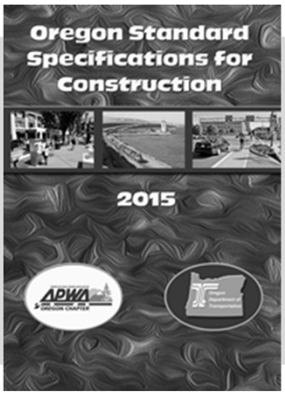
Construction Documents

Lesson 3



ODOT MATERIALS & INSPECTION

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BS in Civil Engineering from OSU

MSE in Civil Engineering from University of Michigan (Geotechnical)

1998-2001 Geotechnical/Environmental Engineer at RMT, INC

2001-Present – ODOT

- 1 year Construction Inspection
- 5 years Specifications and Pre-Letting Unit
- 9 years Region 2 Geotechnical Engineer

ODOT MATERIALS & INSPECTION

Learning Objectives

- Identify key inspection elements of the contract documents
- Explain the governing order of contract documents
- Locate plan sheet details related to drilled shafts
- Understand key elements of the ODOT Standard Specifications and Special Provisions for Drilled Shafts.
- Identify key elements of the Drilled Shaft Installation Plan

Construction Documents

MUST HAVE	RESOURCES
▪ Complete set of Project Plans	▪ Drilled Shaft Inspector's Manual
▪ Special Provisions with all addendums	▪ ADSC Drilled Shaft Inspector Manual
▪ Approved Submittals	▪ ODOT Inspector's Manual
▪ Project Geotechnical Report	▪ ODOT Manual of Field Test Procedures
▪ Inspection Forms	▪ ODOT Non-Field Tested Materials Guide
▪ Standard Specifications	▪ ODOT Construction Manual

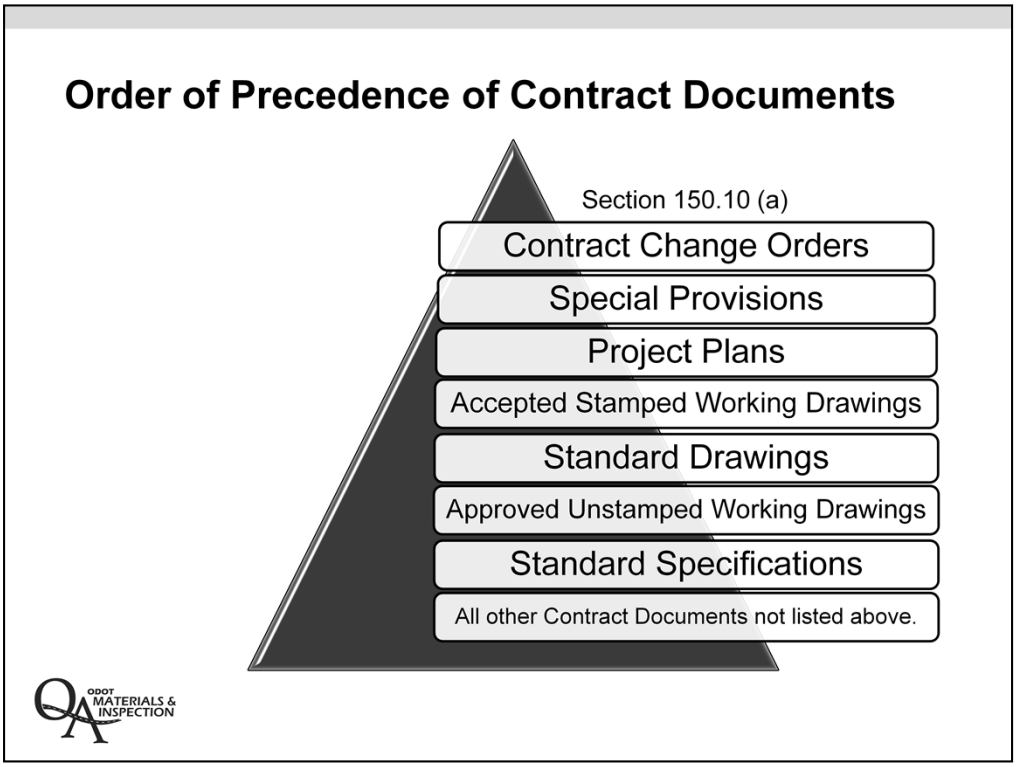
As a drilled shaft Inspector you can perform your duties only if you know and understand the construction of drilled shafts as well as the project to be constructed. That is, you must know what the design intent was, how the Contractor proposes to construct the shafts, and the specifications which are your tools to assure that the drilled shafts are properly constructed.

Presented above is a brief list of items that the drilled shaft Inspector should have in possession prior to start of the drilled shaft work.

Make sure you coordinate with the contractor QA personnel and the ODOT Quality Control Compliance Specialist to understand who is responsible for conducting the field testing requirements associated with drilled shafts.

Drilled Shaft Inspection Forms:

- Drilled Shaft Inspection Report (734-2598)
- Drilled Shaft Excavation Log (734-2604)
- Drilled Shaft Concrete Placement Log (734-2597)
- Drilled Shaft Concrete Volumes (734-2603)
- Drilled Shaft Inspector's Checklist (734-2625)



00150.10 Coordination of Contract Documents – The Contract Documents, including but not limited to Contract Change Orders, the Special Provisions, the Plans 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:

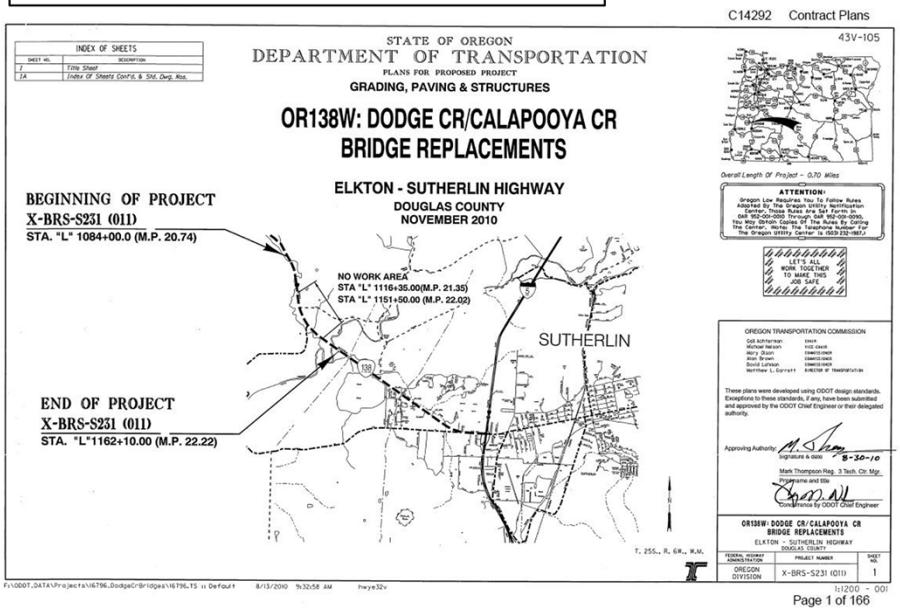
- Contract Change Orders;
- Special Provisions;
- Agency-prepared drawings specifically applicable to the Project and bearing the Project title;
- Reviewed and accepted, stamped Working Drawings;
- Standard Drawings;
- Approved Unstamped Working Drawings;
- Standard Specifications; and
- All other Contract 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.

Contract Plans Review

***Included in Resource Manual* Tab — Plans.**



The Calapooya Creek Bridge project, constructed in 2010 in Region 3, will be used throughout this course as an example of a typical ODOT drilled shaft construction project. Plans, specifications, reports, and other documents and experiences from this project are presented in this, and later, sessions.

This first sheet of the plans helps you familiarize yourself with the general location and construction work of the project. There may be multiple structures on a project with drilled shafts and this sheet helps you locate where they are and how far apart they are.

Key Parts of the Bridge Plans

Plan & Elevation	Shows plan and elevation views of the structure and foundations including the location of drilled shafts
General Notes	Concrete strength, construction sequencing,
Foundation Data Sheet	Shows subsurface materials and conditions discovered from the project borings.
Footing Plan	Shows shaft locations and diameters, location of temporary shoring/cofferdams, project-specific notes.
Bent Details	Shows shaft diameters, top-of-shaft and shaft tip elevations; shaft and column reinforcement, CSL tubes, concrete clearance, construction joints, permanent casing, minimum rock embedment

ODOT MATERIALS & INSPECTION

The project plans should be closely reviewed to find all information and details related to the construction of the drilled shafts. This may include a review of traffic staging plans, overhead and underground utilities, right-of-way limits, no-work areas and construction access among other areas aside from the bridge plans. All details for constructing the shafts should be on the plans. If not, notify the Engineer prior to shaft construction to get any questions or issues resolved.

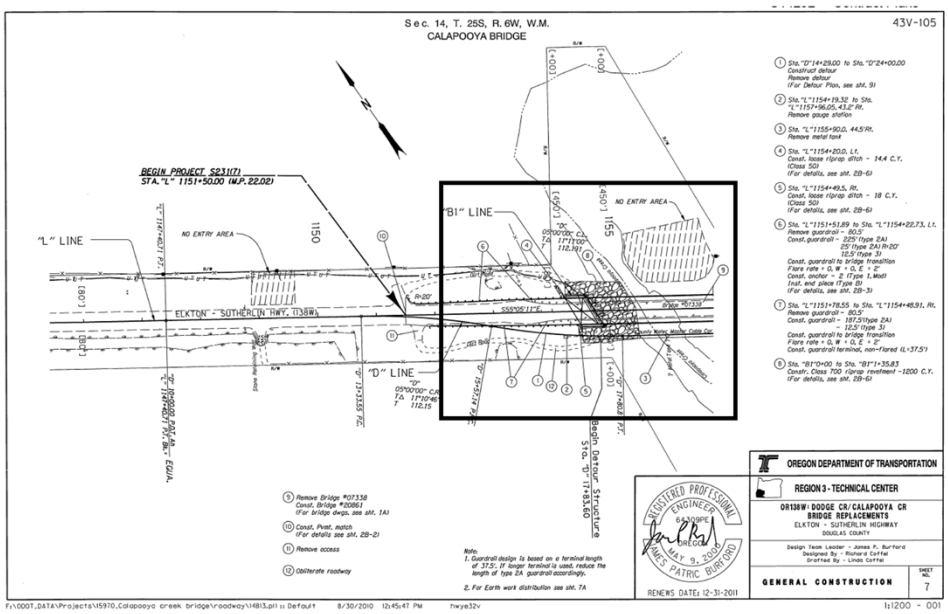
It is extremely important that not only you know how to locate pertinent parts of the plans but have them with you on the job-site at all times.

Key Parts of Other Plans Sections
(Roadway Plan Sheets)

- Check utility locations
- Available right-of-way limits and easements
- Check proximity to other facilities or structures
- Traffic and construction staging plans
- Erosion control plans

Other construction plan sheets may have an important impact on the drilled shaft construction work and may affect the staging and sequencing of the work and other impacts. Review other work proposed in the area to see if there are possible conflicts or constraints that should be considered.

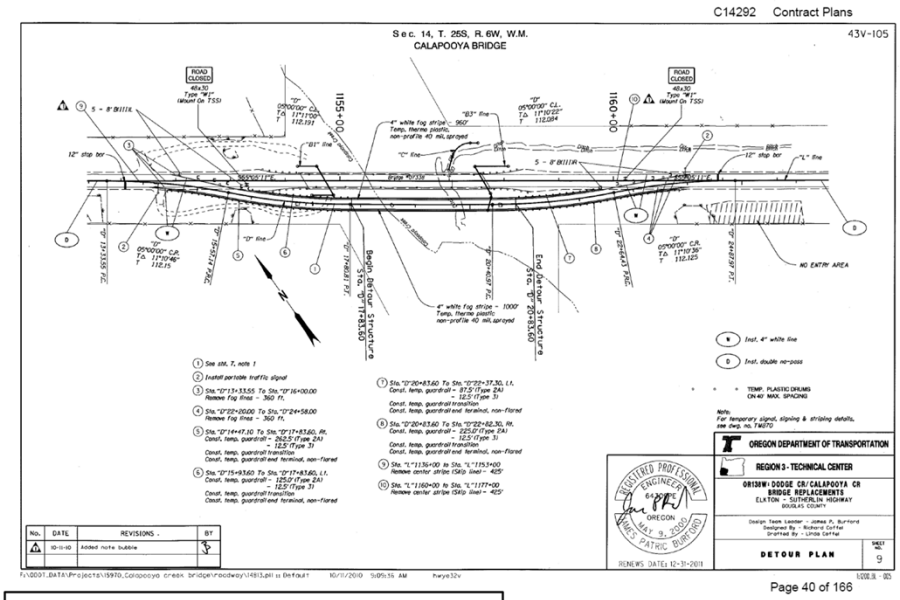
Location of Bridge in Roadway Plans



***Included in* Plans – Sheet 37 of 166.**

Locate the bridge in the roadway plans to see what other construction activities might affect the drilled shaft construction work. This could be the location of utilities, existing structures or other nearby facilities, construction of scour revetment (riprap), right of way limits, and designated restricted, or no-entry, areas.

Location of Detour Bridge



***Included in* Plans – Sheet 40 of 166.**

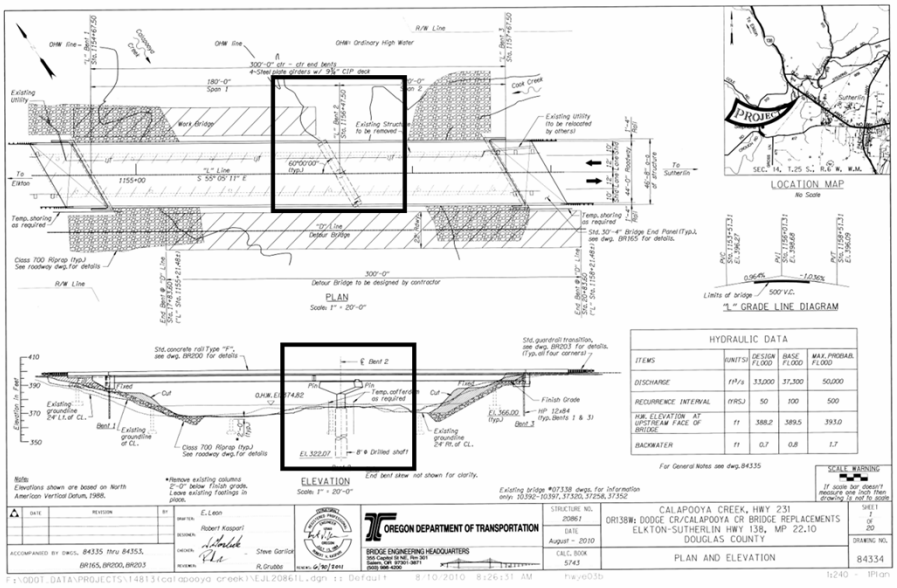
If there is a detour bridge being constructed immediately adjacent to the drilled shaft location(s) consider how that might affect access to the drilled shaft work area for drill rigs, steel reinforcement cages, cranes and other support equipment and tools.

Also consider how construction of the drilled shaft might affect adjacent structures or facilities.

If shafts are located close to existing facilities or structures their may be requirements in the Special Provisions for protection and/or monitoring of these structures during shaft construction.

If some or all of the existing bridge will be removed consider how that might affect drilled shaft equipment access and construction.

Plan & Elevation

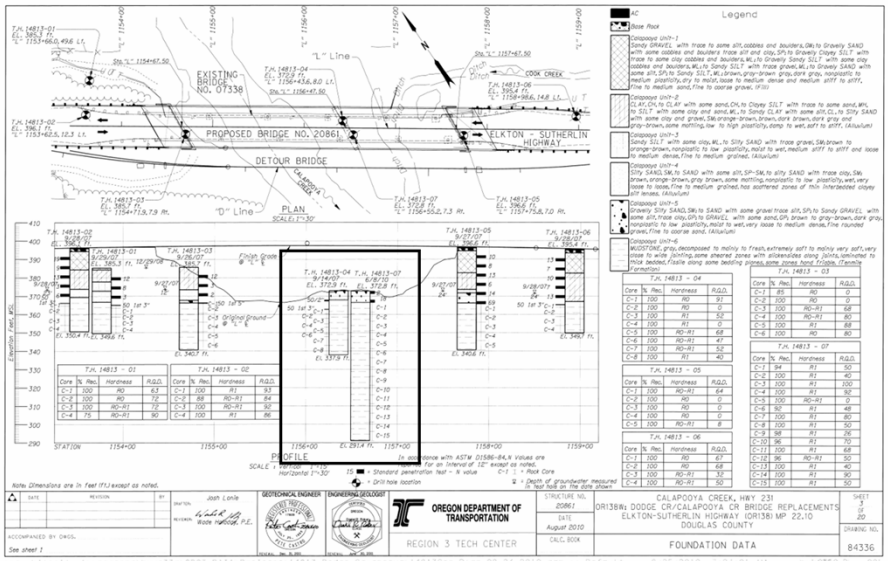


***Included in* Plans – Sheet 76 of 166.**

The Plan and Elevation sheet is usually the first sheet in a set of bridge plans. If the bridge has drilled shaft foundations they will be shown on the Plan & Elevation sheet. The number and diameter(s) of the shafts are usually shown on this sheet and often the shaft tip elevations are also shown. References are provided to other sheets where additional drilled shaft information can be found.

Foundation Data Sheet

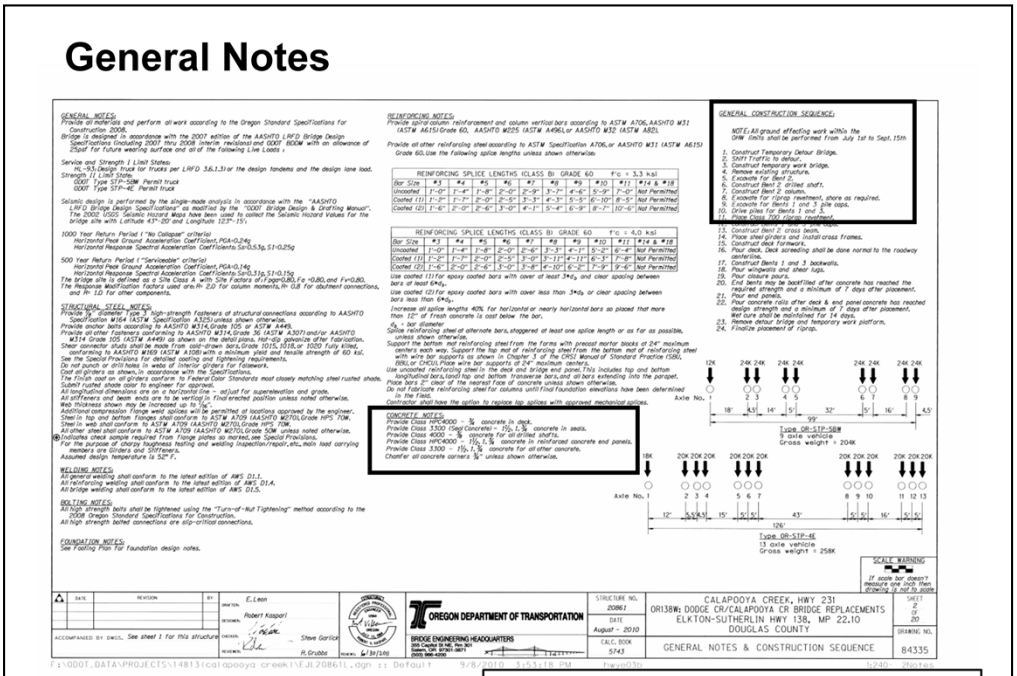
***Included in* Plans – Sheet 78 of 166.**



The Foundation Data sheet of the bridge drawings provides very important information about the subsurface materials and groundwater conditions that will be encountered when constructing the shaft. Usually the Geotechnical Engineer's name can be found on the data sheet and this person will often be the main contact regarding geotechnical construction issues.

Carefully review this information to gain a good understanding of the materials and conditions that the shafts will be constructed in. Note if the borings are located directly at drilled shaft locations or some distance away. Also note where the water table is, if one is present, so you know where you might expect it during shaft excavation.

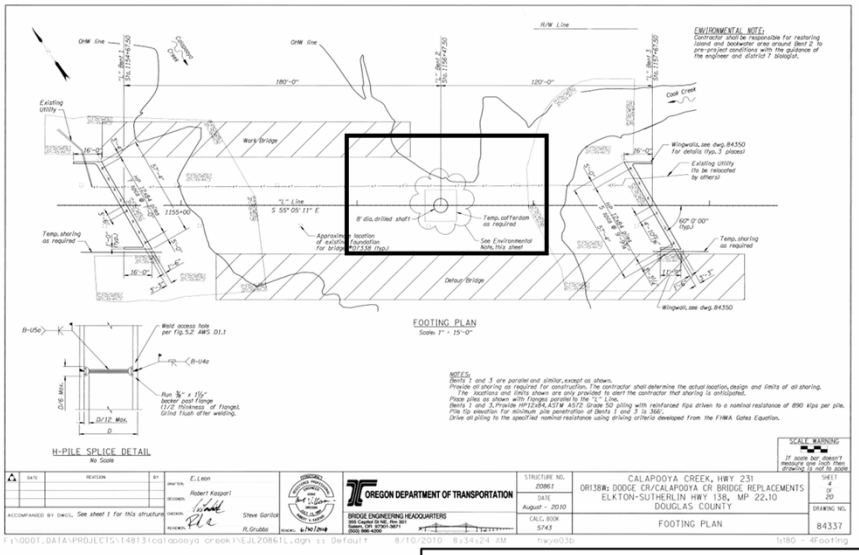
Get a copy of the project Geotechnical Report which contains all the exploration logs and more detailed information about the materials and conditions to expect in the shaft excavation.



***Included in* Plans – Sheet 77 of 166.**

The class of concrete for the drilled shaft is usually found in the General Notes page. Other site specific notes regarding shaft construction, such as the sequence of concrete pours, may be found here.

Footing Plan

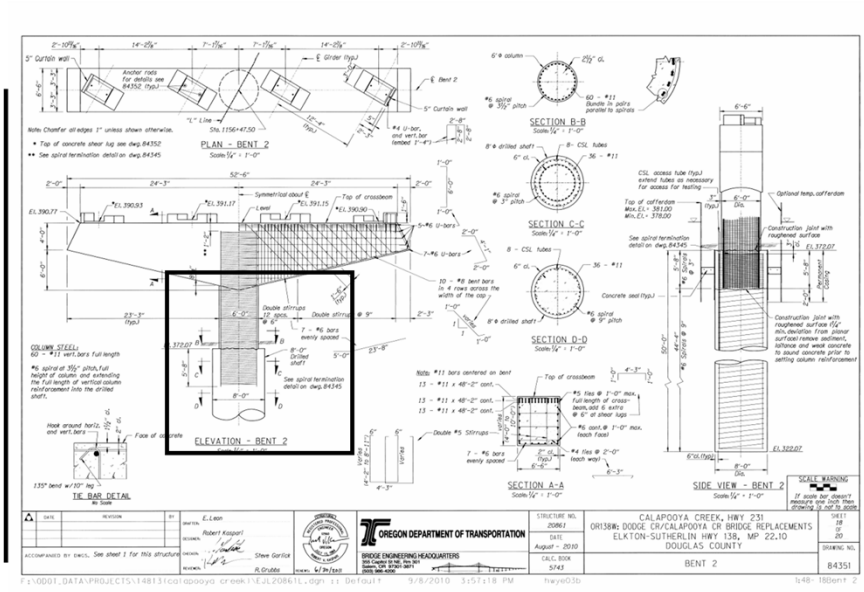


Included in **Plans – Sheet 79 of 166.**

The Footing Plan is a plan view that will show the location of the shafts, the shaft size (diameter), spacing between shafts and any temporary construction such as cofferdams or shoring that may be needed to build the shafts.

The “Top-of-Shaft” elevation may be shown on either this sheet or on Bent detail sheets for each bent. This elevation marks the pay limits for quantities of shaft steel and concrete unless otherwise described in the Special Provisions.

Bent Details



***Included in* Plans – Sheet 93 of 166.**

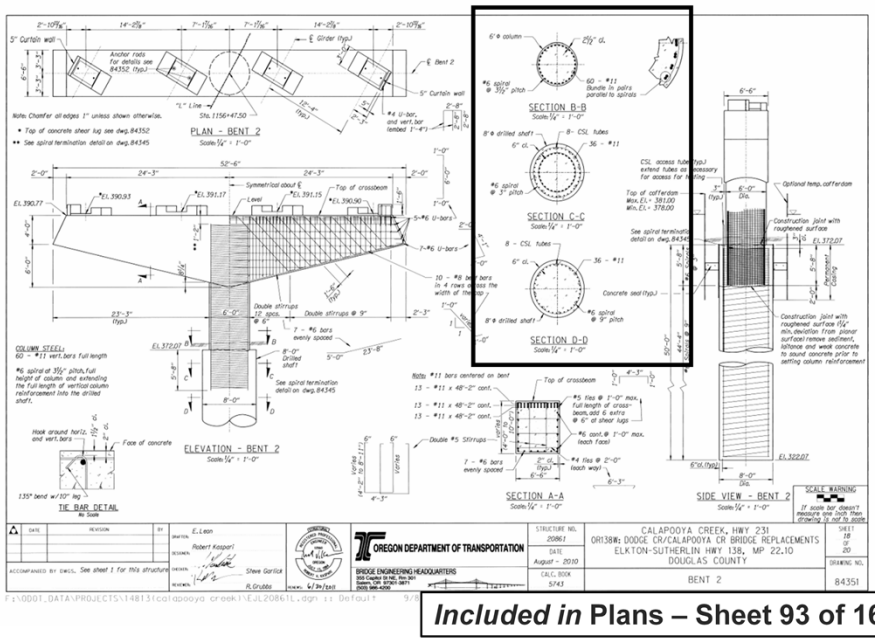
The Bent Details Sheet will usually show most of the information for the drilled shaft construction. It will show an elevation view with drilled shaft tip elevations and/or minimum bedrock embedment depths. Sometimes a table will be provided listing Bottom of Shaft (tip) Elevations for multiple bents and shaft locations.

Steel reinforcement details for the shaft are shown here including lengths of specific spiral pitch segments.

Drilled shafts are usually larger in diameter than the columns they support. In these cases the smaller column steel cage is placed inside the drilled shaft cage in the upper portion of the shaft called the “non-contact splice zone”. In these cases, the concrete pour for the shaft is conducted in two stages and there are two rings of steel reinforcement in this transition zone, the inner column steel and the outer shaft steel.

For shafts with a non-contact splice zone, three cross sections of the shaft/column reinforcement are shown on this sheet; 1) the column section, 2) the non-contact splice zone and 3) the drilled shaft section.

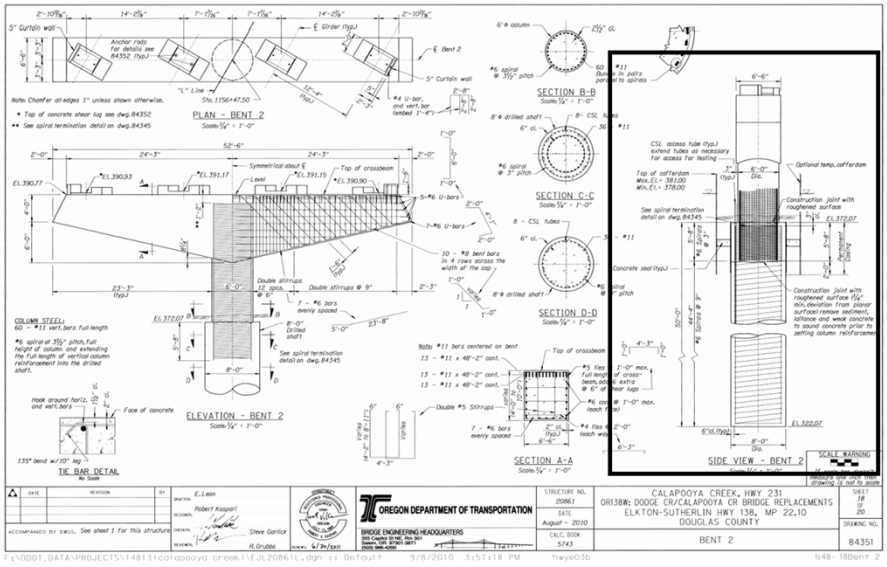
Bent Details



***Included in* Plans – Sheet 93 of 166.**

The steel reinforcement is shown for each of the three sections. Note the types and amount of reinforcement required for each reinforcement cage (column and shaft), the dimensions, minimum concrete coverage, and crosshole sonic log (CSL) tube locations.

Bent Details



Included in **Plans – Sheet 93 of 166.**

Note the top-of-shaft and bottom-of-shaft elevations on this drawing.

Permanent casing (if required) is also shown on this drawing. Temporary casing is typically not shown since it is not usually a specified item shown in the plans. The contractor typically determines the type, size and lengths of any temporary casing that may be needed to construct the shaft and this is submitted as part of the Drilled Shaft Installation Plan.

In the example design shown, a non-contact splice is required. The drilled shaft/column are constructed in three stages requiring two construction joints. The first concrete pour extends from the bottom of the shaft to the lower construction joint which is the base of the non-contact splice zone. This joint surface must be thoroughly cleaned and roughened as specified. Then the column steel is placed inside the shaft reinforcement and a second pour is made up to the top of the shaft. At that point the second construction joint is cleaned and the column is then formed and poured on top of the completed shaft.

Note any cofferdam or seal that may be required to construct the shaft. Typically any cofferdam or seals will be designed by the contractor using the design water elevations shown on the plans. Drawings for these items will be submitted for approval with the shaft installation plan.

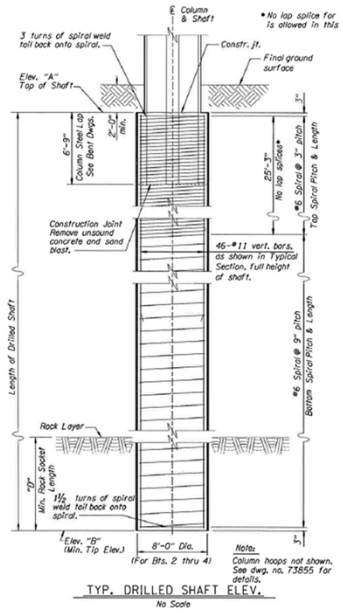
Bent Details

For Drilled Shafts with
a required embedment
into bedrock (rock socket)

**Note: Elev. "B" may be adjusted to match minimum penetration below competent rock surface as approved by the Engineer.

SHAFT SCHEDULE

Bent	Vert.Bars	Vert.Bars Length	Top Spiral Length	Bott. Spiral Length	Elev. "A" (ft.)	Elev. "B" (ft.)**	"D" (ft.)
2 Lt.	46-#11	51'-6"	25'-3"	26'-3"	239.0	187.0	24.0
2 Rt.	46-#11	51'-6"	25'-3"	26'-3"	239.0	187.0	24.0
3 Lt.	46-#11	39'-6"	25'-3"	14'-3"	208.0	168.0	24.0
3 Rt.	46-#11	39'-6"	25'-3"	14'-3"	208.0	168.0	24.0
4 Lt.	46-#11	53'-6"	25'-3"	28'-3"	238.0	184.0	24.0
4 Rt.	46-#11	53'-6"	25'-3"	28'-3"	238.0	184.0	24.0

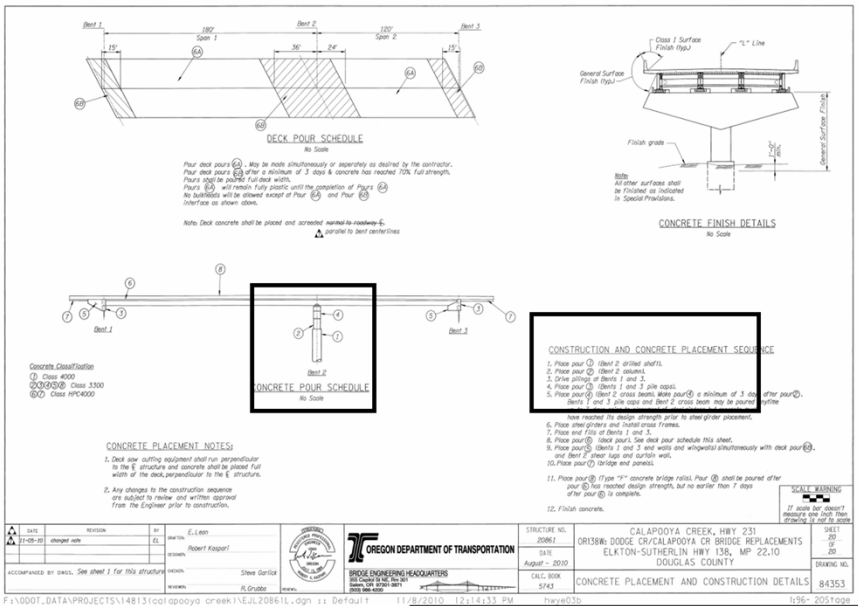


TYP. DRILLED SHAFT ELEV.
No Scale

***Not in Plans* – Example only.**

This Bent Detail sheet shows an example of a drilled shaft with a minimum rock socket embedment length "D", as specified in the adjacent table. In this case the bottom of the shaft (Elevation "B") may need to be adjusted during construction in order to obtain the minimum rock socket length "D". This type of design requires close communication, and usually on-site confirmation, with the Geotechnical Engineer to make sure the top-of-rock layer is properly identified during shaft excavation.

Concrete Pour Schedule



***Included in* Plans – Sheet 95 of 166.**

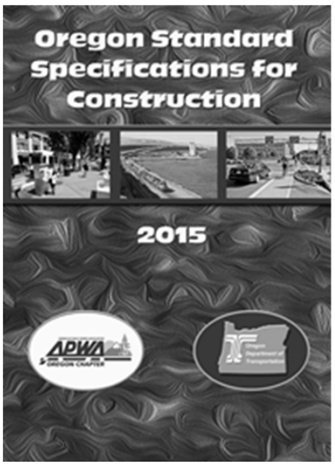
This drawing shows the sequence of concrete pouring for the drilled shaft and column.

Note that for shafts with non-contact splices, the concrete pour for the shaft concrete will be in two stages.

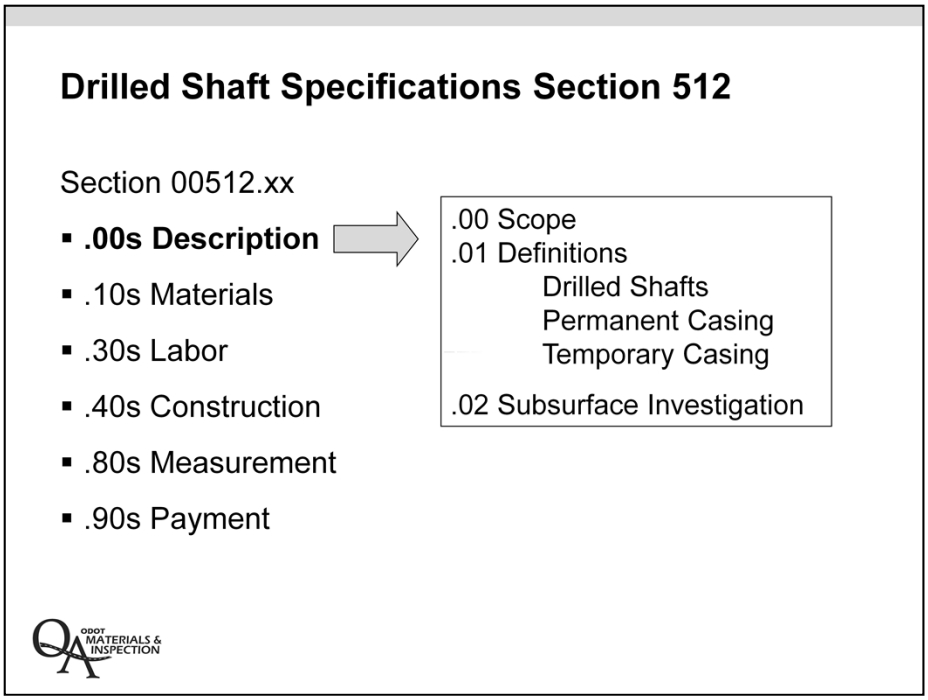
Drilled Shaft Specifications
Section 512: Drilled Shafts

Section 00512.xx

- .00s Description
- .10s Materials
- .30s Labor
- .40s Construction
- .80s Measurement
- .90s Payment



Section 512 of the Standard Specifications and the Special Provisions for the project should be carefully reviewed prior to shaft construction. A summary of the major items are listed above but there are many more details that will come to light once the entire specifications are read. Any questions or issues regarding the drilled shaft specifications should be brought to the Project Manager's or Engineer's attention and resolved prior to shaft construction.



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.

Drilled Shaft Specifications Section 512

Section 00512.xx

- .00s Description
- **.10s Materials**
- .30s Labor
- .40s Construction
- .80s Measurement
- .90s Payment

.10 General
Reinforcement
Concrete

.12 Concrete Mix Design

.13 Steel Casing

.14 Drilling Slurry

.15 Crosshole Sonic Log
Access Tubes

.18 Crosshole Sonic Log
Cement Grout

.19 Quality Control

These are the materials typically used in shaft construction or incorporated into the completed drilled shafts. All materials must be checked for compliance with the specifications. QA/QC field testing is usually performed by field technicians.

Drilled Shaft Specifications Section 512

Section 00512.xx

- .00s Description
- .10s Materials
- **.30s Labor** → **.30 Personnel Qualifications**
- .40s Construction
- .80s Measurement
- .90s Payment

Personnel qualifications are required to be submitted by the Contractor for approval prior to beginning the work as per Section 00512.30.

Drilled Shaft Specifications Section 512

Section 00512.xx

- .00s Description
- .10s Materials
- .30s Labor
- **.40s Construction**
- .80s Measurement
- .90s Payment

.40 Submittals
.41 Drilled Shaft Coordination Meeting
.42 Construction Tolerances
.43 Drilled Shaft Excavation
.45 Reinforcing Steel
.46 CSL Test Access Tubes
.47 Concrete
.48 Drilled Shaft Testing and Acceptance
.49 Scheduling and Restrictions

ODOT MATERIALS & INSPECTION

Under Submittals (Section 00512.40), the main submittal required is the **Drilled Shaft Installation Plan**. This plan should be a detailed description of the Contractor's equipment, tools and methods of constructing the drilled shafts (Section 00512.40(a)).

Drilled Shaft Specifications Section 512

Section 00512.xx

- .00s Description
- .10s Materials
- .30s Labor
- .40s Construction
- **.80s Measurement**
- **.90s Payment**

Furnish Drilling Equipment
Permanent Casing
Drilled Shaft Excavation
Drilled Shaft Concrete
Drilled Shaft Reinforcement
CSL Test Access Tubes
CSL Tests

ODOT MATERIALS & INSPECTION

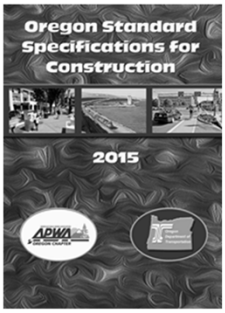
Pay items and quantities are listed in the Special Provisions for each structure.

Other Drilled Shaft Specifications

Section 921: Major Sign Support Drilled Shafts

Section 963: Signal Support Drilled Shafts

- Developed based on the Drilled Shaft 512 Standard Specifications with modifications.
- No permanent casing
- Commercial concrete for signal poles
- Construction tolerances of steel and concrete
- Shaft cleanliness
- Payment only by lineal foot.



ODOT MATERIALS & INSPECTION

Sections 921 and 963 were developed based on the Drilled Shaft Section 512 Standard Specifications. Most sections within these two specifications are very similar to Section 512, however some sections are modified, abbreviated from those in Section 512 or completely deleted.

The pay items are different in these drilled shaft specifications than in Section 512. Drilled shafts for traffic structures are typically much smaller and shorter than shafts for bridges and therefore all the standard pay items for excavation (drilling), reinforcement and concrete are lumped into one pay item (per liner foot). Estimated quantities for steel reinforcement and concrete are provided in the Special Provisions.

Drilled Shaft Specifications Section 512

Special Provisions

- Permanent casing requirements
- Additional equipment and reinforcement length requirements (due to anticipated variations in the soil bearing layer)
- Changes to concrete specifications
- Estimated quantities for concrete and steel

CONTRACT AND BONDS
FOR HIGHWAY CONSTRUCTION

OREGON DEPARTMENT OF TRANSPORTATION
SALEM OREGON

ODOT MATERIALS & INSPECTION

The Special Provisions contain the latest changes made to the standard Section 512 specifications and also project specific information like the diameters and lengths of permanent casing that may be required, estimated quantities for steel and concrete and any additional equipment or rebar lengths that may be required to construct the shafts. Below are excerpts from the Section 512 Boiler Plate Special Provisions.

00512.43(a) Drilled Shaft Excavation, General – Add the following paragraph after the last paragraph:

Variations in the bearing layer elevation from that shown are anticipated. Provide equipment on-site capable of excavating an additional _____ feet of depth below that shown.

00512.45 Reinforcing Steel – Add the following paragraph to the end of this subsection:

At locations requiring minimum shaft penetrations into specific bearing layers, furnish steel reinforcing bar cages, including CSL access tubes if specified, ___ feet longer than the lengths shown. Add the increased length to the bottom of the cage. Trim the shaft steel reinforcing bar cage to the proper length prior to placing it in the excavation. Shift or trim CSL access tubes (if present) to the revised cage length. If CSL tubes are cut, adapt the ends of the tubes to receive the watertight caps as specified.

Submittal Requirements

Section 00512.30 Personnel Qualifications

Section 00512.40 Drilled Shaft Installation Plan

Cannot begin shaft construction until these submittals have been reviewed and approved. Engineer has 21 calendar days for this review.

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 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 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 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 3 years. CSL testing personnel shall be trained in the operation of the CSL equipment and have at least one year of experience in operating CSL testing equipment on a minimum of 10 shafts.

Personnel Qualifications

- Project reference list of at least three separate foundation projects, successfully completed in the last five years,
- On-site supervisors shall have at least two 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.
- Drill operators shall have at least one year experience in the construction of drilled shaft foundations.

00512.30 Personnel Qualifications – Continued

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.

Personnel Qualifications (continued)

- 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.

The contractor's on-site personnel should be the same as those approved in the personnel qualifications submittal. If other personnel are substituted the Project Manager should be notified immediately and the contractor informed that the personnel present are not those approved through the contract specified, personnel qualifications submittal and review process.

Drilled Shaft Installation Plan 00512.40(a)

The Contractor's Shaft Installation Plan has to include at least the following:

- Drilling equipment, methods and tools
- Methods of shaft excavation and maintaining borehole stability
- Temporary and permanent casing installation methods
- Slurry materials and methods (if applicable)

ODOT MATERIALS & INSPECTION

Overview

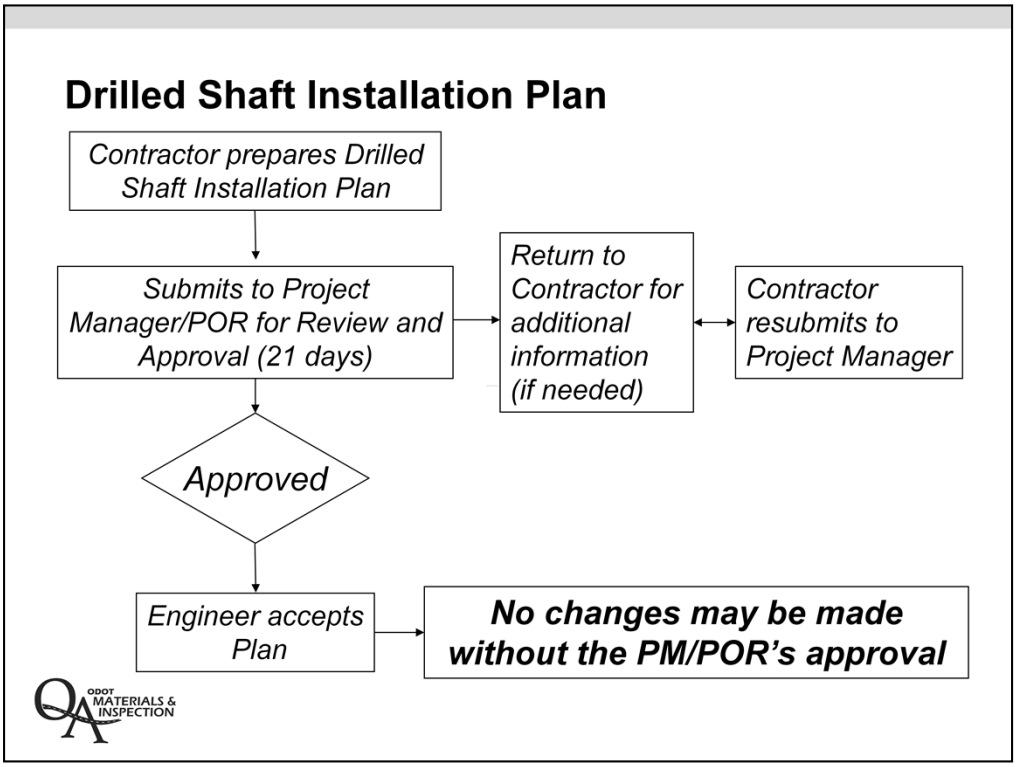
The Drilled Shaft Installation Plan is an unstamped submittal describing in detail the Contractor's tools and methods of constructing the drilled shafts. Section 512.40 "SUBMITTALS" of the ODOT Standard Specifications describes the minimum requirements of the Drilled Shaft Installation Plan. The idea behind this submittal requirement is to have the Contractor put thought and planning into the project. Often contractors want to take a "wait and see" attitude, where a general approach to the task is identified and a list of probable equipment to be used is given. For most Contractors, that is the extent of their pre-job planning, relying heavily on flexibility to adjust once on site, as the job begins to develop. There are so many uncontrollable unknowns when dealing with subsurface conditions, that the Contractor would benefit from paying closer attention to details regarding methods of installation and equipment ahead of time, minimizing some of the unknown factors. A smooth and successful start will usually be carried all the way through the job.

Drilled Shaft Installation Plan

- Steel reinforcement shop drawings and methods to maintain cage stability, alignment and concrete clearance
- Concrete mix design
- Concrete placement methods
- CSL testing company
- Methods of handling and disposal of materials

- Methods for protecting nearby structures
- Any containment requirements

ODOT MATERIALS & INSPECTION



ODOT Standard Specifications

00512.40 Submittals – Provide the following submittals to the Agency for review and approval:

(a) Drilled Shaft Installation Plan

…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.

The drilled shaft installation plan may require several iterations of submittals and reviews before approval is reached.

Drilled Shaft Installation Plan

- As a Drilled Shaft Inspector you must have a copy of the Contractor's approved Drilled Shaft Installation Plan.
- You should be familiar with the installation plan well in advance of the start of shaft construction.

As a Drilled Shaft Inspector you must receive a copy of the Contractor's approved Drilled Shaft Installation Plan. You should be familiar with the installation plan well in advance of the start of shaft construction.

Sample Drilled Shaft Installation Plan

Inland Foundation Specialties
A Division of Inland Crane Inc
PO Box 5313
Boise, ID 83705
Phone: 208.367.1699
Fax: 208.343.8534
Oregon CCB# 114951
www.inlandfoundationspecialties.com

Section 00512 – Drilled Shafts

Specialty Contractor – Inland Foundation Specialties

Project – OR138W: Dodge Cr/Calapooya Cr Bridge Replacements
Oregon Department of Transportation

Location – Calapooya Creek Bridge – OR138

General Contractor – Concrete Enterprises

Submittals:

00512.30 Personnel Qualifications

- Project Reference List (See Appendix A)
- On-Site Supervisor (See Appendix B)

On-site supervisors, one or more of the following Keith House, Levi Goins, Terry Lehto, Brent Reindel or Dustin Crea.

Keith House has over 40 years construction experience with 8 years of drilled shaft construction experience. Keith has drilled shafts ranging from 18" diameter to 120" diameter and depths up to 125'.

Levi Goins has over 9 years experience as a drill rig operator and drilled shaft construction supervisor. Levi has drilled shafts ranging from 2' diameter to 10' diameter and depths exceeding 100'. Levi has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Terry Lehto has over 8 years experience as a drill rig operator and drilled shaft construction supervisor. Terry has drilled shafts ranging from 2' diameter to 8' diameter and depths exceeding 80'. Terry has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

***Included in Resource Manual* Tab – Installation Plans.**

Sample Drilled Shaft Installation Plan

Dustin Crea has over 7 years experience as a drill rig operator and drilled shaft construction supervisor. Dustin has drilled shafts ranging from 2′ diameter to 8′ diameter and depths exceeding 80′. Additionally he has experience in placing rebar cases and concrete on the jobs he has performed.

- Drill Rig Operators (See Appendix B)

Keith House has over 40 years construction experience with 10 years of drilled shaft construction experience. Keith has drilled shafts ranging from 2′ diameter to 10′ diameter and depths exceeding 125′. Keith has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Levi Goins has over 9 years experience as a drill rig operator and drilled shaft construction supervisor. Levi has drilled shafts ranging from 2′ diameter to 10′ diameter and depths exceeding 100′. Levi has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Terry Lehto has over 8 years experience as a drill rig operator and drilled shaft construction supervisor. Terry has drilled shafts ranging from 2′ diameter to 8′ diameter and depths exceeding 80′. Terry has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Brent Reindel has over 5 years drilled shaft experience and 2 years experience as a drill rig operator. Brent has drilled shafts ranging from 2′ diameter to 8′ diameter and depths exceeding 80′. Brent has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Dustin Crea has over 7 years experience as a drill rig operator and drilled shaft construction supervisor. Dustin has drilled shafts ranging from 2′ diameter to 8′ diameter and depths exceeding 80′. Dustin has experience in placing rebar cages and concrete on almost all of the drilled shaft jobs he has performed.

Sample Drilled Shaft Installation Plan

IFS would install the Bent 2 drilled shaft after access to the shaft has been constructed. The shaft will be constructed during the in-water work period.

00512.40 Submittals

(a) Drilled Shaft Installation Plan

- Drilled Shaft Sequence:

- Equipment Suitability: (See Appendix C)

  IFS proposes to use a Casagrande B180 or B250 hydraulic track mounted drill rig, or similar sized machine. The drill will have adequate torque and down pressure to drill through the gravel, silt, sand, and mudstone as indicated in the boring logs. A variety of drill tooling may be implemented including the following: dirt augers, rock augers, coring barrels, cleaning buckets and flat pans. A service truck with a torch, welder and variety of tools will also be on the jobsite. A crane and vibratory hammer will also be on the jobsite.

- Shaft Excavation Methods:

  Shaft excavation will be performed by conventional rotary methods. Various tools such as augers, core barrels and cleanout buckets will be used to drill the soil and rock. The final cleanout will be performed by using a flat pan or cleanout bucket to remove loose material from the bottom of the shaft. IFS may choose to use an air lift method to clean the bottom of the shaft. If voids are present between the permanent casing and the surrounding soil, drill spoils, leancrete or concrete will be placed to fill the voids. Water displaced by concrete during the shaft pour will be pumped off the top of the shaft to a containment area provided by the others. Drilled shaft spoils disposal will be handled by others.

ODOT Standard Specifications

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).

Sample Drilled Shaft Installation Plan

- Shaft Stability:

  The permanent casing will be used for shaft stability for concrete placement. IFS will use temporary casing and/or slurry to ensure shaft stability in loose materials as necessary. Due to the high rock elevation, it is not anticipated that slurry will be needed for this project.

- Drilling Slurry: (See Appendix D for Slurry Data)

  IFS does not anticipate the need for slurry drilling on this project. However, if needed, IFS is able to perform slurry drilling. If slurry is needed, IFS will us water or Slurry Pro CDP, synthetic polymer slurry.

- Slurry QC Plan: (See Appendix D for Slurry Data)

  IFS does not anticipate the need for slurry drilling on this project. If slurry is needed, the properties and tests will be used as recommended by the slurry manufacturer. Technical assistance will be provided by John Tuttle 661-212-1223. All of the drill operators submitted above have been trained by the synthetic slurry manufacturer in the proper use of synthetic slurry.

ODOT Standard Specifications

Section 00512.40 Drilled Shaft Installation Plan – Continued

- Details of the proposed method(s) 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) of the Contractor's personnel assigned to the Project and trained by the synthetic slurry manufacturer in the proper use of synthetics slurries.

Sample Drilled Shaft Installation Plan

- Reinforcing Steel:

  The supply and assembly of the rebar cage with the CSL tubes is by others. The assembled rebar cage will be picked with the use of a crane or the drill rig. Once the cage is vertical, internal supports would be removed. Centralizers will be used to align the cage in the center of the shaft, centralizers are by others. The cage will be supported by chains and binders from the permanent or temporary casing. IFS would propose, as an option, setting the rebar cage on feet. These feet would consist of a carbon steel pipe of adequate size to slip over a vertical bar. This pipe would have a metal pad on one end and a piece of rebar material would be installed inside this pipe to provide the proper clearance for the rebar cage above the shaft bottom. This foot assembly would be secured to the cage with tie wire.

- Material Conformance:

  The permanent casing will be new domestic steel meeting the requirements of ASTM A36. The certifications will be submitted when the casing is delivered to the site.

  The drilled shaft concrete mix design will be submitted at a later date as an amendment to this submittal.

ODOT Standard Specifications

Section 00512.40 Drilled Shaft Installation Plan – Continued

- 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.

Added by Special Provision (2015)

- Documentation that the workability and slump retention properties of Section 2001 are met.
- If the concrete mix design allows the addition of water at the Project Site, documentation that specifies the amount of water that may be added and allowable methods for adding the water.

Sample Drilled Shaft Installation Plan

- Concrete Placement:

  If the shaft is dry, IFS will free-fall the concrete without the use of a tremie as allowed by the specifications. If the shaft is wet, IFS will truck chute or pump the concrete to the hopper of the 10" steel tremie pipe. The bottom of the tremie pipe will be placed approximately 12" from the bottom of the shaft. Concrete will be poured from the bottom of the shaft to the top of the construction joint. If the head pressure from the concrete causes the tremie to backup, IFS will slowly raise the tremie pipe until the concrete will flow through the tremie pipe. The tremie pipe will not be removed from the concrete that is poured and will always have at least 5 ft. of penetration into the fresh concrete. If there is water in the shaft, IFS will use a seal (pig) in the tremie pipe to prevent water mixing and segregation during the initial charge with the first load of concrete. During under water placement, IFS will pump water off the top of the fresh placed concrete to prevent overflowing. IFS will pump to a containment area provided by others. Grout placement in the crosshole sonic logging test access tubes will be by others.

ODOT Standard Specifications

Section 00512.40 Drilled Shaft Installation Plan – Continued

- 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).

Sample Drilled Shaft Installation Plan

- Permanent and Temporary Casing Installation and Removal:

  Temporary casing shoring may be installed for stream isolation and containment. The casing shoring would be between 9' diameter and 12' diameter by approximately 14' in length. The casing shoring would be driven using the drill or a vibratory hammer down to approximately elevation 364.40 or when a seal is established.

  The permanent casing will be between 8'6" diameter and 8' diameter by approximately 7' 8" in length. The permanent casing will be installed by the crane, vibratory hammer or drill.

- CSL Testing:

  CSL testing will be performed by others.

- Confinement Methods:

  Confinement methods will be handled by others. Casing shoring may be used to isolate drilling activities from the stream. Drilling fluids will be pumped thru continuous hose/piping to a containment area provided by others. Disposal of these materials are by others. Spoils will be deposited adjacent to the drill rig and contained by others.

- Protecting Existing Structures:

  Permanent casing will be installed in the upper portions of the shaft providing shaft stability. Existing structures will be visually monitored for negative impacts due to drilling operations. If existing structures are negatively impacted by drilling operations, operations will be stopped until a resolution is reached.

ODOT Standard Specifications

Section 00512.40 Drilled Shaft Installation Plan – Continued

- 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.

Sample Drilled Shaft Installation Plan

Project Reference List

- Job Name
- Customer (name address, phone number)
- Owner (name address phone number)
- Scope of Work
- Completion Date

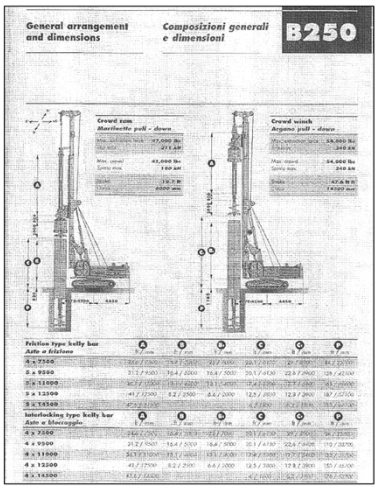
Project Reference List

JOB Name	CUSTOMER	Owner	Scope of work	Completed
Locus Grove/McMillian	H&H Utility Contractors Eric Boswell 225 W. Franklin Rd. Meridian, ID 83642 208-888-6876	Idaho Power Company PO Box 70 Boise, ID 83707 208-388-2741	This project consisted of drilling, setting anchor bolt pattern and pouring of concrete for a 7' diameter shaft, 20' deep. Soil conditions included sands, clays and cobbles with a water table level at approximately 22' below grade. Concrete pour was completed with the use of a tremie pipe.	Feb 2011
BSU Field Goal Net Polls	Alpine Construction, Inc. PO 190025 Boise, ID 83719 (208) 602-9426	Boise State University	36" Diameter drilled shaft, crane to set the pole.	Oct 2010
Pacific Recycling	PCM Co. LTD, 12485 W. View Ridge Drive Boise, ID 83709 Matt Brown (208) 869-7555	Pacific Recycling Center	Install 51 mm micropile by 40' Foot Lengths.	Oct 2010
BSU Parking Garage	Thyssen Krupp Randy 8564 W. Elisa St. Boise, ID 83709 208- 658-0000	Boise State University	Furnish & place 24" permanent casing.	Oct 2010
36th Ave Pedestrian Bridge	Guho Corp. 391 W. State Street, Suite G, Eagle, Idaho 83616 208-939-8850	Idaho Department of Transportation	Furnish & drive H-pile, Install pipe tips, crane service to set pre-engineered metal bridge.	Jan 2011
I-84 Franklin Blvd. to 11th Ave., Nampa ID	Concrete Placing Company 6451 W. Gowen Rd. Boise, ID 83709 208-362-2100	Idaho Department of Transportation	783'Ln. Ft. bridge pre-drill, piling in soil, install CMP sleeves.	Nov 2010
Clearwire Tower, Nampa Airport	Idaho Tower Constructors 9380 Chaparral Ranch Rd. Nampa, ID 83686 Rusty Wallace (208) 461-8003	Clearwire	60" diameter drilled shaft.	July 2010
Sorrento Lactalis, Inc. PO Box 1280 Nampa, Idaho 83653 (208) 467-4424	Stahlman Group, Inc. 5 Chenell Drive, Box 3 Concord, NH 03301 Janat Halasinski 603-225-0010 Ext. 3806	Sorrento Lactalis, Inc.	Installed 25 micropiles to support a new slab foundation for a cheese factory whey tank. The micropile was installed through silt clay and embedded into dense gravel with cobbles. Embedded plates were installed and the micropiles poured into the slab. 3 piles were tested at 75 kips.	Jun 2010
OR202 Nehalem River Banzer Bridge #30140A	Carter & Company Inc. 4676 Commercial St SE #203 Salem OR 97302 503-371-4582	Oregon Department of Transportation	38" diameter drilled shaft excavation, 72" diameter drilled shaft.	Oct 2010

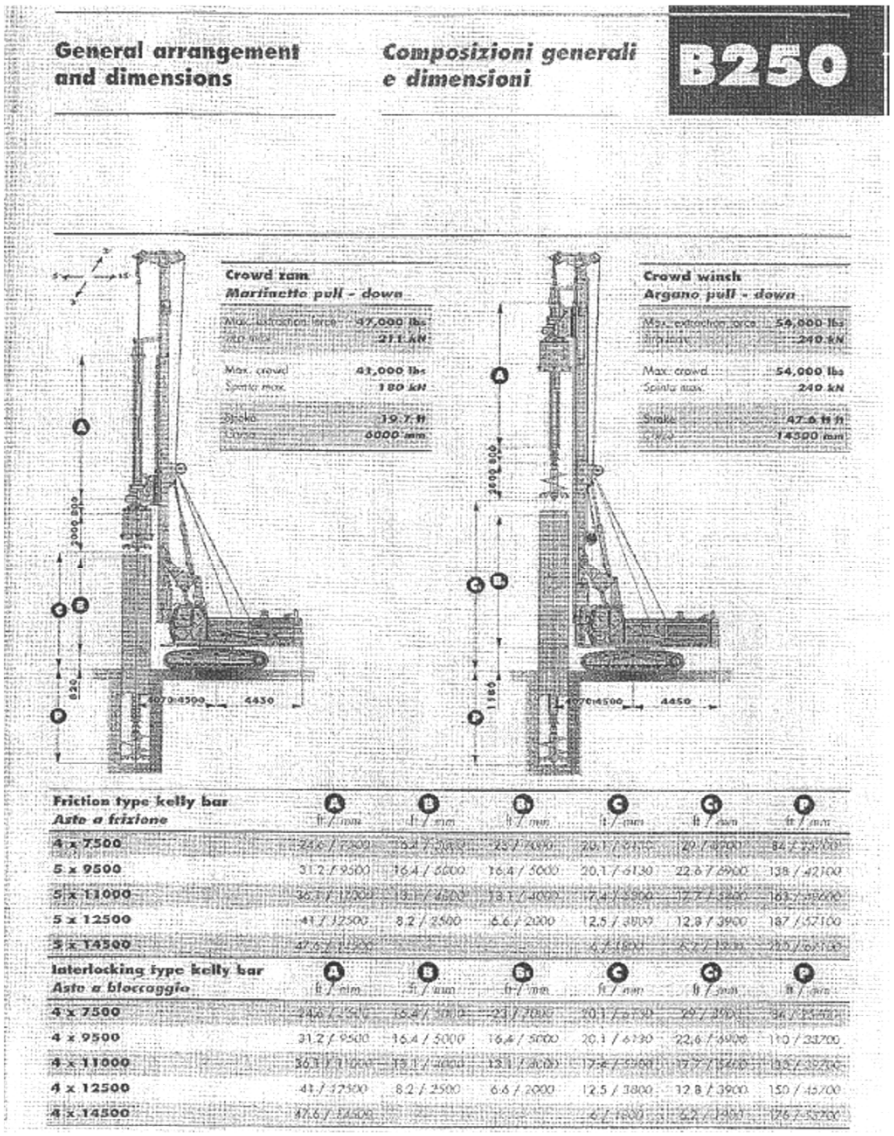
Sample Drilled Shaft Installation Plan

Drill Rig Specifications

- Manufacturer, make, model number
- Type of rig, dimensions, weight
- Diameter and depth range
- Project references



ODOT MATERIALS & INSPECTION



Sample Drilled Shaft Installation Plan

Slurry Data

- Manufacturer
- Type(s) of slurry proposed
- Materials and equipment required
- Mixing instructions and application procedures
- Testing procedures
- Safety data (environmental / hazard / health data)
- Onsite assistance and tech support

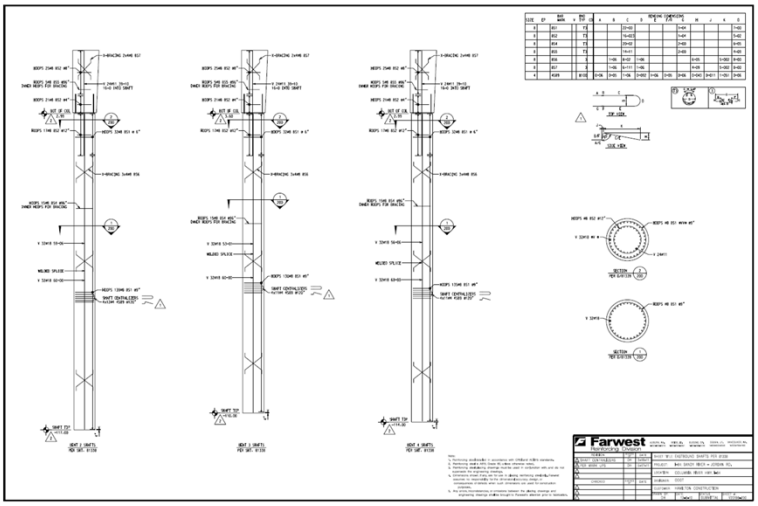
An example of a drilled shaft slurry submittal is included in the Appendix.

Drilled Shaft Reinforcement Shop Drawing

- Submitted as an unstamped drawing for review and approval in accordance with Section 00530 (Steel Reinforcement for Concrete).
- The drawing should show all dimensions, grades, order lengths and bending diagrams for the steel reinforcement.
- The drawing should show all the internal bracing requirements for the steel cage.

See handout for full size drawing.

Drilled Shaft Reinforcement Shop Drawing

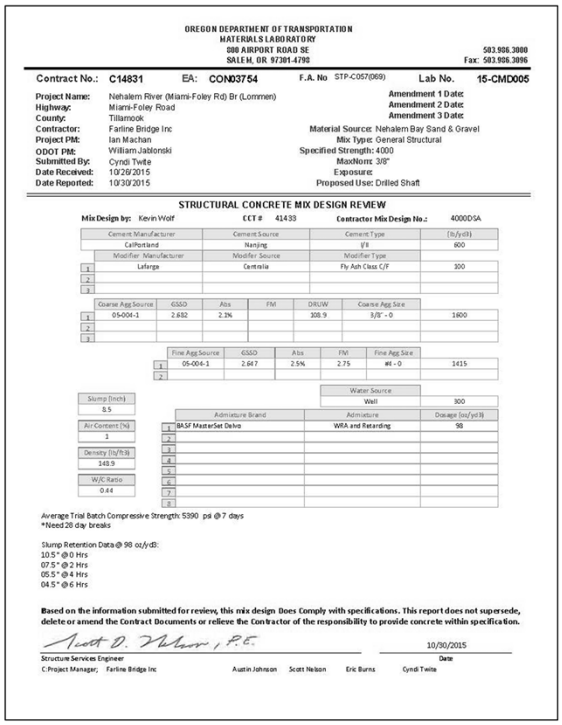


The drilled shaft reinforcement shop drawing is submitted as an unstamped drawing for review and approval in accordance with Section 00530 (Steel Reinforcement for Concrete). The drawing should show all dimensions, grades, order lengths and bending diagrams for the steel reinforcement

It is important to note the internal bracing requirements for the steel cage especially for long lengths of shaft reinforcement. This internal bracing helps maintain the shape, integrity and stability of the cage during pickup and placement into the excavation. This bracing is removed after the cage is lifted into place and while being placed into the excavation. This is to facilitate concrete placement.

For safety reasons, it is very important that this bracing constructed and tied properly.

Drilled Shaft Concrete Mix Design



OREGON DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
800 AIRPORT ROAD SE
SALEM, OR 97301-4798
503.986.3000
Fax: 503.986.3096

Contract No.: C14831 EA: CON03754 F.A. No STP-C057(069) Lab No. 15-CMD005

Project Name: Nehalem River (Miami-Foley Rd) Br (Lommen)
Highway: Miami-Foley Road
County: Tillamook
Contractor: Farline Bridge Inc
Project PM: Ian Machan
ODOT PM: William Jablonski
Submitted By: Cyndi Twite
Date Received: 10/29/2015
Date Reported: 10/30/2015

Amendment 1 Date:
Amendment 2 Date:
Amendment 3 Date:
Material Source: Nehalem Bay Sand & Gravel
Mix Type: General Structural
Specified Strength: 4000
MaxNom: 3/8"
Exposure:
Proposed Use: Drilled Shaft

STRUCTURAL CONCRETE MIX DESIGN REVIEW

Mix Design by: Kevin Wolf CCT # 41433 Contractor Mix Design No.: 4000DSA

	Cement Manufacturer	Cement Source	Cement Type	(lb/yd3)
	CalPortland	Nanjing	I/II	600
	Modifier Manufacturer	Modifier Source	Modifier Type	
1	Lafarge	Centralia	Fly Ash Class C/F	100
2				
3				

	Coarse Agg Source	GSSD	Abs	FM	DRUW	Coarse Agg Size	
1	05-004-1	2.682	2.2%		108.9	3/8" - 0	1600
2							
3							

	Fine Agg Source	GSSD	Abs	FM	Fine Agg Size	
1	05-004-1	2.647	2.5%	2.75	#4 - 0	1415
2						

Water Source	
Well	300

Slump (inch)
8.5

Air Content (%)
1

Density (lb/ft3)
148.9

W/C Ratio
0.44

	Admixture Brand	Admixture	Dosage (oz/yd3)
1	BASF MasterSet Delvo	WRA and Retarding	98
2			
3			
4			
5			
6			
7			
8			

Average Trial Batch Compressive Strength: 5390 psi @ 7 days
*Need 28 day breaks

Slump Retention Data @ 98 oz/yd3:
10.5" @ 0 Hrs
07.5" @ 2 Hrs
05.5" @ 4 Hrs
04.5" @ 6 Hrs

Based on the information submitted for review, this mix design Does Comply with specifications. This report does not supersede, delete or amend the Contract Documents or relieve the Contractor of the responsibility to provide concrete within specification.

Scott D. Nelson, P.E. 10/30/2015
Structure Services Engineer Date
C: Project Manager; Farline Bridge Inc Austin Johnson Scott Nelson Eric Burns Cyndi Twite

The concrete mix design should show:

- Compressive Strength
- Slump and slump retention
- Max. Aggregate size
- Admixtures used
- % air entrainment (no air entrainment is required)

OREGON DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
800 AIRPORT ROAD SE
SALEM, OR 97301-4798

503.986.3000
Fax: 503.986.3096

Contract No.: C14831 **EA:** CON03754 **F.A. No** STP-C057(069) **Lab No.** 15-CMD005

Project Name: Nehalem River (Miami-Foley Rd) Br (Lommen)
Highway: Miami-Foley Road
County: Tillamook
Contractor: Farline Bridge Inc
Project PM: Ian Machan
ODOT PM: William Jablonski
Submitted By: Cyndi Twite
Date Received: 10/26/2015
Date Reported: 10/30/2015

Amendment 1 Date:
Amendment 2 Date:
Amendment 3 Date:
Material Source: Nehalem Bay Sand & Gravel
Mix Type: General Structural
Specified Strength: 4000
MaxNom: 3/8"
Exposure:
Proposed Use: Drilled Shaft

STRUCTURAL CONCRETE MIX DESIGN REVIEW

Mix Design by: Kevin Wolf **CCT #** 41433 **Contractor Mix Design No.:** 4000DSA

Cement Manufacturer	Cement Source	Cement Type	(lb/yd3)
CalPortland	Nanjing	I/II	600

	Modifier Manufacturer	Modifer Source	Modifier Type	
1	Lafarge	Centralia	Fly Ash Class C/F	100
2				
3				

	Coarse Agg Source	GSSD	Abs	FM	DRUW	Coarse Agg Size	
1	05-004-1	2.682	2.1%		108.9	3/8" - 0	1600
2							
3							

	Fine Agg Source	GSSD	Abs	FM	Fine Agg Size	
1	05-004-1	2.647	2.5%	2.75	#4 - 0	1415
2						

Water Source	
Well	300

Slump (Inch)
8.5

Air Content (%)
1

Density (lb/ft3)
148.9

W/C Ratio
0.44

	Admixture Brand	Admixture	Dosage (oz/yd3)
1	BASF MasterSet Delvo	WRA and Retarding	98
2			
3			
4			
5			
6			
7			
8			

Average Trial Batch Compressive Strength: 5390 psi @ 7 days
*Need 28 day breaks

Slump Retention Data @ 98 oz/yd3:
10.5" @ 0 Hrs
07.5" @ 2 Hrs
05.5" @ 4 Hrs
04.5" @ 6 Hrs

Based on the information submitted for review, this mix design Does Comply with specifications. This report does not supersede, delete or amend the Contract Documents or relieve the Contractor of the responsibility to provide concrete within specification.

Scott D. Nelson, P.E. 10/30/2015

Structure Services Engineer **Date**

C:Project Manager; Farline Bridge Inc Austin Johnson Scott Nelson Eric Burns Cyndi Twite

Additional Submittals

- **Section 00512.40(b) Drilled Shaft Repair Plans**
  - Only submitted if shaft repairs are needed
  - POR decides the need for repairs after reviewing all available data
  - May be stamped or unstamped depending on the extent and type of repair.
- **Section 00512.40(c) Drilled Shaft Inspection Reports**
  - Submit the report within 21 calendar days after the completion and acceptance of each shaft.
- **Section 00512.40(d) Concrete Placement Logs and Volume Curves**
  - Submit within 24 hours after completion of shaft concrete placement.

00512.40 Submittals - Provide the following submittals to the Agency for review and approval:

(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.

Drilled Shaft Coordination Meeting

00512.41 Drill Shaft Coordination Meeting

- At least seven calendar days before beginning any shaft construction work
- To discuss:
  - Shaft Installation Plan
  - construction procedures
  - schedules
  - staging
  - personnel
  - equipment and other elements of the plan
  - status of outstanding submittals

ODOT MATERIALS & INSPECTION

00512.41 Drill Shaft Coordination Meeting – Hold a drilled shaft coordination meeting at least seven 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.

At this meeting it is important to go over and resolve any outstanding issues that remain after the review and approval of the installation plan and to establish a clear line of communication among all personnel involved in the shaft construction. Make sure notes are taken of the items discussed and any decisions made at this meeting.

Drilled Shaft Coordination Meeting

00512.41 Drill Shaft Coordination Meeting

- Representing the Contractor:
  - The superintendent
  - On-site supervisors
  - All supervisors in charge of excavating the shaft, placing the casing, mixing and installing slurry (as applicable), placing the steel reinforcement, and placing the concrete
  - Slurry manufacturer's representative (if used) and the Contractor's employee trained in the use of the slurry

If synthetic slurry is to be used, the contractor submits personnel knowledgeable and experienced in the use of the slurries that will be used. Often the slurry manufacturers representative will be on-site at the beginning of the project to direct and monitor the slurry operations and train one or more of the contractors personnel in the proper use of the slurry.

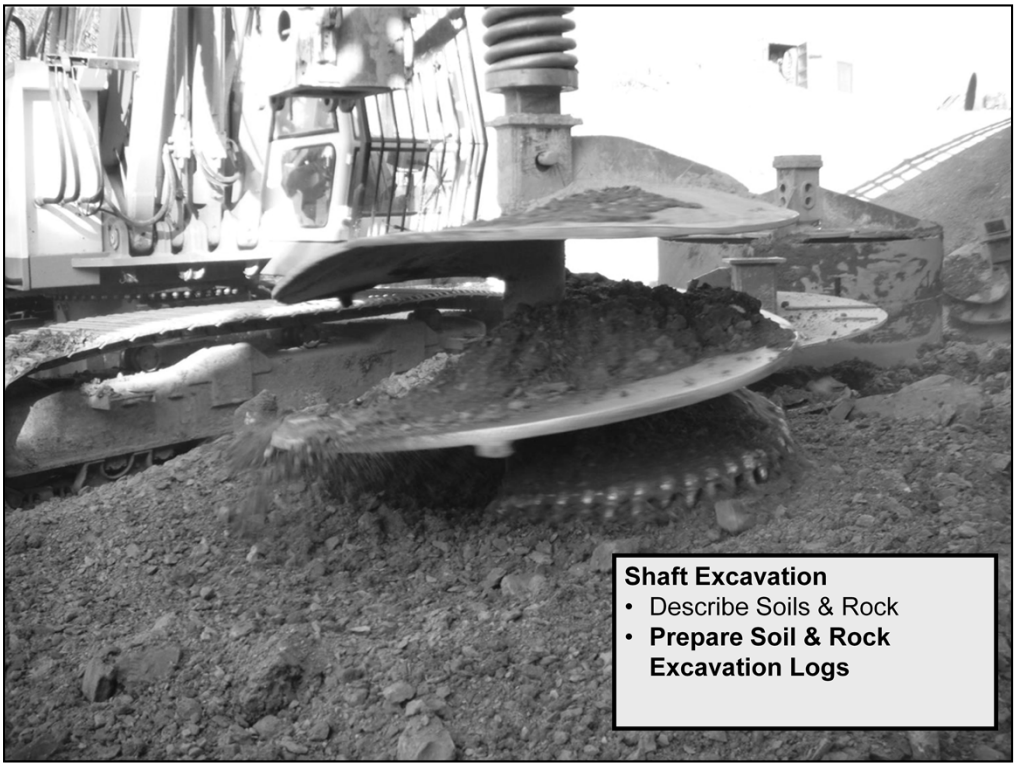
Drilled Shaft Coordination Meeting

00512.41 Drill Shaft Coordination Meeting

- Representing the Contracting Agency:
  - The Project Manager
  - Key inspection personnel
  - Professional of Record (POR) or the appointed representatives

Make sure you attend this meeting!!!!

This is also a good time to go over any issues in person with the Professionals of Record (geotechnical and structural).



The photo is an example of how different soil/rock materials can look at excavation. This is mudstone coming out of the ground at the Calapooya project.

00512.40 c & d require the Contractor to complete the drilled shaft inspection report, concrete placement logs and volume curves. However, it is a good idea to take your own set of notes so you can compare it with the information the contractor submits. By taking notes yourself you are more engaged in recognizing the change in materials being excavated, equipment failures, if it is taking longer than usual to drill the shaft, are they checking for plumb and alignment, etc. Typical activities to document during excavation include:

- Depth of drilling versus time.
- Changes in soil/rock layers and impacts on drilling time.
- Equipment related and/or other delays.

Blank forms and examples of completed forms are included in Appendix C in the student notebook.

Drilled Shaft Contract Bid Items

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 Casing	Foot
(c) Drilled Shaft Excavation, ____ Diameter	Foot
(d) Drilled Shaft Concrete	Lump Sum
(e) Drilled Shaft Reinforcement	Lump Sum
(f) CSL Test Access Tubes	Foot
(g) CSL Tests	Each

These are the standard bid items relating to drilled shaft construction and are found in the contract Special Provisions.

Drilled Shaft Contract Bid Items

SECTION 0004 BR NO 20861

0510	0501-0100000A BRIDGE REMOVAL WORK	LUMP	ALL	25,000.00	25,000.00
0520	0510-0100000A SHORING, CRIBBING AND COFFERDAMS	LUMP	ALL	20,000.00	20,000.00
0530	0510-0101000A STRUCTURE EXCAVATION	LUMP	ALL	1,000.00	1,000.00
0540	0510-0106000A GRANULAR WALL BACKFILL	LUMP	ALL	2,000.00	2,000.00
0550	0512-0100000A FURNISH DRILLING EQUIPMENT	LUMP	ALL	21,500.00	21,500.00
0560	0512-0101000A DRILLED SHAFT CONCRETE	LUMP	ALL	22,500.00	22,500.00
0570	0512-0103000A DRILLED SHAFT REINFORCEMENT	LUMP	ALL	18,000.00	18,000.00

Included in Resource Manual **Tab – Special Provisions, Sheet 199 of 223.**

ODOT MATERIALS & INSPECTION

Drilled Shaft Contract Bid Items

OR138W: DODGE CR/CALAPOOYA CR BRIDGE REPLACEMENTS
CONCRETE ENTERPRISES, INC.

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
0580	0512-0105000F CSL TEST ACCESS TUBES	FOOT	400.00	5.00	2,000.00
0590	0512-0106000E CSL TESTS	EACH	1.00	2,500.00	2,500.00
0600	0512-0114000F DRILLED SHAFT EXCAVATION, 96 INCH DIAMETER	FOOT	50.00	462.00	23,100.00
0610	0512-0115000F PERMANENT SHAFT CASINGS	FOOT	7.70	1,040.00	8,008.00

Included in Resource Manual **Tab – Special Provisions, Sheet 201 of 223.**

ODOT MATERIALS & INSPECTION

ODOT Drilled Shaft Inspection Checklist

- ODOT Form 734-2625
- Available on ODOT Construction Web page under Construction Forms:

http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/Pages/HwyConstForms1.aspx

***Included in Drilled Shaft Inspector Training Notebook* – Appendix C.**

ODOT MATERIALS & INSPECTION

Print Form

Drilled Shaft Inspector's Checklist

The following is a general checklist to follow when constructing a drilled shaft. The answer to each of these questions should be "Yes" or "NA" unless plans, specifications or specific approval has been given otherwise. Any answer of "No" should be explained in the Notes/Comments.
CONSULT WITH PROJECT MANAGER FOR YOUR SPECIFIC PROJECT RESPONSIBILITIES.

Pre-Construction

☐ Yes ☐ No ☐ NA 1. Has the Drilled Shaft Installation Plan been submitted and approved (00512.40)?

☐ Yes ☐ No ☐ NA 2. Has a list of project personnel been submitted and approved (00512.30)?

☐ Yes ☐ No ☐ NA 3. Have the Contractor's quality control technicians been submitted and verified?

☐ Yes ☐ No ☐ NA 4. Does the Contractor have an approved concrete mix design according to 02001.35? The Inspector should have a copy on the project site.

☐ Yes ☐ No ☐ NA 5. Has the Contractor run the required plastic concrete tests (slump loss tests) for their concrete mix design (02001.35(h))?

☐ Yes ☐ No ☐ NA 6. If the Contractor proposed a polymer slurry, do you have a copy of the quality control plan for the slurry (00512.40 and 00512.43(f)) and the name and phone number of the slurry manufacturer's representative who will be providing technical assistance?

☐ Yes ☐ No ☐ NA 7. If the Contractor plans to use a manufactured slurry, do they have the proper equipment to mix it?

☐ Yes ☐ No ☐ NA 8. Have you reviewed the Foundation Data sheet and drill logs and understand the subsurface conditions?

☐ Yes ☐ No ☐ NA 9. Has the Contractor addressed the Protection of Existing Structures (00512.40)?

☐ Yes ☐ No ☐ NA 10. Does the Contractor have all the equipment and tools shown in the Drilled Shaft Installation Plan (00512.40)?

☐ Yes ☐ No ☐ NA 11. If permanent casing is required, is it the right size and material in accordance with the plans and Section 00512.13?

☐ Yes ☐ No ☐ NA 12. If temporary casing is to be used, is it in accordance with the Drilled Shaft Installation Plan (00512.40)?

☐ Yes ☐ No ☐ NA 13. If there are contaminated media (materials), hazardous materials, or contaminated groundwater present, are they being treated in accordance with 00290 and 00294?

☐ Yes ☐ No ☐ NA 14. Do you have all the required drilled shaft forms that need to be filled out during shaft construction?
a. Drilled Shaft Excavation Log (form 734-2604)
b. Drilled Shaft Concrete Volume Log (form 734-2603)
c. Drilled Shaft Concrete Placement Log (form 734-2597)
d. Drilled Shaft Inspection Report (form 734-2598)

☐ Yes ☐ No ☐ NA 15. Has the drilled shaft coordination meeting been held (Section 00512.41)?

Shaft Excavation & Cleaning

☐ Yes ☐ No ☐ NA 16. Have the locations for the drilled shafts been accurately located and marked, and both the Contractor and Inspector understand the survey markings?

☐ Yes ☐ No ☐ NA 17. Is the shaft being constructed in the correct location and vertical alignment according to tolerances in Section (00512.42)?

☐ Yes ☐ No ☐ NA 18. Is the slurry level being properly maintained in accordance with 00512.43(f)?

☐ Yes ☐ No ☐ NA 19. Are the proper number and types of tests being performed on the slurry and reported in accordance with 00512.43(g)?

☐ Yes ☐ No ☐ NA 20. Are all excavated materials (spoils) properly contained and disposed of in accordance with 00512.43(a)?

☐ Yes ☐ No ☐ NA 21. If temporary casing is being used, does it meet the requirements of Section 00512.43(c)?

☐ Yes ☐ No ☐ NA 22. Is the shaft of proper depth?

☐ Yes ☐ No ☐ NA 23. Does the shaft bottom meet the clean-out requirements of Section 00512.43(h)?

☐ Yes ☐ No ☐ NA 24. Have the drilled shaft excavation forms been completed?

Reinforcing Cage (Construction & Placement)

☐ Yes ☐ No ☐ NA 25. Is the rebar the proper grade steel, correct sizes and correct configurations as shown in the project plans and shop drawings?

☐ Yes ☐ No ☐ NA 26. Is the rebar properly tied in accordance with Section 00530.41(b)?

☐ Yes ☐ No ☐ NA 27. Are the proper number of Crosshole Sonic Log (CSL) tubes furnished and installed according to the project plans?

☐ Yes ☐ No ☐ NA 28. Does the Contractor have the proper number and type of spacers for the steel cage in accordance with the approved Drilled Shaft Installation Plan and Section 00512.45(d)?

☐ Yes ☐ No ☐ NA 29. If the steel cage was spliced, was it done in accordance with the details shown on the contract plans?

☐ Yes ☐ No ☐ NA 30. Is the steel cage adequately secured to maintain vertical tolerance during concrete placement operations (00512.45(a) and 00512.47(e))?

Concrete Operations

☐ Yes ☐ No ☐ NA 31. Prior to concrete placement, has the slurry (both manufactured and natural) been tested in accordance with Section 00512.43(g)??

☐ Yes ☐ No ☐ NA 32. If required, was the casing removed in accordance with Section 00512.47(e)?

☐ Yes ☐ No ☐ NA 33. Does the Contractor's tremie meet the requirements of Section 00512.47(a)?

☐ Yes ☐ No ☐ NA 34. Was the discharge end of the tremie maintained in the concrete mass with proper concrete head above it at all times (00512.47(c))?

☐ Yes ☐ No ☐ NA 35. For shafts with non-contact splices, have the cold joints been properly cleaned and roughened in accordance with Section 00512.47(a)?

☐ Yes ☐ No ☐ NA 36. For shafts without non-contact splices, did the Contractor overflow the shaft until good concrete flowed out of the top of the excavation (00512.47(a))?

☐ Yes ☐ No ☐ NA 37. Have the Concrete Placement and Concrete Volume logs been completed?

☐ Yes ☐ No ☐ NA 38. Were the concrete acceptance tests performed as required?

☐ Yes ☐ No ☐ NA 39. Were the Crosshole Sonic Log (CSL) tubes filled with water and capped in accordance to Section 00512.46?

Post Installation

☐ Yes ☐ No ☐ NA 40. Is all casing removed to the proper elevations in accordance with 00512.47(e)?

☐ Yes ☐ No ☐ NA 41. Is the concrete being cured in accordance with Section 00540.51?

☐ Yes ☐ No ☐ NA 42. Has all Crosshole Sonic Log (CSL) Testing been completed in accordance with Section 00512.48?

☐ Yes ☐ No ☐ NA 43. Is the shaft within the allowable construction tolerances (00512.42)?

☐ Yes ☐ No ☐ NA 44. Has the Contractor completed the Drilled Shaft Inspection Report (00512.40(c))?

☐ Yes ☐ No ☐ NA 45. Has the Inspector completed the Drilled Shaft Inspection Report (00512.40(c))?

NOTES / COMMENTS

ODOT Drilled Shaft Inspection Checklist

Pre-Construction

☐ Yes ☐ No ☐ NA 1. Has the Drilled Shaft Installation Plan been submitted and approved (00512.40)?

☐ Yes ☐ No ☐ NA 2. Has a list of project personnel been submitted and approved (00512.30)?

☐ Yes ☐ No ☐ NA 3. Have the Contractor's quality control technicians been submitted and verified?

☐ Yes ☐ No ☐ NA 4. Does the Contractor have an approved concrete mix design according to 02001.35? The Inspector should have a copy on the project site.

☐ Yes ☐ No ☐ NA 5. Has the Contractor run the required plastic concrete tests (slump loss tests) for their concrete mix design (02001.35(h))?

☐ Yes ☐ No ☐ NA 6. If the Contractor proposed a polymer slurry, do you have a copy of the quality control plan for the slurry (00512.40 and 00512.43(f)) and the name and phone number of the slurry manufacturer's representative who will be providing technical assistance?

☐ Yes ☐ No ☐ NA 7. If the Contractor plans to use a manufactured slurry, do they have the proper equipment to mix it?

☐ Yes ☐ No ☐ NA 8. Have you reviewed the Foundation Data sheet and drill logs and understand the subsurface conditions?

☐ Yes ☐ No ☐ NA 9. Has the Contractor addressed the Protection of Existing Structures (00512.40)?

☐ Yes ☐ No ☐ NA 10. Does the Contractor have all the equipment and tools shown in the Drilled Shaft Installation Plan (00512.40)?

☐ Yes ☐ No ☐ NA 11. If permanent casing is required, is it the right size and material in accordance with the plans and Section 00512.13?

☐ Yes ☐ No ☐ NA 12. If temporary casing is to be used, is it in accordance with the Drilled Shaft Installation Plan (00512.40)?

☐ Yes ☐ No ☐ NA 13. If there are contaminated media (materials), hazardous materials, or contaminated groundwater present, are they being treated in accordance with 00290 and 00294?

☐ Yes ☐ No ☐ NA 14. Do you have all the required drilled shaft forms that need to be filled out during shaft construction?
a. Drilled Shaft Excavation Log (form 734-2604)
b. Drilled Shaft Concrete Volume Log (form 734-2603)
c. Drilled Shaft Concrete Placement Log (form 734-2597)
d. Drilled Shaft Inspection Report (form 734-2598)

☐ Yes ☐ No ☐ NA 15. Has the drilled shaft coordination meeting been held (Section 00512.41)?

ODOT Drilled Shaft Inspection Checklist
Pre-Construction

1. Has the Contractor submitted a Drilled Shaft Installation Plan (00512.40)?
2. Has the Drilled Shaft Installation Plan been approved?
3. Does the Contractor have an approved concrete mix design (00512.12)?
4. Has the Contractor run the required trial mix and slump loss tests for their concrete mix design (00512.12)?
5. Has the Contractor performed a satisfactory slump loss test for the entire duration of the pour in accordance with Section 00512.12, Concrete Mix Design?

ODOT MATERIALS & INSPECTION

Has the Contractor performed a satisfactory slump loss test for the entire duration of the pour in accordance with Section 00512.12, Concrete Mix Design?

This is an example of concrete that was placed without sufficient slump retention properties. The upper (older) portion of the concrete pour began to setup around the reinforcing steel such that the cage was being lifted upwards out of the ground during the pour. The cage had to be removed, cleaned off for reuse and the hole redrilled.

ODOT Drilled Shaft Inspection Checklist
Pre-Construction (continued)

6. If the Contractor proposed a polymer slurry, do you have a copy of the quality control plan for the slurry (00512.43(f)) and the name and phone number of the slurry manufacturer's representative who will be providing technical assistance?
7. If the Contractor plans to use a manufactured slurry, do they have the proper equipment to mix it?
8. Have you reviewed the Foundation Data Sheet and Drill Logs and understand the subsurface conditions?
9. Has the Contractor addressed the protection of existing structures?

ODOT MATERIALS & INSPECTION

ODOT Drilled Shaft Inspection Checklist
Pre-Construction (continued)

10. Does the Contractor have all the equipment and tools shown in the Drilled Shaft Installation Plan (00512.40)?
11. If permanent casing is required, is it the right size and material in accordance with the plans and Section 00512.13?
12. If temporary casing is to be used, is it in accordance with the Drilled Shaft Installation Plan (00512.40)?
13. If there are contaminated media (materials), hazardous materials, or contaminated groundwater present, are they being treated in accordance with 00290 and 00294?

ODOT MATERIALS & INSPECTION

ODOT Drilled Shaft Inspection Checklist
Pre-Construction (continued)

14. Do you have all the required drilled shaft forms that need to be filled out during shaft construction?
    a. Drilled Shaft Excavation Log (734-2604)
    b. Drilled Shaft Concrete Volume Log (734-2603)
    c. Drilled Shaft Concrete Placement Log (734-2597)
    d. Drilled Shaft Inspection Report (734-2598)
15. Has the drilled shaft coordination meeting been held (Section 00512.41)?

Unit Review

- Identify key inspection elements of the contract documents
- Understand the order of precedence for contract documents
- Locate plan sheet details related to drilled shafts
- Understand key elements of the ODOT Standard Specifications and Special Provisions for Drilled Shafts.
- Identify key elements of the Drilled Shaft Installation Plan