafluoroethylene (PTFE) surface is 2,000 psi. It shall not be greater than 0.045 when the maximum working stress for the PTFE surface is above 3,000 psi. Determine the coefficient of friction at 68 °F according to the requirements of section 18.3.4.3.2 of the AASHTO LRFD Bridge Construction Specifications.

(~~b~~d) Proof Load Test:

(1) Vertical Proof Load Test - Apply a vertical load equal to 150~~%~~ percent of the vertical design capacity of the tested bearing for ~~a period of one hour.~~5 minutes, unload, then reapply for an additional 5 minutes. Place the bearing in a rotated position during the test. Rotation shall be 0.015 radians or the design rotation, whichever is greater. The test bearing shall show no indication of failure or other defects such as weld cracking, plate distortion, extrusion of the elastomer or bearing material, or displacement of the elastomer seal while under load or subsequently upon disassembly and inspection.

~~The bearing tested for vertical proof load shall have a vertical design capacity no more than 50% greater or no less than 50% smaller than the capacity of the required bearing.~~ The successful test of a bearing with a vertical design capacity of 50 tons or less will be accepted as qualification for all bearings of a similar design with a lesser design capacity.

(2) Horizontal Proof Load Test - A horizontal proof load test is required when the design horizontal capacity exceeds 10~~%~~ percent of the design vertical capacity and no engineer's calculations are submitted. Apply a horizontal load equal to 100~~%~~ percent of the horizontal design capacity while also applying a vertical load equal to 100~~%~~ percent of the dead load for a period of ~~two~~ 2 minutes. The bearing does not need to be in the rotated position. The bearing shall show no indication of failure or other defects such as weld cracking, plate distortion, extrusion of the elastomer or bearing material, or displacement of the elastomer seal while under load or subsequently upon disassembly and inspection.

The bearing tested for horizontal proof load may be either a bearing specified for use on the Project or a similar type bearing with both a vertical design capacity and a horizontal design capacity within 10~~%~~ percent of the design capacities of bearings specified for use on the Project.

~~(c)~~02570.30 Acceptance - For each composite bearing used in the structure, provide the manufacturer's quality compliance certificate according to 00165.35 that verifies the bearing has been manufactured according to the design of the tested bearing.

Section 02571 - Elastomeric Bearing Pads

Description

02571.00 Scope - This Section includes the requirements for plain and laminated elastomeric bearing pads.

Materials

02571.10 Elastomeric Compound - The elastomer portion of the elastomeric compound shall be 100~~%~~ percent virgin chloroprene (neoprene) meeting the requirements of section 18 of the AASHTO LRFD Bridge Construction Specifications including the properties from the following table:

Table 02571-1

Properties	ASTM Test Method	Requirements
Hardness, Durometer D	D 2240	60 ± 5
Tensile strength, min., psi	D 412	2,250
Ultimate elongation, min., %	D 412	350
Heat Resistance:		
Change in durometer hardness max. points after 70 hr. at 212 °F	D 2240	+ 15
Change in tensile strength, max. % after 70 hr. at 212 °F	D 573	- 15
Change in ultimate elongation, max. % after 70 hr. at 212 °F	D 573	- 40
Compressive set, max. % after 22 hr. at 212 °F	D 395 Method B	35
Adhesion: Bond made during vulcanization, lb/in	D 429 Method B	40
Tear Resistance, (psi)	D 624 Die C	180

02571.15 Metal Reinforcement - Metal reinforcement shall be rolled, mild steel sheets 14 gauge thick and conforming to ASTM A 1011, Grade 36 Type 1, or ASTM A 1008, Grade 40.

02571.20 Manufacturing Requirements:

(a) Pads - Pads 1/2 inch thick shall be all elastomer. Pads over 1/2 inch thick shall consist of alternate laminations of elastomer and metal.

In metal reinforced pads, the top and bottom layers shall be elastomer 1/4 inch thick, and interior elastomer layers shall be 1/2 inch thick. The nominal thickness of the bearing shown reflects the thickness of the elastomer only. It does not include the steel laminates.

(b) Laminations - Laminations of elastomer shall be of uniform thickness and in no case shall the thickness of an individual lamination exceed 5/8 inch. Variations in thickness of an individual elastomer lamination shall not exceed 1/8 inch and the variation in thickness of all elastomer laminations within a pad shall be such that each metal lamination shall not vary by more than 1/8 inch from a plane parallel to the top or bottom surface of the pad.

(c) Laminated Pads - Laminated pads shall be molded individually to the sizes required. No shearing to size or drilling of holes will be allowed. Cover all edges of metal laminations with a minimum of 1/8 inch, and a maximum of 1/4 inch, of elastomer except at laminate restraining devices and around holes that will be entirely closed when the pad is in place on the structure.

Clean the exposed edge voids in the pads caused by the steel laminate restraining devices with a solvent. Shop seal with an appropriate caulking material before shipment.

Sandblast and clean the steel laminates of all surface coatings such as grease, oil, rust and mill scale before bonding. Free the laminates of sharp edges and burrs.

Pads 1/2 inch in thickness may be sheared. The shearing shall not heat the material and shall produce a smooth finish to 250 microinches with no tears or jagged areas.

(d) Dimensional Tolerances and Finishes - See section 18 of the AASHTO LRFD Bridge Construction Specifications for fabrication tolerances.

Fabricate pads to meet flash tolerance, finish and appearance requirements given in the current edition of the Rubber Handbook, published by the Rubber Manufacturers Association, Inc., RMA F3 and T.063 for molded bearings and RMA F2 for extruded bearings.

02571.30 Laminated Bearing Pad Tests and Acceptance Criteria:

(a) General - Comply with additional test requirements of this subsection. Non-laminated bearing pads do not require these tests.

Independently test all completed bearings by compressive visual inspection according to 02571.30(b). Failure of individual bearings to pass the compressive visual inspection will be cause for rejection of those individual bearings.

Independently test five standard test specimens of laminated pads according to 02571.30(c). Failure of any individual specimen to meet the peel strength test requirements will be cause for rejection of the entire bearing production lot. A lot is defined as 50 or less bearings which are manufactured in a reasonably continuous manner from the same batch of elastomer, cured under the ~~dame~~same conditions, and are all the same size and type.

Replace rejected bearings with new acceptable bearings at no additional cost to the Agency. Provide the sample pad and perform all testing at no additional cost to the Agency.

Mark all bearings in indelible ink or flexible paint with the Contract number, lot number, date of manufacturer, and bearing identification number. Place the marking on a side face visible after erection of the bridge.

Clean and free the bearings of any foreign substances such as dust, grit and moisture before testing.

(b) Short-Duration Compression Test - Bring all bearings to a temperature of 73 °F ± 10 °F and proof load for a compressive loaded to 1.5 times the maximum design load. The load shall be held for ~~five~~ 5 minutes, removed, then reapplied for a second period of ~~five~~ 5 minutes. Maintain the load constant while the bearing is inspected for visual faults. The following will be cause for rejection:

- A bulging pattern or patterns implying lack of bond between the elastomer and the laminate or bulging patterns that imply improper laminate placement.
- Three separate surface cracks which are greater than 5/64 inch wide and 5/64 inch deep, or a single crack 3/16 inch deep or wider than 1/4 inch.

(c) Peel Strength Test - Perform a peel strength test according to ASTM D 429 Method B, with the exception that the specimens shall be taken randomly and cut from a production bearing submitted for the Project. The bond between the elastomer and steel laminate in each specimen shall be not less than 40 pounds per inch.

(d) Long Duration Compression Test - Perform long term duration compression tests according to the requirements of AASHTO LRFD Construction Specifications when steel reinforced elastomeric bearings are designed using Method B, or when using Grade 4 elastomer.

02571.31 Acceptance - Provide a quality compliance certification according to 00165.35 that the bearing pads conform to the requirements for materials, fabrication and testing. Provide a test result certificate according to 00165.35 that includes the manufacturer's and independent test results according to 02571.30(a).

Aggregates

Section 02610 - Special Filter Material

Description

02610.00 Scope - This Section includes the requirements for special filter material for backfilling or filling trenches for perforated drains and other subsurface drains.

Materials

02610.10 Special Filter Materials - Furnish a specially graded filter material of coarse sand, and crushed or uncrushed rock that meets the following requirements:

(a) Grading - Sieve analysis shall be determined according to AASHTO T 27. The material shall meet the following gradation requirements:

Sieve Size	Percent Passing (by Weight)
3/8"	100
No. 4	54 - 82
No. 10	34 - 56
No. 40	9 - 17
No. 100	0 - 3

(b) Sand Equivalent - Special filter material shall be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 25.

Section 02630 - Base Aggregate

Description

02630.00 Scope - This Section includes the requirements for aggregates in base.

Materials

02630.10 Dense-Graded Aggregate:

(a) Grading - Dense-graded base aggregate shall be crushed rock, including sand. Uniformly grade the aggregates from coarse to fine. Sieve analysis shall be determined according to AASHTO T 27. The aggregates shall conform to one of the grading requirements of Table 02630-~~-~~1 as identified in the Special Provisions or indicated by the pay ~~item(s)~~items in the Contract Schedule of Items.

Table 02630-1
Grading Requirements for Dense-Graded Aggregate
Separated Sizes

Sieve Size	2 1/2" - 0	2" - 0	1 1/2" - 0	1" - 0	3/4" - 0
			Percent Passing (by Weight)		
3"	100				
2 1/2"	95 - 100	100			
2"	–	95 - 100	100		
1 1/2"	–	–	95 - 100	100	
1 1/4"	55 - 75	–	–	–	
1"	–	55 - 75	–	90 - 100	100
3/4"	–	–	55 - 75	–	90 - 100
1/2"	–	–	–	55 - 75	–
3/8"	–	–	–	–	55 - 75
1/4"	30 - 45	30 - 45	35 - 50	40 - 55	40 - 60
No. ~~10~~	~~[1]~~	~~[1]~~	~~[1]~~	~~[1]~~	~~[1]~~
~~–~~	~~–~~	~~–~~	~~–~~	~~–~~	~~No. 10~~
~~[2]~~	~~[2]~~	~~[2]~~	~~[2]~~	~~[2]~~	

~~[1]~~ Report percent passing sieve when no grading requirements are listed
~~[2]~~ Of the fraction passing the 1/4 inch sieve, 40~~%~~ percent to 60~~%~~ percent shall pass the No. 10 sieve

(b) Fracture Of Rounded Rock - Fracture of rounded rock shall be determined according to AASHTO ~~TP 61~~T 335. Provide at least one fractured face based on the following percentage of particles retained on the 1/4 inch sieve for the designated size:

Minimum Percent of Fractured Particles
(by Weight of Material)

Designated Size	Retained on 1/4 inch Sieve
1 1/2" - 0 and larger	50
Smaller than 1 1/2" - 0	70

(c) Durability - Dense-graded aggregate shall meet the following durability requirements:

Test	Test Method	Requirements
Abrasion	AASHTO T 96	35.0% maximum
Degradation (coarse aggregate)		
Passing No. 20 sieve	ODOT TM 208	30.0% maximum
Sediment Height	ODOT TM 208	3.0" maximum

(d) Sand Equivalent - Dense-graded aggregate shall be tested according to AASHTO T 176, and shall have a sand equivalent of not less than 30.

02630.11 Open-Graded Aggregate:

(a) Grading - Open-graded aggregate shall conform to the following grading requirements:

Table 02630-2
Aggregate Gradation for Open-Graded Aggregate

Sieve Size	Percent Passing (by Weight)
1"	100
3/4"	80 - 98
1/2"	60 - 85
3/8"	30 - 65
No. 10	5 - 20
No. 40	0 - 6
No. 100	0 - 3 (Dry Sieve)

(b) Fracture of Rounded Rock - Fracture of rounded rock shall be determined according to AASHTO ~~TP 61~~T 335. Open-graded aggregate fracture requirements shall conform to the following:

Percentage of Fracture (by Weight)

Material Retained on 3/4", 1/2", and 1/4" Sieves (two fractured faces) 90
Material Retained on No. 10 Sieve (one fractured face) 75

(c) Durability - Open-graded aggregate shall meet the durability requirements of 02630.10(c).

Section 02640 - Shoulder Aggregate

Description

02640.00 Scope - This Section includes the requirements for shoulder aggregate.

Materials

02640.10 Aggregate:

(a) Grading - Shoulder aggregate shall be crushed rock, including sand. Sieve analysis shall be determined according to AASHTO T 27. Uniformly grade the aggregates from coarse to fine. The aggregates shall conform to one of the grading requirements of Table 02640-1 as identified in the Special Provisions or indicated by the pay item in the Contract Schedule of Items.

Table 02640-1
Grading Requirements - Shoulder Aggregates

	Separated Sizes	
	1" - 0	3/4" - 0
Sieve Size	Percent Passing (by Weight)	
1 1/2"	100	
1"	90 - 100	100
3/4"	–	90 - 100
1/4"	40 - 55	40 - 60

(b) Fracture of Rounded Rock - Fracture of rounded rock shall be determined according to AASHTO ~~TP 61~~T 335. Provide at least one fractured face based on the following percentage of particles retained on the 1/4 inch sieve for the designated size:

Minimum Percent of Fractured Particles
(by Weight of Material)

Designated Size	Retained on 1/4" Sieve
1 1/2" - 0 and larger	50
Smaller than 1 1/2" - 0	50

(c) Durability - The produced aggregates shall meet the following requirements:

Test	Test Method	Requirements
Abrasion	AASHTO T 96	35.0% maximum
Degradation (coarse aggregate)		
Passing No. 20 sieve	ODOT TM 208	30.0% maximum
Sediment Height	ODOT TM 208	3.0" maximum

(d) Sand Equivalent - Shoulder aggregate shall be tested according to AASHTO T 176, and shall have a sand equivalent of not less than 25.

Section 02690 - PCC Aggregates

Description

02690.00 Scope - This Section includes the requirements for coarse and fine aggregates for portland cement concrete.

Materials

02690.10 Materials - The Contractor may request approval to produce coarse and fine aggregates in sizes other than those stated in 02690.20 and 02690.30. The request shall be in writing, and shall state the proposed target value and specified tolerances for each of the individual sieve sizes of the materials the Contractor proposes to produce.

02690.20 Coarse Aggregate:

(a) General Requirements - Coarse aggregate shall consist of rock, or other approved inert material of similar characteristics having hard, strong, durable pieces free from adherent coatings.

(b) Harmful Substances - Harmful substances shall not exceed the following limits:

Test	Test Method ODOT	Test Method AASHTO	Percent (by Weight)
Lightweight Pieces		T 113	1.0
Material passing No. 200 sieve		T 11	1.0 ~~1~~*
Wood Particles	TM 225		0.05

~~1~~* For crushed aggregates, if the material finer than the No. 200 sieve consists of fracture dust, essentially free of clay or shale and is non-plastic, the percentage may be increased to 1.5~~%.~~ percent.

The materials shall be reasonably free from all other deleterious substances.

(c) Soundness - Coarse aggregates for concrete shall be tested for soundness using sodium sulfate salt, according to AASHTO T104. The weighted percentage loss shall not exceed 12~~%~~ percent by weight.

(d) Durability - Coarse aggregates shall meet the following durability requirements:

Test	Test Method ODOT	Test Method AASHTO	Requirements
Abrasion		T 96	30.0% Max.
Oregon Air Aggregate Degradation:			
Passing No. 20 sieve	TM 208		30.0% Max.
Sediment Height	TM 208		3.0" Max.

(e) PCC Paving Aggregate - In addition to requirements above, comply with the following:

(1) Fracture - Provide aggregate with at least two fractured faces on at least 50~~%~~ percent of the particles retained on the 3/8 inch, 1/2 inch, 3/4 inch, 1 inch, and 1 1/2 inch sieves, as determined by AASHTO ~~TP 61~~T 335.

(2) Elongated Pieces - Provide aggregate with elongated pieces not exceeding 10~~%~~ percent by weight of the material retained on the No. 4 sieve when tested according to ODOT TM 229 with the proportional caliper device set at a ratio of 5:1.

(f) Grading and Separation by Sizes for Prestressed Concrete - Sampling shall be according to AASHTO T 2 and sieve analysis shall be determined according to AASHTO T 27 and AASHTO T 11. PCC coarse aggregate shall conform to grading and separated sizes as follows:

(1) Where indicated in Table 02690-1, the coarse aggregate shall be separated into two sizes and each separated size shall be measured into the batch in the quantity determined by the mix design.

For each of the indicated maximum sizes of coarse aggregates, the separated sizes shall be as indicated in Table 02690-2:

Table 02690-1

Maximum Nominal Size of Aggregates	Separated Sizes
1"	1" - No. 4
3/4"	3/4" - No. 4
3/4"	3/4" - 1/2" and 1/2" - No. 4
3/4"	3/4" - 3/8" and 3/8" - No. 4

(2) The grading of each of the specified separated sizes of coarse aggregate shall conform to the following:

Table 02690-2

	Separated Sizes					
Sieve Size	**1" - No. 4**	**3/4" - No. 4**	**3/4" - 1/2"**	**3/4" - 3/8"**	**1/2" - No. 4**	**3/8" - No. 4**
	Percent Passing (by Weight)					
1 1/2"	100					
1"	90 - 100	100	100	100		
3/4"	50 - 80	90 - 100	85 - 100	85 - 100	100	100
1/2"	–	–	0 - 15	–	85 - 100	–
3/8"	15 - 40	20 - 50	–	0 - 15	35 - 65	85 - 100
No. 4	0 - 10	0 - 10	–	–	0 - 15	0 - 15
No. 200	[1]	[1]	[1]	[1]	[1]	[1]

[1] See 02690.20(b)

(g) Grading and Separation by Sizes for Other Concrete - Sampling shall be according to AASHTO T 2. Sieve analysis shall be according to AASHTO T 27 and AASHTO T 11. Provide aggregates meeting the gradation requirements of Tables 02690-3 and 02690-4 for structural concrete on projects with more than 100 cubic yards of concrete. Provide a CAgT to perform sampling and testing when required.

~~Table 02690-3~~

~~Gradation of Coarse Aggregates~~

Table 02690-3

Gradation of Coarse Aggregates

Sieve Size	Combined ~~[1]*~~ Sizes 1 1/2" - No. 4	Separated Sizes 1 1/2" - 3/4"	Separated Sizes 1" - No. 4	Separated Sizes 3/4" - 1/2"
	Percent Passing (by Weight)			
2"	100	100		
1 1/2"	95 - 100	90 - 100	100	
1"	–	20 - 55	95 - 100	100
3/4"	35 - 70	0 - 15	–	85 - 100
1/2"	–	–	25 - 60	0 - 15
3/8"	10 - 30	0 - 5	–	–
No. 4	0 - 5	–	0 - 10	–
No. 8	–	–	0 - 5	–

~~[1] For 1 1/2 inch coarse aggregate use two or more separated sizes which when combined shall meet the gradation limits for 1 1/2" - No. 4~~

~~Table 02690-4~~

~~Gradation of Coarse Aggregates~~

~~ted Sizes - 3/8"~~ ~~Separated or Combined Sizes 3/4" - No. 4~~ ~~Separated Sizes 1/2" - No. 4*~~ For 1 1/2 inch coarse aggregate use two or more separated sizes whic when combined shall meet the gradation limits for 1 1/2" - No. 4

Table 02690-4

Gradation of Coarse Aggregates

Sieve Size	Separated Sizes 3/4" - 3/8"	Separated or Combined Sizes 3/4" - No. 4	Separated Sizes 1/2" - No. 4	Separated Sizes 3/8" - No. 8
	Percent Passing (by Weight)			
1"	100	100		
3/4"	90 - 100	90 - 100	100	
1/2"	20 - 55	–	90 - 100	100
3/8"	0 - 15	20 - 55	40 - 70	85 - 100
No. 4	0 - 5	0 - 10	0 - 15	10 - 30
No. 8	–	0 - 5	0 - 5	0 - 10
No. 16	–	–	–	0 - 5

02690.30 Fine Aggregates:

(a) General Requirements - Fine aggregate shall consist of natural or crushed aggregates or other inert material consisting of hard, strong, durable particles and conforming to a specified grading.

(b) Different Sources - Do not mix fine aggregates from different sources of supply, or store in the same pile. Do not use alternately in the same class of mix, without prior approval.

(c) Harmful Substances - The amount of harmful substances shall not exceed the following limits:

Test	Test Method (AASHTO)	Percent (by Weight)
Lightweight Pieces	T 113	2.0%
Material passing No. 200 Sieve [1]*	T 11	4.0% [1]*

[1]* If this material consists of fracture dust, essentially free of clay and non-plastic, the percentage may be increased to 6.0%. percent.

The material shall also be reasonably free from all other harmful substances, such as shale, alkali, mica, coated grains, and soft and flaky particles.

(d) Soundness - Fine aggregate shall be tested for soundness using sodium sulfate salt, according to AASHTO T 104. The weighted percentage loss shall not exceed 10% percent by weight.

(e) Organic Impurities - All fine aggregate shall meet the requirements of AASHTO M 6 for organic impurities.

(f) Sand Equivalent - Fine aggregate shall be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 68.

(g) Sand For Mortar - Sand for mortar shall conform to the requirements of this Section.

(h) Grading - Sampling shall be according to AASHTO T 2. Sieve analysis shall be determined according to AASHTO T 27 and AASHTO T 11. Provide aggregates meeting the gradation requirements of Table 02690-5 for structural concrete on projects with more than 100 cubic yards of concrete, and all prestressed concrete. Provide a CAgT to perform sampling and testing when required.

Table 02690-5

Gradation of Fine Aggregate [1]

Table 02690-5

Gradation of Fine Aggregate [1]

Sieve Size	Percent Passing (by Weight)
3/8"	100
No. 4	90 - 100
No. 8	70 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	5 - 30
No. 100	0 - 10
No. 200	0.0 - 4.0 [2]

[1] Determine the fineness modulus according to AASHTO T 27 and AASHTO T 11. Maintain the fine aggregate fineness modulus within plus or minus 0.20 from the fineness modulus used in the Contractor'sContractor's mix design. Fine aggregates in which the fineness modulus varies by more than 0.20 from the mix design target shall be

rejected unless an adjustment in the aggregate proportions is performed by a CCT according to the provisions of ACI 211.

[2] For manufactured sand, where the material passing No. 200 is non-plastic rock dust crusher fines, the specification limits may be increased to 6~~%.~~ percent.

Section 02695 - Reclaimed Glass (Mixed Waste Cullet)

Description

02695.00 Scope - This Section includes the requirements for reclaimed glass (mixed waste cullet) as a substitute for aggregates.

Materials

02695.10 Mixed Waste Cullet - Cullet shall be 1/2" - 0. It shall be clean, hard, and durable. Not more than 5~~%~~ percent by weight shall pass a No. 200 sieve.

The maximum debris level shall be 10~~%~~ percent except as noted below. Debris is defined as any deleterious material that impacts the performance of the backfill. Percent of debris shall be estimated.

02695.20 Cullet Applications:

Use	Maximum Cullet Content (%)	Maximum Debris Level (%)	Minimum Compaction Level (%)
Nonstructural Fill	100	10	90

02695.41 Hauling and Placing - Transport the cullet to the Project Site, add water to obtain the proper moisture content, and place in the trench by means acceptable to the Engineer, in loose lifts of 8 inches or less.

02695.43 Compacting and Shaping - Compact each layer of material by steel wheel vibratory rollers or as directed.

02695.50 Testing - The Engineer will check gradation and density by laboratory or field testing as deemed appropriate. Impurities will be checked visually by sampling a specimen of processed cullet with a weight of approximately 1/2 pound.

Railing and Guidance Devices

Section 02810 - Bridge Rail

Description

02810.00 Scope - This Section includes the requirements for the steel in railings for bridges.

Materials

02810.10 Shapes, Plates, and Bars - Shapes, plates and bars shall comply with ASTM A 36.

The silicon content of all exposed shapes, plates and bars that are called out on drawings as "Galvanize - Control Silicon", shall be according to 02530.70.

02810.20 Structural Steel Tubing - Structural steel rail members shall comply with ASTM A 500, Grade B, or ASTM A 501. Steel conforming to ASTM A 513 or ASTM A 618 may be substituted for ASTM A 500 tubing subject to the following limitations:

- Provide chemical and tensile properties test results.
- Silicon content shall be according to 02530.70.
- Strength and elongation requirements of ASTM A 513 tubing shall meet the requirements of ASTM A 500 tubing.

02810.30 Steel Pipe - Metal parapet rail members shall be standard steel pipe complying with ASTM A 53, Grade B or ASTM A 500, Grade B.

02810.40 Cast Steel Posts - Cast steel posts shall be carbon steel castings complying with AASHTO M 103 (ASTM A 27), Grade 65-35.

02810.50 Metal Thrie Beam Rail - Galvanize steel thrie beam rail according to AASHTO M 180, Class A rail, Type II coating after fabrication and subject to the single spot test. Backup plates will be accepted with ungalvanized edges and bolt holes, provided these areas are field-coated with an approved galvanizing substitute according to 02530.71. Metal posts and hardware shall meet the requirements of 02820.20 and 02820.30.

02810.60 Incidentals - Plates, caps and miscellaneous pieces necessary to complete the rail shall be as shown or specified.

02810.70 Acceptance - Bridge rail materials will be accepted according to 00165.35 and this Section.

Section 02820 - Metal Guardrail

Description

02820.00 Scope - This Section includes the requirements for forming galvanized steel sheets into metal beam rail, and the manufacture of guardrail hardware.

Materials

02820.10 Metal Beam Rail - Form metal beam rail from galvanized steel. Galvanized steel beam rail shall conform to the requirements of AASHTO M 180, Class A. The zinc coating shall conform to the requirements of AASHTO M 180, Type II, applied after fabrication and subject to the single spot test. Backup plates will be accepted with ungalvanized edges and boltholes, provided these areas are field-coated with an approved galvanizing substitute.

02820.20 Metal Guardrail and Median Barrier Posts - Metal posts shall be of structural steel conforming to the requirements of ASTM A 36 and galvanized according to AASHTO M 111 (ASTM A 123).

02820.30 Guardrail Hardware - All bolts, nuts, washers and other fittings for beam type guardrail shall be galvanized steel meeting the requirements of AASHTO M 180.

All bolts, nuts, and washers shall be as detailed, with nuts tapped oversize not to exceed 1/32 inch.

02820.40 Guardrail Anchor Hardware - Provide cable and fittings for guardrail anchors that conform to the requirements of AASHTO M 30, Class C, for Type II cable. Galvanize all fittings according to AASHTO M 111 (ASTM A 123).

For steel anchors, the steel tubing shall meet the requirements of ASTM A 500, Grade B, ASTM A 501 or ASTM A 618. The soil plate shall meet the requirements of ASTM A 36. After fabrication galvanize tubing and plate according to AASHTO M 111 (ASTM A 123).

02820.50 Acceptance of Materials - Manufacturing plants may be inspected periodically for compliance with specified manufacturing methods, and material samples obtained for laboratory testing for compliance with materials quality requirements. This may be the basis for acceptance of manufacturing lots as to quality.

Acceptance of metal guardrail materials will be according to Section 00165.35 and this Section.

Section 02830 - Metal Handrail

Description

02830.00 Scope - This Section includes the requirements for the steel in handrail for ~~bridges and~~ stairways and pedestrian facilities.

Materials

02830.10 Shapes, Plates, and Bars - Shapes, plates, and bars shall ~~comply with~~conform to ASTM A 36.

~~The silicon content of all exposed shapes, plates and bars that are called out on drawings as "Galvanize - Control Silicon", shall be according to 02530.70.~~

Punch anchor plate bolt holes at the locations shown before fabrication.

02830.20 Steel Pipe - Steel pipe ~~used for handrail members~~shall conform to ASTM A 500, seamless, Grade B.

02830.21 Steel Tube - Steel tube shall ~~comply with ASTM A 53 or~~ conform to ASTM A 500, seamless, Grade B.

02830.22 Fasteners - Fasteners shall meet the requirements of Section 02560. Machine screws shall be SAE 18-8 stainless steel.

02830.30 Galvanizing - Hot-dip galvanize all handrail components according to AASHTO M 111 (ASTM A 123) after shop fabrication.

02830.31 Repair of Hot-Dip Galvanizing - Repair damaged hot-dip galvanizing according to ASTM A 780 and ASTM A 123. Minimum zinc content for Method A2 is 94 percent on the dry film.

02830.40 Incidentals - Plates, caps, and miscellaneous pieces necessary to complete the rail shall be as shown.

02830.~~40~~50 Acceptance - Acceptance of handrail materials will be according to 00165.35 and this Section.

Illumination and Traffic Control Materials

Section 02910 - Sign Materials

02910.00 Scope - This Section includes the requirements for backing, sheeting, legend, reflectors, and hardware for sign installations.

02910.02 Types of Signs - Traffic signs are classified by sign type as follows:

"B" Blue Type III or Type IV sheeting background with silver-white Type III or Type IV permanent or removable legend, or silver-white Type III or Type IV sheeting overlaid with blue transparent paste background with retroreflective silver-white screened legend.

"B1" Blue Type I sheeting background with silver-white Type III or Type IV permanent or removable legend, with retroreflective silver-white screened legend.

"B2" Blue Type III or Type IV sheeting background with white Type ~~VII or Type~~ IX permanent removable legend.

"B3" Blue Type IX sheeting background with white ~~Type VII or~~ Type IX permanent or removable legend or white Type IX sheeting overlaid with blue transparent paste background, with retroreflective silver-white screened legend.

"C" Brown Type III or Type IV sheeting background with silver-white Type III or Type IV permanent or removable legend, or silver-white Type III or Type IV sheeting overlaid with brown transparent paste background with retroreflective silver-white screened legend.

"C1" Brown Type III or Type IV sheeting background with white Type ~~VII or Type~~ IX permanent or removable legend.

"C2" Brown Type IX sheeting background with white ~~Type VII or~~ Type IX permanent or removable legend or white Type IX sheeting overlaid with brown transparent paste background, with retroreflective silver-white screened legend.

"F" Silver-white Type III or Type IV sheeting background overlaid with red and blue transparent paste background with retroreflective silver-white screened legend or silver-white Type III or Type IV permanent legend.

"F1" White Type IX sheeting background overlaid with red and blue transparent paste background with white Type ~~VII or Type~~ IX permanent legend.

"G" Green Type III or Type IV sheeting background with silver-white Type III or Type IV permanent or removable legend, or silver-white Type III or Type IV sheeting background overlaid with green transparent paste background with retroreflective silver-white screened legend.

"G1" Green Type III or Type IV sheeting background with white Type ~~VII or Type~~ IX removable legend.

"G2" Green Type III or Type IV sheeting background with white Type ~~VII or Type~~ IX permanent legend.

"G3" Green Type IX sheeting background with white ~~Type VII or~~ Type IX permanent legend, or white Type IX sheeting background overlaid with green transparent paste background with retroreflective silver-white screened legend.

"G4" Green Type IX sheeting background with white~~ Type VII or~~ Type IX removable legend.

"O" Orange Type I sheeting background with black nonreflective permanent or removable legend.

"OO" Orange Type III or Type IV sheeting background with black nonreflective permanent or removable legend.

"O3" Fluorescent orange Type ~~VII, Type~~ VIII~~, Type IX,~~ or Type ~~X~~IX sheeting background with black nonreflective permanent legend and red retroreflective symbol (Stop or Yield Ahead Symbol Sign).

"O4" Fluorescent orange Type ~~VII, Type~~ VIII~~, Type IX,~~ or Type ~~X~~IX sheeting background with black nonreflective permanent legend.

"O5" Fluorescent orange Type ~~VII, Type~~ VIII~~, Type IX~~ or Type ~~X~~IX sheeting background with black nonreflective removable legend.

"O6" Fluorescent orange Type VIII or Type IX sheeting background with black nonreflective permanent legend and red, yellow, and green Type VIII and Type IX circles. (Signal Ahead Symbol Sign)

"O8" Fluorescent orange Type VIII or Type IX sheeting background with black nonreflective screened or cut-out permanent legend and silver-white Type VIII or Type IX symbol. (Speed Reduction Symbol Sign)

"R" Silver-white Type III or Type IV sheeting background overlaid with red transparent paste background with silver-white Type III or Type IV permanent legend. (Stop Sign, Wrong~~-~~-Way, Do Not Enter.)

"R1" White Type IX sheeting background overlaid with red transparent paste background with white Type ~~VII or Type~~ IX permanent legend.

"R2" Silver-white Type III or Type IV sheeting background overlaid with screened red transparent paste triangle and legend or red Type III or Type IV triangle and permanent legend. (Yield Sign)

"R3" White Type IX sheeting background overlaid with screened red transparent paste triangle and permanent legend.

"R4" Rubber STOP flap made of natural rubber with a red background and white lettering.

"W1" Silver-white Type III or Type IV sheeting background with black nonreflective screened, cut-out permanent or removable legend.

"W2" Silver-white Type III or Type IV sheeting background with a screened black nonreflective legend overlaid with a screened red transparent paste circle and continuous diagonal bar. (Prohibition)

"W3" Silver-white Type III or Type IV sheeting background with transparent brown screened legend or brown Type III or Type IV cut-out permanent legend.

"W4" Silver-white Type III or Type IV sheeting background with transparent red screened legend or red Type III or Type IV cut-out permanent legend.

"W5" Silver-white Type III or Type IV sheeting background with transparent green screened legend or green Type III or Type IV cut-out permanent legend.

"W6" White Type IX sheeting background with a screened or cut-out black nonreflective legend overlaid with a screened red transparent paste circle and continuous diagonal bar. (Prohibition sign overhead)

"W7" White Type IX sheeting background with black nonreflective screened or cut-out permanent legend.

"W8" Silver-white Type III or Type IV sheeting background with blue transparent screened legend or blue Type III or Type IV cut-out permanent legend.

"W9" Silver-white Type III or Type IV sheeting background with ~~fluorescent orange Type IX border and OTIA logo permanent legend. Lower legend is black~~blue nonreflective screened or cut~~-~~-out permanent legend~~.~~

"W10" White Type IX sheeting background with black nonreflective removable legend.

"W11" Silver-white Type III or Type IV sheeting background with black nonreflective screened or cut-out permanent legend with red Type III or Type IV symbol.~~ (Bicycle Stop or Bicycle Yield symbol signs)~~

"W12" Silver-white Type III or Type IV sheeting background with transparent green screened legend or green Type III or Type IV cut-out permanent legend with blue Type III or Type IV symbol.

"Y1" Yellow Type III or Type IV sheeting background with black nonreflective screened, cut-out permanent or removable legend.

"Y2" Yellow Type III or Type IV sheeting background with a screened or cut-out black nonreflective legend and red and green Type III or Type IV circles. The center yellow circle part shall be part of the background sheeting. (Signal Ahead Symbol Sign)

"Y3" Yellow Type IX sheeting background with black nonreflective screened, cut-out permanent or removable legend.

"Y4" Yellow Type III or Type IV sheeting background with black nonreflective screened or cut-out permanent legend and red Type III or Type IV symbol. (Stop or Yield Ahead Symbol Sign)

"Y5" Fluorescent yellow Type IX sheeting background with black nonreflective screened cut-out permanent legend, or removable legend.

"Y6" Fluorescent yellow Type IX sheeting background with black nonreflective screened or cut-out permanent legend and red and green Type IX circles. The center yellow circle shall be part of the background sheeting. (Signal Ahead Symbol Sign overhead)

"Y7" Fluorescent yellow Type IX sheeting background with black nonreflective screened or cut-out permanent legend and red Type ~~VII or Type~~ IX symbol. (Stop or Yield Ahead Symbol Sign)

"Y8" Yellow Type III or Type IV sheeting background with black nonreflective screened or cut-out permanent legend and silver-white Type III or Type IV symbol. (Speed Reduction Symbol Sign)

"YG" Fluorescent yellow-green Type IX sheeting background with black non-reflective legend or cut-out permanent legend.

"YGW" Fluorescent yellow-green Type IX sheeting background with black nonreflective screened or cut-out permanent legend and silver-white Type III or Type IV symbol with black nonreflective screened or cut-out permanent legend and red Type III or Type IV symbol. (In-Street Pedestrian Crossing Symbol Sign)

"YW" Yellow Type III or Type IV sheeting background with black nonreflective screened or cut-out permanent legend, and white Type III or Type IV sheeting background with black nonreflective screened or cut-out permanent legend and red Type III or Type IV symbol.

02910.10 Aluminum - The aluminum materials shall be new and conform to the following requirements:

Aluminum Bars or Rods ..... ASTM B 211
Aluminum Sand Castings ..... ASTM B 26
Aluminum Sheet ..... ASTM B 209
Extruded Aluminum Shapes ..... ASTM B 221
Rolled or Extruded Structural Shapes ..... ASTM B 308

Aluminum to be color coated shall be of an alloy which is compatible with the coating and the application process. The color-coated aluminum shall have a temper that, after coating and aging, provides an ultimate strength of 30,000 psi and a yield strength of 25,000 psi.

Fabricate sheet aluminum signs from aluminum alloy 6061-T6, 5052-H38, 5154-H38, or approved equal~~, and give~~. Give a chromate treatment conforming to ASTM B 449, Class 2 or a titanium-based coating according to ASTM B 921. Provide certified test reports for all heats of aluminum products furnished to the Agency. Signs shall be of the thickness shown on Table 02910-1 unless otherwise indicated.

Table 02910-1

Sign Width (Horizontal Measure)	Sheet Aluminum Thickness
Less than 20"	0.063"
20" through 30"	0.080"
31" through 48"	0.100"
Over 48"	0.125"

02910.11 Plywood:

(a) General - Construct all plywood signs for permanent signing from 3/4 inch high-density overlay plywood. Construct plywood signs for temporary signs from either 3/4 inch high-density overlay plywood or 3/4 inch medium-density overlay plywood. Plywood shall be Douglas fir plywood, Grade B-B exterior or better, conforming to "Product Standard PS-1 for Douglas Fir Plywood" published by the U. S. Department of Commerce.

(b) Overlay - High-density and medium-density overlay shall be black or buff unless otherwise shown or specified. High-density and medium-density overlay shall conform to "Product Standard PS-1 for Douglas Fir Plywood".

(c) Plywood Sealer - Fill all voids in top or sides of panel with caulking compound after cutting plywood to size. Apply an approved plywood edge sealer tinted to match the color of the panel overlay material. The sealer shall be a medium oil alkyd primer.

02910.20 Reflective and Retroreflective Sheeting:

(a) General - Use reflective sheeting Type I and retroreflective sheeting Type III, Type IV, Type ~~VII, Type~~ VIII, ~~Type IX,~~ and Type ~~X~~IX from the QPL and the following:

(1) Perforation - If required for application, the sheeting may be pre-perforated with holes not greater than 0.02 inch in diameter. The perforations shall be approximately 0.4 inch apart in rows approximately 1.5 inches apart.

(2) Surface - The sheeting and adhesive shall be compatible with non-reflective permanent cut-out legend.

(b) Acceptance - Furnish a quality compliance certification according to 00165.35, certifying that the reflective sheeting furnished meets the above requirements.

02910.21 Nonreflective Sheeting for Sign Background:

(a) General - The nonreflective sheeting shall be durable, weather resistant, gloss plastic film, and shall have a protected, precoated adhesive backing.

(b) Color - Color of the nonreflective sheeting shall conform to 00940.02. Submit for testing a 4 inch by 4 inch sample of the background color for each color of nonreflective sheeting shown.

(c) Adhesive - Adhere the nonreflective sheeting by a mildew and vandal resistant precoated adhesive that has no staining effect on the sheeting.

(d) Film:

(1) General - The nonreflective sheeting shall be flexible and easily cut to shape. The minimum tensile strength of the sheeting shall be 5 pounds per inch width.

(2) Surface - The sheeting surface shall be smooth and flat, to facilitate cleaning and wet performance. The sheeting surface shall be readily processed and compatible with recommended transparent and opaque process inks.

The sheeting shall permit cutting and color processing at minimum temperatures of 60 °F. The sheeting shall be heat resistant and shall permit force curing of applied sheeting at temperatures up to 150 °F. The sheeting surface shall be solvent resistant. Clean according to the manufacturer's recommendations.

(e) Durability - Process and apply according to the ~~manufacturer's~~manufacturer's recommendations. The material shall be weather resistant, and following cleaning shall show no discoloration, cracking, crazing, blistering or dimensional change.

The sheeting surface shall be capable of being readily refurbished when cleaned and clear over-coated according to the ~~manufacturer's~~manufacturer's recommendations.

(f) Acceptance - Furnish a quality compliance certificate according to 00165.35, certifying that the nonreflective sheeting furnished meets all the above requirements.

02910.32 Retroreflective Removable Legend:

(a) General - The letters and numerals for all removable legend shall conform to the design of the FHWA "Standard Rounded Capital Letter Alphabets". The letters and numerals for removable legend for all freeway and expressway signs shall conform to the design of Series "E" modified from the FHWA "Standard Rounded Capitol Letter Alphabets".

Provide mounting holes within the frames to permit the use of the mounting hardware specified in these Specifications. Provide a sufficient number of mounting holes to ensure a firm attachment of the frames to the sign and meet the requirements of 00940.45(b). This requires a minimum of four mounting holes at each joint in the border.

(b) Retroreflective Sheeting Legend - The silver-white or white letters, numerals, symbols and borders shall be of adhesive-coated retroreflective sheeting permanently adhered to a flat aluminum frame. The white retroreflective sheeting shall consist of Type ~~VII or Type~~ IX sheeting conforming to 02910.20. The silver-white retroreflective sheeting shall consist of Type III or Type IV sheeting conforming to 02910.20.

Letters, numerals, symbols and borders shall be a minimum of 0.032 inch thick aluminum conforming to ASTM B 209, alloy 3003-H14. Degrease and etch the aluminum, or treat with a light, tight amorphous chromate type coating.

Apply the reflective sheeting to the prepared aluminum according to the sheeting ~~manufacturer's~~manufacturer's recommendations.

The finished letters, numerals, symbols and borders shall be clean-cut and sharp, and shall have a nearly plane surface.

(c) Acceptance - Acceptance of retroreflective removable legend shall be a mill test certificate from the aluminum manufacturer attesting to the correct alloy, temper, and material thickness of the metal supplied. The Engineer may reject damaged or non-specification materials regardless of the test certification furnished.

02910.33 Permanent Legends:

(a) General - Permanent legends consist of silver-white retroreflective screened, red retroreflective screened, black screened or cut-out silver-white retroreflective sheeting. The letters and numerals of all permanent legends shall conform to the design of the FHWA "Standard Rounded Capital Letter Alphabets".

(b) Retroreflective White Screened Legend - The transparent paste materials used for the reverse screening of retroreflective white legends and for the screening of retroreflective red legends shall conform to the recommendations of the manufacturer of the reflective sheeting.

(c) Retroreflective Cut-out Legend - The material used for retroreflective cut-out legend shall conform to the requirements of 02910.20.

(d) Nonreflective Black Screened Legend - ~~The~~Furnish screen process ink for nonreflective legends ~~shall be Naz-Dar 811 Black Screen Process Ink (Naz-Dar Company), Sherwin Williams Kem Screen Process, color D22-B2 (Sherwin Williams Company), or approved equal~~from the QPL.

(e) Nonreflective Black Cut-out Legend - The material used for nonreflective cut-out legend shall conform to 02910.21.

02910.40 Hardware - The bolts, nuts, and washers used to fabricate and erect signs shall be aluminum alloy, stainless steel, or galvanized steel. Aluminum for bolts and nuts shall conform to ASTM B 211, alloys 2024-T4 or 6061-T6 as the Contractor elects. Aluminum washers shall conform to ASTM B 209, alloy Alclad 2024-T4. Stainless steel shall be Type 316. Galvanized steel bolts, nuts, and washers shall be medium carbon steel. Galvanize steel hardware according to AASHTO M 232 (ASTM A 153).

Use nylon washers supplied by the sheeting manufacturer as shown or directed.

All mounting hardware shall be of the design and type shown, or if not shown shall be of such sizes and kinds as approved by the Engineer.

Blind rivets shall be 1/8 inch diameter, 1/4 inch head diameter, domed head, aluminum alloy conforming to ASTM B 316. Aluminum alloys 5052 and 5056 are acceptable alloys. Blind rivets used to attach sign panels to closure strips or wind beams shall be anodized the same color as the sign background.

02910.60 Electronically Cuttable Films for Use on Retroreflective Sheeting:

(a) General - Electronically cuttable films shall consist of durable, transparent, colored films coated with a transparent pressure sensitive adhesive protected by a removable liner. The films shall be designed to be cut on knife-over-roll (sprocket fed or friction fed) and flat bed electronic cutting machines. The films shall be available in standard traffic colors, be dimensionally stable, and be designed to optimally cut, weed, lift and transfer. Use electronically cuttable films from the QPL.

(b) Acceptance - If requested, furnish with each lot or shipment a quality compliance certificate according to 00165.35, certifying that the material supplied is an acceptable product on the QPL.

02910.75 Manufacturer's Warranty - Furnish a Warranty, for Warranty periods stated below, from the Manufacturer and signed by a Manufacturer's Representative, conforming to the following requirements:

For retroreflective Type III~~, Type IV,~~ and Type ~~VII~~IV sheeting used for permanent signs, provide a Warranty, for a Warranty period of 10 years, for restoring sign panels and replacing sheeting if the sheeting has failed as defined below.

For retroreflective Type IX sheeting used for permanent signs, provide a Warranty, for a Warranty period of 12 years, for restoring sign panels and replacing sheeting if the sheeting has failed as defined below.

For retroreflective sheeting used for temporary signs, provide a Warranty, for a period of 3 years, for restoring sign panels and replacing sheeting if the sheeting has failed as defined below.

For purposes of the Warranty, the retroreflective sheeting will be deemed to have failed if it has deteriorated due to conditions inherent to the sheeting (including inks, overlay film, and electronic cuttable film) to the extent that:

- The sign shows discoloration, cracking, delamination, loss of adhesion, or
- The coefficient of retroreflection is less than the following:

- 80~~%~~ percent of minimum coefficient of retroreflection for designated sheeting or cuttable film according to ASTM D 4956 for the first 7 years of the Warranty period.
- 70~~%~~ percent of minimum coefficient of retroreflection for designated sheeting or cuttable film according to ASTM D 4956 for the remaining 3 years of the Warranty period for Type III~~, Type IV,~~ and Type ~~VII~~IV sheeting and remaining 5 years of the Warranty period for Type IX sheeting.

All coefficient of retroreflection measurements will be made after signs are cleaned according to the ~~Manufacturer's~~Manufacturer's recommendation.

The Warranty shall recite that, upon written notification by the Agency that the supplied sheeting or supplied sheeting with applied cuttable film, used according to the Manufacturer's recommendations, has failed, the Manufacturer shall repair or replace the sheeting, or sheeting with applied electronic cuttable film, within 6 months of the written notification according to the following:

- During the first ~~seven~~ 7 years, the Manufacturer shall restore the sign panel to a condition that meets the remaining warranty conditions at no cost to the Agency (100~~%~~ percent full replacement covering all material and labor costs).
- For the remaining ~~three~~ 3 years, (~~five~~ 5 years for Type IX sheeting) the Manufacturer shall furnish replacement sheeting required to restore the sign panel to a condition that meets the remaining warranty conditions at no cost to the Agency (100~~%~~ percent sheeting replacement).

When the Agency makes written notification to the Manufacturer of sheeting failure, the Warranty period will stop for the effected signs until required repairs or replacements are made and accepted.

All repaired or replaced signs and sheeting shall meet current sheeting specifications and be warranted for the remaining Warranty period.

The Agency will date all approved signs at the time of inspection at the Agency's material laboratory. That date is the start of the Warranty period.

Applicable warranties for sign sheeting shall be turned over to the Agency. The Agency shall be named oblige on all manufacturer's warranties. The warranty document shall have an identifying document number assigned to it that is unique to the project that it is submitted for, such that warranty claims can be processed under a specific document number. The warranty document shall be dated to reflect the date that the document is submitted to the Agency for approval.

Section 02920 - Common Electrical Materials

Description

02920.00 Scope - This Section includes the requirements for common electrical systems.

Materials

02920.01 Materials - Where shown or specified, furnish and install hardware that is hot-dip galvanized or Type 304 or 316 stainless steel screws, bolts, nuts, and washers.

02920.02 Powder Coating - Powder coat materials according to Section 00593.

02920.10 Metal Conduit - Furnish metal conduit meeting the following requirements:

- **Rigid Metal Conduit** - Galvanized rigid metal manufactured of mild steel conforming to UL 6, Rigid Metal Electrical Conduit.

- **Liquid-Tight Flexible Metal Conduit** - Liquid-tight, nonmetallic, sunlight resistant outer jacket over an inner flexible metal core. Conduit shall conform to UL 360 Liquid-Tight Flexible Steel Electrical Conduit.

02920.11 Nonmetallic Conduit - Furnish nonmetallic conduit meeting the following requirements:

- **Rigid Nonmetallic Conduit** - Heavy wall, extruded, rigid polyvinyl chloride (PVC) conforming to UL 651, Schedule 40 or 80 Rigid PVC Conduit as shown.

- **Liquid-Tight Flexible Nonmetallic Conduit** - Meet the requirements of Article 351 of the NEC and shall be ~~UL~~UL1660 listed.

- **High Density Polyethylene Conduit (HDPE)** - SDR15 (Schedule 40) equivalent minimum conforming to UL651B. The conduit shall lay flat when unwound.

- **Rigid Nonmetallic Fiberglass Conduit** - Schedule 40 or Schedule 80 reinforced thermosetting resin conforming to UL1684.

02920.12 Conduit Fittings - Furnish conduit fittings meeting the following requirements:

- **Expansion Fittings** - Weatherproof, hot dip galvanized malleable iron expansion head and body. Where the plans do not specify an equipment grounding wire in the conduit run, furnish fittings with external bonding jumpers. The expansion fitting shall permit a 4 inch conduit movement minimum.

- **Condulets** - Hot-dip galvanized malleable iron conduit body with corrosion resistant cover and moisture proof gasket.

- **Metallic Bushings** - Galvanized steel or die cast zinc with insulated throat. Include a bonding lug if required.

- **Nonmetallic Bushings** - PVC push on end bell style.

- **Conduit Hub** - Hot-dip galvanized malleable iron screw-on style with neoprene "O" ring.

- **HDPE Fittings** - Factory mechanical HDPE coupling with individual reverse locking threads and built in center stop meeting the requirements of ASTM F 2176.

02920.13 Underground Marking Tape - Provide underground marking tape that is red polyethylene film, 6 inches wide, 4 mils thick minimum, and imprinted with the following or similar legend:

"CAUTION CAUTION CAUTION BURIED ELECTRIC LINE"

02920.14 Junction Boxes:

(a) General - Junction ~~box~~boxes and covers in vehicle traffic areas shall be rated for AASHTO H-20 highway loading. Surface-mounted boxes shall have overlapping covers.

Junction boxes and covers in incidental vehicle traffic areas shall be rated Tier 22 for the box and Tier 15 for the lid according to ANSI/SCTE 77-2010.

Junction box covers shall have the legend "SIGNALS", "STREET LIGHTING", etc stamped or embossed on the cover as appropriate. Letter size shall be no smaller than 1/16 of the box width.

(b) Metal Junction Boxes - Construct boxes of cast iron or 1/8 inch nominal welded sheet steel. Make covers from reinforced non-slip steel plate. Hot-dip galvanize boxes and covers after fabrication according to AASHTO M 232 (ASTM A 153). Each box shall have a cover gasket that will, with cover in place, form a NEMA 4 watertight fit. Provide covers with stainless steel hex-head cap screws. Recess screw heads in the cover.

Recessed covers shall fit the box so that when the cover is set in the box, the top of the cover shall be even with the top of the box, with not more than a 1/8 inch gap between any part of the top edge of the cover and the inside lip edge of the box.

Flush-mounted boxes shall be outside-flanged with recessed, checkered steel covers.

(c) Concrete Junction Boxes - Concrete junction boxes and covers shall be precast concrete, water meter type. ~~Covers shall be capable of withstanding a load of 15,000 pounds over a 10 inch by 10 inch square surface.~~ Covers shall have a skid-resistant surface, and bolt to the junction box with recessed stainless steel hex-head bolts. All covers shall be recessed and fit the box so that when the cover is set in the box, the top of the cover shall be even with the top of the box.

(d) Polymer Concrete Junction Boxes - Polymer concrete junction boxes and covers shall be precast water meter type. Material shall consist of aggregate bonded with a polyester resin and reinforced with fiberglass strands. The box and cover shall be gray in color. ~~Covers shall be capable of withstanding a load of 15,000 pounds over a 10 inch by 10 inch square surface.~~ Covers shall have a skid-resistant surface, and bolt to the junction box with a recessed stainless steel hex-head bolts. All covers shall be recessed and fit the box so that when the cover is set in the box, the top of the cover shall be even with the top of the box.

(e) Hybrid Junction Boxes - Hybrid junction boxes and covers shall be constructed of polymer, fiberglass, or polymer concrete. Materials shall be resistant to temperature extremes and ultraviolet light exposure. ~~Cover and boxes shall be capable of withstanding loads of 15,000 pounds over a 10 inch by 10 inch square surface.~~ Covers shall have a skid-resistant surface and bolt to the junction box with recessed stainless steel hex-head bolts. All covers shall be recessed and fit the box so that when the cover is set in the box, the top of the cover shall be even with the top of the box.

02920.20 Cable and Wire - Unless otherwise noted, all electrical conductors shall be stranded copper conforming to ASTM B 3 and ASTM B 8, Class B or C. Insulation shall be 600 V plasticized

polyvinyl chloride, polyethylene, or chemically cross-linked polyethylene, conforming to ASTM D 2220, ASTM D 1351, ASTM D 2655, and ASTM D 2656. Do not use polyethylene compounds where exposed to sunlight. Tape the ends of unused and spare conductors with insulating vinyl plastic tape.

02920.21 Wire and Cable Color Coding:

(a) General - Apply wire color coding mechanically, with striping clearly visible the entire length. Colored tape may be used where striping is worn from handling.

(b) Illumination Circuits - Color coding of illumination circuits will be required for three-phase systems only. Color coding of each phase conductor shall remain consistent throughout the entire electrical system.

(c) Traffic Signal Circuits - Color coding of traffic signal circuits shall conform to the wiring color code shown or specified.

02920.22 Cable - Furnish cable meeting the following requirements:

- **Direct Burial Cable** - All cable shown or specified as direct burial cable shall be:
  - **Underground Service Entrance Cable** - Comprised of a heat and moisture resistant cross-linked polyethylene insulated wire rated for 167 °F operation in wet or dry locations and be UL labeled as type USE cable according to the NEC.
  - **Underground Feeder and Branch Circuit Cable** - Comprised of moisture resistant thermoplastic insulated wires and a moisture and sunlight resistant thermoplastic outer covering rated for 140 °F operation in wet or dry locations and be UL labeled as type UF cable according to the NEC.
- **Messenger Cable** - Galvanized steel seven-strand conforming to ASTM A 475 utility grade with Class A coating.
- **Tether and Stabilizer Cable** - Galvanized steel seven-strand conforming to ASTM A 475 common grade with Class A coating.
- **Loop Feeder Cable** - Two-conductor No. 14 AWG twisted pair shielded cable with drain wire conforming to IMSA 50-2. When shown, construct loop feeder circuits of two-conductor No. 18 AWG twisted pair shielded cable with drain wire conforming to IMSA 50-2.
- **Interconnect Cable** - REA PE-38 or PE-39 cable consisting of No. 19 AWG stranded or solid individual conductors. The cable shall contain the number of wire pairs shown.
- **Control Cable** - Comply with IMSA 20-1. Outside jacket insulation shall be black in color.
- **Cable Ties** - Heavy-duty UV resistant black plastic self-locking straps approximately 5/16 inch in width, serrated gripping surfaces through a binding buckle, and a minimum tensile strength of 45 pounds.
- **TC Cable** - XHHW conductors with PVC jacket.
- **Polyethylene Pull Line** - An electrical polyethylene pull rope with a 1,200 pound minimum break strength.

- **Industrial Ethernet Cable** - Waterblock/direct burial rated, shielded enhanced, Category-6 cable with 24 AWG solid bare copper conductors, PE inner jacket, overall shield, and sunlight and oil resistant PE jacket. Terminate cable with factory installed RJ-45 connectors.

02920.23 Wire - Furnish wire meeting the following requirements:

- **TFFN Wire** - Insulated stranded copper wire rated for 194 °F operation in dry locations and be UL listed as TFFN.

- **THWN Wire** - Insulated stranded copper wire rated for 167 °F operation in wet or dry locations and be UL listed as THWN.

- **XHHW Wire** - Insulated stranded copper wire rated for 194 °F dry and 167 °F wet locations and be UL listed as XHHW.

- **Grounding and Bonding Wire** - Stranded copper wire. Minimum size shall be No. 6 AWG or as shown. When installed in conduit use type THWN that is green in color.

- **Loop Wire** - Insulated stranded copper No. 14 AWG type XHHW conductor inside a polyethylene tube conforming to IMSA Specification No. 51-7.

02920.24 Eyebolts - Furnish eyebolts meeting the requirements to ASTM A 307.

02920.25 Electrical Splice Materials - Furnish electrical splice material meeting the following requirements:

- **Split Bolt** - Made of silicon bronze to securely join the wires both mechanically and electrically.

- **Heat-Shrink Tubing** - Surface-irradiated tube complying with UL 486, rated at 194 °F, with 600 V inner melting wall or liner to provide void-free encapsulated insulation.

- **Insulating Rubber Tape** - Electrical grade, nondrying, rubber based, elastic type conforming to ASTM D 4388.

- **Insulating Vinyl Plastic Tape** - Comply with ASTM D 3005, Type II and UL 510.

02920.26 In-Line Fuse Holder - The in-line fuse holder rated for 30 A at 600 V shall be designed to hold a 13/32 inch by 1 1/2 inch 10 A KTK type fuse. In-line fuse connectors to be used on single phase 120/240 V and 240/480V lighting circuits shall be designed for two-pole fusing so both poles disconnect simultaneously from both legs of the line side. The case shall be rigid plastic with a threaded coupling for joining the two halves. When threaded together, the two halves shall completely enclose the fuse and exert pressure against a neoprene "O" ring to provide a waterproof seal. The load side holder shall hold the fuse securely in place, so when the two halves are disconnected, the load side holder will retain the fuse. The line side contact point shall be spring-loaded to provide pressure between the fuse and the contact points. Wire terminals shall be set screw type rated for copper wire.

02920.27 Ground Rod and Clamp - Furnish 5/8 inch x 8 foot copper covered steel ground rods with bronze grounding wire clamps.

02920.28 Conduit Plug - Furnish conduit plug material used to seal the ends of conduit composed of closed cell polyethylene foam or duct seal meeting the following requirements:

- **Closed Cell Polyethylene Foam** - Consisting of precut sections with a plug length of 3 inch and a plug diameter 1/2 inch larger than the conduit diameter being plugged. Approximately one third of the plug length shall be exposed after installation.

- **Duct Seal** - UL listed clay putty material designed to seal electrical conduit.

Section 02925 - Traffic Signal Materials

Description

02925.00 Scope - In addition to Section 02920, this Section includes the requirements for traffic signal installations:

Materials

02925.01 Materials - Where shown or specified, hardware shall be furnished and installed with hot-dip galvanized or Type 304 or 316 stainless steel screws, bolts, nuts and washers. Bolts and screws shall have square or hex heads. Allen head fasteners will not be allowed.

02925.33 Frangible Bases:

(a) General - Bolts, nuts and washers shall conform to 02560.20 and shall be galvanized according to 02560.40.

(b) Vehicle Signal Pedestals - Transformer bases shall be constructed to bolt to shaft flanges. Bases shall be square with rounded corners, tapered from the base to the top and approximately 20 inches in height. They shall be made of cast aluminum~~, cast iron or steel plate~~ and include a removable access plate~~. Hot-dip galvanize cast iron and steel plate bases after fabrication~~.

(c) Pedestrian Signal Pedestals - Pedestrian signal pedestal bases shall be a frangible type and constructed of ~~either galvanized cast iron or~~ cast aluminum. Include a removable access plate and a threaded connection to accept a 4 inch nominal steel pipe.

02925.34 Anchor ~~Bolts~~Rods - Anchor ~~bolts~~rods shall conform to 02560.30 and to the types and sizes shown.

Cabinets and Control Devices

02925.40 Cabinets - Construct all cabinets, except signal controller cabinets, from 12 gauge Type 304 stainless steel, or 10 gauge sheet steel and hot-dip galvanize after fabrication according to 02530.70, or 8 gauge 5052 - H32 powder-coated aluminum. Cabinets shall be weatherproof, NEMA type 3R rated, and constructed as shown. Pole-mounted controller cabinets shall be provided with solid bottoms or equipped with a bottom cover plate.

The internal wiring of cabinets shall be done by a UL listed facility. Cabinets shall conform to one or more of the following standards where appropriate:

- UL 50, Cabinets and Boxes
- UL 67, Panel Boards
- UL 869A, Service Equipment

Use a welded conduit hub or screw-on hub to make conduit entrances into cabinets. Welded hubs shall be securely welded to the cabinet before galvanizing.

Power service cabinets with live parts exposed shall have a dead-front panel installed with cutouts for operating handles. Dead-front panels up to and including 120 square inches in size shall have a minimum of three holding studs. Install panels larger than 120 square inches in size using an adequate number of studs to maintain rigidity of the panel.

Construct the dead-front panels of stainless steel or galvanized steel and treat all cut galvanized steel edges with zinc-rich paint. Prime galvanized steel dead-front panels with vinyl wash primer and finish with exterior polyurethane enamel. The finish color of galvanized steel shall be grey.

Mounting pans or false backs are required for circuit breakers, contactors, relays, switches, transformers or other types of electrical equipment. They shall be securely mounted inside the cabinet.

Label circuit breakers and equipment with an engraved permanent label on the dead-front panel to indicate the circuit controlled.

Provide each cabinet with a latching device for a standard Agency padlock.

02925.41 Circuit Control Devices:

(a) General - Install circuit breakers**,** the copper neutral block, and contactors as shown.

(b) Circuit Breakers - Provide UL489 listed circuit breakers of the rating shown or specified. Circuit breakers shall be of the unenclosed, molded case bolt-on type with end conductor terminals, suitable for surface mounting in the cabinet on a false back or bracket.

(c) Terminal Blocks - Provide sectional channel mount 600 V terminal blocks of sufficient size to accommodate the wiring shown.

02925.42 Traffic Signal Control Devices - The traffic signal controllers and related equipment shall conform to requirements of the current edition of the ODOT Standard Specification for Microcomputer Signal Controller, except as supplemented and modified by the Special Provisions.

02925.51 Traffic Signal Lamps - Vehicle signal and pedestrian signals shall be illuminated by ~~incandescent bulbs or~~ LED modules ~~as indicated in the Special Provisions.~~

~~**(a) Incandescent Lamps** - Incandescent lamps shall be rated for 130 V AC operation with a rated life of at least 8,000 hours. Lamps shall be designed to withstand vibration and intended for use in traffic signal heads.~~

~~**(b) Light Emitting Diode (LED) Modules** -~~ . Use only prequalified LED modules that are listed in the Traffic Signal Materials "Blue Sheets".

Signal Indication Material

02925.60 Signal Indication Material - The housings, including doors and hoods, shall have a smooth homogeneous black finish. All parts shall be clean, smooth, and free from flaws, cracks, blow holes, and other imperfections. All fasteners not specifically noted as hot-dip galvanized shall be Type 304 or 316 stainless steel installed with anti-seize compound.

02925.62 Signal and Sign Mounting Hardware:

(a) General - All fasteners not specifically noted as hot-dip galvanized shall be Type 304 or 316 stainless steel. All fasteners shall have either square or hex heads.

(b) Plumbizer - Provide plumbizers that are constructed of cast bronze. Paint the mounting hardware with two coats of zinc-rich aluminum paint.

(c) Span Wire Hanger - Provide span wire hangers that are constructed of cast bronze. Paint the mounting hardware with two coats of zinc-rich aluminum paint.

(d) Adjustable Bracket - Attach adjustable brackets to the pole with cables. A safety cable shall be supplied to capture the appurtenance in the event of a failure of the mounting bracket.

(e) Tri-stud Adapters - Furnish tri-stud adapters with two backing washers and omit the neoprene washer/gasket. Use silicon caulking to seal between the tri-stud adapter and the signal head.

02925.64 Vehicle Signal - Each housing shall be of the one-section expandable type. Each section shall be of one-piece construction. The design shall be such that at any time and without the use of other than simple tools, it shall be possible to convert any housing into a one-, two-, three-, four- or five-section housing by the addition or subtraction of housing sections. The entire housing shall be made dust and water resistant. Vehicle signal heads not utilizing the bottom opening for mounting shall have a screw hole plug installed and shall have a 1/4 inch drain hole drilled in the bottom of the plug. Construct vehicle signal housings and doors of die-cast aluminum alloy~~. If LED modules are used omit the requirements of (a) and (c) below for that housing section~~ or polycarbonate.

~~**(a) Lenses** - Vehicular signal lenses shall conform to ITE Specifications and meet the following requirements:~~

- ~~Glass.~~
- ~~Circular with a nominal diameter as shown or specified.~~
- ~~Mounted in a separate door hinged to the signal housing.~~
- ~~Mounted in an endless composition rubber gasket that completely encompasses the edge of the lens and provides a cushion and positive seal between the lens and the door. Use at least four lens clips to secure the lens and gasket to the door.~~

(~~b~~a) Doors - Gasket each door to provide moisture resistant construction.

~~**(c) Reflectors and Lamp Sockets** - Illuminate each lens independently of any other lens and provide with a parabolic aluminum reflector. Hinge reflector frames to either the door or the housing, so access to the rear of the reflector is allowed without breaking the light circuit. Use suitable clips to hold each reflector firmly to its frame so lamp socket inspection is allowed without removing the reflector. The reflector retaining rings shall be stainless steel, black powder-coated aluminum, or polycarbonate. All lamp sockets shall be brass with a phosphor bronze center contact. The lamp socket mounting shall incorporate the ability to orient the lamp filament after the lamp has been securely seated into the socket.~~

(~~d~~b) Visors - Construct visors of sheet aluminum alloy 3003-H16 (ASTM B 209), nominal thickness 16 gauge~~.~~ or polycarbonate. Visors shall be of one-piece construction and attach to the signal housing doors with Type 304 or 316 stainless steel screws. Provide 8 inch lenses with a 7 inch visor and 12 inch lenses with a 9 1/2 inch visor. Signal housing doors, with visors attached, shall be capable of being opened a minimum of 90 degrees. Use tunnel visors on all vehicular signal indications with the bottom portion open, so the sections light output is visible directly in front of and below the signal head.

(~~e~~c) Backboards - Construct backboards of sheet aluminum alloy 3003-H14 (ASTM B 209), 14 gauge nominal thickness~~. All~~ or polycarbonate. Aluminum backboards shall be louvered. Provide all vehicular signal heads with backboards and include all of the necessary mounting hardware for completing the installation. Backboard dimensions shall fit the signal head housings used, with no gap between backboard and housing. Backboards shall have a border width of 5 inches. Attach backboards with stainless steel screws and washers. Use washers at least 3/8 inch in diameter.

02925.65 Pedestrian Signal Heads - Provide single-section pedestrian signal heads meeting the following requirements:

(a) Light Source:

(1) Standard - The standard light source shall:

- Be LED filled hand/man style.
- Meet ITE standards for color and luminous intensity.
- Compatible with all other controller equipment.

(2) Count Down - The count down, if shown, shall:

- Be 16 inch by 18 inch module.
- Be LED overlaid filled countdown style. Overlaid filled hand/man on the left with countdown on the right.
- Meet ITE standards for color and luminous intensity.
- Countdown only in the flashing ~~don't~~don't walk interval.
- Compatible with all other controller equipment.

(b) Housing and Door - The housing and door shall:

- Use a one-piece housing and sealed door constructed of die-cast aluminum alloy or polycarbonate that provides a dustproof and weatherproof enclosure.
- Allow easy access for maintenance of the interior components with the door open.
- Be installed with a hex head pipe plug with 1/4 inch drain hole drilled in the bottom of the plug when pedestrian signal heads are not utilizing the bottom opening for mounting.
- Be installed with terminal blocks to accommodate wire terminations.

(c) Visors - The visor shall:

- Use a one-piece z-crate or egg crate type polycarbonate plastic visor.
- Include vertical (or angled) and horizontal members spaced to provide the required shielding and strength.
- Be held securely to the door assembly.

(d) Mounting - The mounting shall be designed to use either a bracket assembly or a clamshell mounting as shown.

02925.66 Pedestrian Push Buttons and Mount:

(a) General - Push buttons shall be:

- Direct contact type.
- Free of levers, handles, or toggle switches externally or internally.

(b) Contacts - Push button contacts shall be:

- Entirely insulated from the housings and operating buttons.
- Normally open.
- Closed only when push buttons are operated by pressure.
- Restored immediately to the normal open position when pressure is released.

(c) Housing - The housing containing the pedestrian push button shall be made with:

- A one-piece ~~H frame construction~~ assembly of extruded aluminum containing the push button, with the signs placed directly on ~~both sides of~~ the extrusion.
- A sign background of two coats of white enamel with black silk-screened legend conforming to Standard Sign ~~R10-4b~~as shown.
- An outlet in the back of the housing for rigid conduit.
- A 1/4 inch diameter drain hole in the bottom.

(d) External Button - The external operating button shall:

- Be constructed of durable materials able to withstand the typical abuse inflicted by the general public.
- Be removable from the housing with simple tools.
- Be at least 2 inches in diameter.

- Operate a momentary contact switch by direct contact.
- Contain a guard completely encircling the push button, and extending far enough to prevent prying under the push button. It shall be resistant to damage associated to striking it with an object other than the hand.

02925.67 Coatings:

(a) Aluminum Signal Heads - Pedestrian signal heads, vehicle signal heads, beacon heads, visors and backboards shall be powder coated inside and outside to meet Federal Standard 595b-37038 (dull black).

(b) Signal Controller Cabinets - Provide signal controller cabinets that are constructed of anodize aluminum.

(c) Brackets and Hangers - Apply two coats of aluminum paint to cast bronze type brackets and hangers after they have been primed.

02925.68 Signal Head Covers - Provide signal head covers that:

- Are yellow prefabricated nylon.
- Completely cover visors and can cover the backplate.
- Include a fine mesh insert for signal testing.
- Have integral elastic bands and clips to secure the covers to the signal.

Section 02926 - Highway Illumination Materials

Description

02926.00 Scope - In addition to Section 02920 and all applicable portions of AASHTO "Roadway Lighting Design Guide" (2005) and "American Standard Practice for Roadway Lighting" (IES, RP-8, 2000), this Section includes the requirements for highway illumination installations.

Materials

02926.01 Materials - ~~Where shown or specified, hardware~~ Hardware shall be furnished and installed with hot-dip galvanized or Type 304 or 316 stainless steel screws, bolts, nuts and washers. Bolts and screws shall have square or hex heads. Allen head fasteners will not be allowed.

Cabinets and Control Devices

02926.40 Cabinets - Construct all cabinets from 12 gauge Type 304 stainless steel, or 10 gauge sheet steel and hot-dip galvanize after fabrication according to 2530.70. Post mount cabinets shall be weatherproof, rated as NEMA type 3R, and constructed as shown.

With 3 phase electrical system and/or main circuit breaker of 200 amp or higher, pad-mount cabinet shall be installed as shown. It shall be NEMA type 3R, with hinged double door, 3 point lockable vault handles and stainless steel hardware. Cabinet size is 48 inches x 63 inches x 18 inches deep, or as shown.

The internal wiring of cabinets shall be done by a UL listed facility. Cabinets shall conform to one or more of the following standards where appropriate:

- UL 50, Cabinets and Boxes
- UL 67, Panelboards
- UL 869A, Service Equipment

Use a welded conduit hub to make conduit entrances into cabinets. Hubs shall be of the size required and shall be securely welded to the cabinet before galvanizing. Malleable iron screw-on hubs may be used as approved.

Power service cabinets with live parts exposed shall have a dead-front panel installed with cutouts for operating handles. Each dead-front panel shall have a minimum of two holding latches to maintain rigidity of the panel.

Construct the dead-front panels of stainless steel or code-gauge galvanized steel and treat all cut galvanized steel edges with zinc-rich paint. Prime galvanized steel dead-front panels with vinyl wash primer and finish with exterior polyurethane enamel. The finish color of galvanized steel shall be aluminum.

In all outdoor locations, mounting pans are required when circuit breakers, contactors, relays, switches, transformers or other types of electrical equipment are to be mounted inside the cabinet.

Label circuit breakers and equipment with an engraved permanent label on the dead-front panel to indicate the circuit controlled.

Provide each cabinet with a latching device for a standard Agency padlock.

Meter base shall be made from 16 gauge galvanized sheet steel (G90), and powder coated inside and out after fabrication, or from 16 gauge Type 304 stainless steel sheet.

02926.41 Circuit Control Devices:

(a) General - Install circuit breakers**,** the copper neutral block, and contactors as shown.

(b) Circuit Breakers - Circuit breakers shall have voltage rating and number of poles shown or specified. Circuit breaker's interrupting rating shall meet or exceed short circuit rating of the specified electrical system.

Circuit breakers shall be UL 489 conformed, thermal magnetic molded case circuit breakers and bolt-on type with individually insulated and protected terminals, suitable for surface mounting in the cabinet on a false back or bracket.

All 100 A frame breakers shall be Class 13a for single pole breakers, Class 18a for multiple pole breakers, and 225 A frame breakers shall be Class 20a in Federal Specification W-C-375B, table "Classification of ratings".

Install overcurrent protection and relay equipment, as shown or specified, with materials and installation conforming to the NEC.

(c) Multiple Light Contactors - Contactors shall be lighting type specifically rated for high-intensity discharge type lamp loads, electrically held. The contactors shall have a 600 V rating. All multiple light contactors shall be unenclosed single-phase, two- or three-pole, open type lighting contactors of the rating shown or specified. Construct contactors for surface mounting on a false back or bracket within a weatherproof cabinet. The contactor coil shall operate on 120 V for 240 V circuits and 240 V, 208 V, and 277 V for 480 V circuits.

(d) Test Switch - Furnish and install a 277 V AC rated test switch in the control cabinets if shown. The test switch shall be a heavy-duty single-pole switch or circuit breaker rated at 15 A and shall be installed in the control cabinet as a roadway lighting test switch. The switch shall be wired to shunt the photoelectric relay power contactor and energize the lighting circuit contactors.

(e) Photoelectric Relay - The photoelectric relay shall attach to a three-pole locking receptacle by a twisting motion.

The unit shall have a built-in surge protective device for protection from induced high voltage and follow-through currents. The relay shall meet or exceed the requirements of ANSI C136.10. Factory set turn-on lights shall be 1.4 footcandle ± 0.2 footcandle at 120 V AC. When operated at 240 V AC, turn-on shall not change more than plus or minus 0.3 footcandle from the 120 V value. Maximum off-to-on ratio shall be 1.5:1.

The photoelectric ~~replay~~relay shall be a cadmium-sulfide photocell encapsulated for humidity protection, or a silicon junction type photo-transistor.

Normal operation shall be designed for dual voltage operation of 105 V - 285 V, 60 Hz.

Power consumption shall be less than 1 W. At the designated voltage, the photoelectric relay shall be capable of controlling a minimum mercury vapor, fluorescent or incandescent lamp load of 1000 W. Minimum operating temperature range shall be from -40 °F to 150 °F.

A time-delay control circuit shall prevent false turn-offs by transient light conditions. Provide a fail-safe circuit for the lighting load to remain on or become energized if any functional failure of the photoelectric control circuit occurs.

Lamps, Ballasts, and Luminaires

02926.50 Illumination Lamps - All high-pressure sodium lamps shall conform to ANSI Standards ~~for dual-arc tubes.~~. All lamps of the same size and type, on a single project, shall be from the same manufacturer's lot number.

All lamp bases shall have a brass mogul base mounting with dating system.

Lamps shall have an average minimum initial lumen rating (after 100 burning hours) and an average minimum lamp life (based on 10 hours per start) as follows:

Lamp Watts	ANSI Code	Minimum Initial Vertical	Lamp Lumens Horizontal	Minimum Average Lamp Life
		High-Pressure Sodium - Clear		
70	S62ME-70	6,300	6,300	24,000
100	S54SB-100	9,500	9,500	24,000
250	S50VA-250/S	29,000	29,000	24,000
400	S51WA-400	50,000	50,000	24,000
1,000	S52XB-1000	140,000	140,000	24,000
		~~**High-Pressure Sodium - Dual Arc-Tube (Standby)**~~		
~~70~~	~~S62~~	~~6,050~~	~~6,050~~	~~40,000~~
~~100~~	~~S54~~	~~9,500~~	~~9,500~~	~~40,000~~
~~250~~	~~S50~~	~~27,500~~	~~27,500~~	~~40,000~~
~~400~~	~~S51~~	~~47,500~~	~~47,500~~	~~40,000~~
~~1,000~~	~~S52~~	~~127,000~~	~~127,000~~	~~40,000~~

02926.52 Ballasts - High-pressure sodium ballasts shall be magnetic regulator (lag type regulator) with primary and secondary windings electrically isolated from each other.

Unless otherwise shown or specified, the ballast shall be an integral part of the luminaire unit. It shall be of the prewired, built-in type mounted in the luminaire.

Provide a manufacturer's nameplate on the ballast housing. The nameplate shall have the manufacturer's name, model number, serial number, hook-up diagram, power supply data, lamp type and operating wattage.

The ballast shall operate the lamp within the limits specified below throughout the rated life of the lamp:

- The lamp wattage shall not vary more than the allowable range shown in the table below over the line voltage variation shown.
- The lamp wattage shall not vary more than plus or minus 5~~%~~ percent of nominal when the lamp is at its rated nominal voltage (high-pressure sodium lamps only).

- The minimum efficiency of the ballast (nominal lamp watts/line watts) shall not be less than shown below.
- The ballast shall not allow the lamp arc to extinguish when a line voltage dip as shown below occurs for several seconds.
- The power factor shall not drop below 90~~%~~ percent for the line voltage variation shown below.
- The line starting current shall not exceed normal line operating current.
- The ballast shall start and operate the lamp in ambient temperatures down to -20 °F.
- The lamp current crest factor shall not exceed 1.8 for line voltage variation shown below.
- The ballast shall conform to all ANSI Standards.
- The ballast shall have capacity to operate dual-arc tube lamps as well as standard lamps without modification of the luminaire.

Submit for review ballast electrical data and lamp operating volt-watt traces for nominal and ± 10~~%~~ percent rated line voltage for each type of high-pressure sodium lamp ballast.

Lamp Type	Lamp Wattage Range	Line Voltage Variation	Allowable Lamp Watt Variation	Minimum Efficiency	Allowable Line Voltage Dip
HPS	70 - 100	± 10%	± 10%	70%	40 - 50%
HPS	150 - 400	± 10%	± 10%	78%	40 - 50%
HPS	1,000	± 10%	± 10%	92%	40 - 50%

Unless otherwise shown or specified, operate ballasts on 240 V or 480 V. When 120 V operation is specified, the ballast shall be a multi-voltage type with taps to allow the ballast to be connected to 120 V, 208 V, 240 V, or 277 V.

02926.53 High-Intensity Discharge Luminaires:

(a) General - Furnish conventional roadway luminaires for horizontal slip fitter end mounting.

Luminaires shall have a cast-aluminum housing and shall attach to 2 inch pipe tenons on mast arms. The luminaire attachment fitting shall provide for a minimum of plus or minus 3 degree adjustment of the luminaire in the vertical direction. The reflector of all luminaires shall be of a snap-on or easily removed design manufactured of polished aluminum or molded from prismatically formed borosilicate glass. The refractor shall be mounted in a door frame assembly hinged to the luminaire and secured in the closed position by means of an automatic latch or a draw latch. The refractor and doorframe assembly, when closed, shall exert pressure against a gasket. Gaskets shall be composed of material capable of withstanding the temperatures encountered and shall be securely held in place. Glassware shall be of the refractor type with prisms.

Reflectors and refractors provided with the luminaire shall be stamped or labeled with a part number. The luminaire photometric submittal (isocandela diagrams) shall indicate the reflector and refractor part number used.

All luminaires shall have their components secured to the luminaire frame with corrosion-resistant mounting hardware. The housing, complete with integral ballast, shall be weather tight.

If sand-cast, the aluminum housing shall be left in its natural finish. If die-cast, the housing shall be given a coat of aluminum paint.

Refractors shall be formed from heat-resistant, high-impact, molded borosilicate glass.

Lamp sockets shall be adjustable to obtain the light distribution shown or specified.

Socket opening shall be sealed with a heat-resistant filter or filtering gasket to prevent the entry of dirt, insects or moisture into the optical system.

The socket mounting mechanism shall be sufficiently rigid that upon application of a 2 pound load in any direction on the light source center, the light source center shall not deflect more than 1/16 inch.

(b) Classification of Luminaire Light Distribution - Furnish the following distribution types as shown or specified. The classifications listed shall conform to ANSI definitions.

(1) Vertical Light Distributions - Divide vertical light distributions into three groups: short (S), medium (M), and long (L). Classification of the three groups depends on the maximum candle power point within a grid area according to the ANSI/IES RP-8 (2000) publication for Roadway Lighting.

(2) Lateral Light Distributions - Lateral light distribution patterns shall have the following designations:

Type I
Type II
Type III
Type IV
Type V

The type designations listed above shall conform to ANSI definitions.

(3) Distribution Above Maximum Candle Power - This classification shall be used to control the candle power in the upper portion of the beam above the maximum candle power. The following three classifications shall be used:

Cutoff
Semi cutoff
Noncutoff

The classifications listed above shall conform to ANSI definitions.

PART 03000 - MATERIALS

Section 03010 - Fencing Materials

Description

03010.00 Scope - This Section includes the requirements for barbed wire, woven wire and chain link fabric, metal posts, braces, hardware, and gates.

Materials

03010.10 Barbed Wire - The barbed wire shall be two-strand and either 12 1/2 gauge or 15 1/2 gauge with four-point barbs spaced at 5 inch intervals conforming to the requirements of AASHTO M 280 (ASTM A 121). Galvanizing shall be Class 3.

All barbed wire installed on the Project shall be new or like new, and the same diameter unless otherwise approved.

03010.20 Woven Wire Fabric - The woven wire fabric shall be 12 1/2 gauge galvanized steel wire conforming to the requirements of AASHTO M 279 (ASTM A 116), Class 3 coating or 11 gauge or 12 1/2 gauge aluminum coated steel wire conforming to the applicable requirements of ASTM A 116. The 12 1/2 gauge aluminum coated steel wire shall have the same coating thickness required for 11 gauge steel wire in Table 2 of ASTM A 116.

03010.30 Chain Link Fabric, Ties, and Tension Wire - Chain link fabric, ties, and tension wire shall conform to the requirements of AASHTO M 181 supplemented and modified as follows:

- Fabric may be zinc-coated steel meeting Type I, Class D coating requirement, aluminum-coated steel, or aluminum alloy. Use only one type on the Project.
- Wire fabric ties, wire ties, and hog rings may be zinc-coated steel wire, aluminum-coated steel, or aluminum alloy as elected, regardless of the type of wire fabric used.
- Use ductile, zinc-coated steel meeting the coating requirements of ASTM A 641, Class 1 for wire fabric ties, wire ties, and hog rings. Aluminum-coated steel wire fabric ties, wire ties and hog rings shall be coated with at least 0.30 ounce per square foot.
- Tension wire shall have a Class 2 coating.
- Fabric for the fence to be installed with pickets shall be 9 gauge wire woven in 3 1/2 inch by 5 1/2 inch diamond mesh. Top and bottom selvage shall be knuckled finish.

03010.31 Pickets - Pickets shall be either standard Grade A redwood or cedar pickets, 3/8 inch x 2 1/2 inch x 6 feet, or industry standard metal, or plastic pickets as shown or approved.

03010.40 Vinyl Clad Fabric - Vinyl clad chain link fabric shall conform to AASHTO M 181, Type IV. The color of the PVC coating shall be either medium or dark green.

03010.50 Metal Fence Posts, Braces, and Appurtenances - Metal fence posts, braces and appurtenances shall conform to the requirements indicated on the plans and the following:

(a) Painted Metal Posts - All painted metal posts shall be of the same kind and color.

(b) Posts, Braces, and Appurtenances for Chain Link Fence - Posts, braces, and appurtenances for chain link fence shall conform to the requirements of AASHTO M 181.

Posts for bridge protective fence shall be galvanized and conform to the requirements of ASTM A 53, Grade B. Braces and appurtenances for bridge protective fence shall conform to the requirements of AASHTO M 181.

(c) Posts, Braces, and Appurtenances for Barbed Wire and Woven Wire Fence:

(1) Tubular Steel Posts - Tubular steel posts, braces and appurtenances shall conform to the requirements of AASHTO M 181. Tubular posts shall be fitted with a snug-fitting, galvanized metal cap.

(2) Other Shapes - Metal posts and braces, other than tubular shape, for barbed wire and woven wire fences, shall conform to AASHTO M 281 (ASTM A 702), except that galvanizing may conform to the requirements of AASHTO M 111 (ASTM A 123). The posts and braces may be either galvanized or painted, as elected. Wire fasteners shall meet the coating requirements of ASTM A 641, Class 1.

(3) Fence Stays, Brace Guys, and Wire Loops - Metal fence stays, brace guy wires, wire loops for gateways and other miscellaneous wire used in barbed and woven wire fences shall be furnished with Class 1 coating as required by ASTM A 641. Either 9 1/2 gauge or 10 gauge wire is acceptable for fence stays.

(d) Concrete In Footings - Concrete for footings shall conform to Section 00440.

(e) Grounding Rod - 5/8 inch by 8 feet, nonrusting, copper covered steel rod with a bronze grounding wire clamp.

(f) Grounding Wire - AWG 4/0 Solid Copper or No. 6 bare aluminum wire with clamps.

03010.60 Fence Gates:

(a) General - Tubular steel gate frames shall conform to AASHTO M 181. Fabric in gates used with chain link fence shall be chain link of the same gauge and conforming to applicable requirements of 03010.30. Fabric in gates used with woven wire fence shall be woven wire fabric conforming to 03010.20 or chain link fabric conforming to the applicable requirements of 03010.30, except that the zinc coating may be either Class C or Class D.

(b) Hardware - All fence and gate hardware shall conform to the requirements of AASHTO M 181, except that the thickness of galvanizing shall be according to AASHTO M 232 (ASTM A 153).

03010.75 Protective Fence Materials, On and Off Structures - Provide certification according to the requirements of 00165.35 that the anchor system selected conforms to requirements shown on the plans.

- **Resin Bonded Anchor System** - The resin bonded anchor system used to install the fence post anchor rods in the concrete bridge rail shall be from the QPL and be installed according to the manufacturer's recommendations.
- **Posts** - Modify posts to attach to the structure as shown.
- **Steel Plates, Angles, and Bolts** - Steel plates, angles, and bolts shall meet the applicable requirements of Section 02530 and galvanized according to 02530.70.
- **Chain Link Fabric, Ties, and Tension Wire** - Chain link fabric, ties, and tension wire shall conform to the requirements of 03010.30.
- **Pickets** - Pickets shall meet the requirements of 03010.31.

03010.80 Acceptance - Acceptance of fencing materials will be according to 00165.35 and this Section.

Section 03020 - Erosion Materials

Description

03020.00 Scope - This Section includes the requirements for erosion control materials.

Materials

03020.10 Commercially Manufactured Compost - Furnish commercially manufactured compost that:

- Is processed through thermophilic composting meeting the EPA's definition of "Process to Further Reduce Pathogens".
- Is from a commercial compost facility that holds a current DEQ composting permit or is registered with DEQ as a composting facility.
- Meets the requirements of the US Composting Council (USCC) and it's Seal of Testing Assurance (STA) program.
- Contains a minimum 65 percent by volume of the following recycled plant waste:
  - Source-separated yard and garden wastes
  - Wood wastes
  - Agricultural crop residues
  - Wax-coated cardboard
  - Preconsumer vegetative food wastes
  - Other similar source-separated materials that the DEQ has determined to have a comparable low level of risk in hazardous substances, human pathogens, and physical contaminants.
  - Manure or biosolids based composts when approved.
- Meets the following compost particle size and media parameters:

Compost Particle Size

	Compost Type		
Sieve Size	Fine*	Medium*	Coarse**
	Percent Passing (By Dry Weight)		
3"	100	100	100
1"	99-100	95-100	90-100
3/4"	99-100	95-100	70-100
5/8"	95-100	90-100	70-100
1/2"	80-100	70-100	60-100
1/4"	75-100	70-90	30-60
* maximum 3 inch particle length ** maximum 6 inch particle length			

Media Parameters

Test	Test Method	Requirements		
Physical Contaminants*	TMECC** 03.08-A	Less than 1.0%		
Organic Matter	TMECC** 05.07-A	35% (Minimum)		
pH	TMECC** 04.11-A	6.0 to 8.5		
Soluble Salt Concentration	TMECC** 04.10-A	5 dS/m (Maximum)		
Total Carbon Total Nitrogen	TMECC** 04.02-D TMECC** 04.02-D	Carbon/Nitrogen Ratio		
		Fine	Medium	Coarse
		<25:1	<30:1	<35:1
Stability	TMECC** 05.08-B	≤8		
Maturity	TMECC** 05.05-A	80% or Greater		
Moisture Content	TMECC** 03.09-A	35-60% (Wet Weight)		

* Man-made Inert
** Test Methods for Evaluation of Compost and Composting

03020.90 Acceptance - Acceptance of commercially manufactured compost material will be the following:

- Quality compliance certification according to 00165.35.
- Copies of STA lab analysis.
- Copy of DEQ permit or registration of the compost producer.