Traffic Control Plans Design Manual

11th Edition

Oregon Department of Transportation

Oregon Department of Transportation
Technical Services
Traffic-Roadway Section
Traffic Control Plans Unit
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Oregon

DATE: April 1, 2015

TO: Traffic Control Plans Designers

FROM: Scott M. McCanna, P.E.

Traffic Control Plans Engineer

SUBJECT: **Traffic Control Plans Design Manual – 11th Edition**

PURPOSE

The purpose of this manual is to introduce Traffic Control Plan Designers to the standards, practices, devices and technologies that make up the temporary traffic control discipline. This manual provides an organized collection of traffic control plan design standards, guidelines, policies, and procedures to be used in the development of a temporary Traffic Control Plan (TCP).

This TCP Design Manual is to be used by TCP Designers, engineers or technical staff within ODOT, members of City or County Public Works offices and private consulting engineering firms who are responsible for the development of temporary traffic control and highway construction staging plans.

Professionals conducting work outside of ODOT for other agencies should exercise caution in applying standards and practices within this manual as differences in design policy may exist between ODOT and those established by other agencies.

This technical manual is intended to provide greater detail in the design of temporary traffic control plans and supersedes other existing ODOT Design policies that make reference to temporary traffic control design standards. This manual should be considered as the primary technical design policy for the design of temporary traffic control plans. Please contact the ODOT Traffic Control Plans Unit, in Salem, for clarification or interpretation of any standards, practices or policies contained in this manual.

MANUAL ORGANIZATION

This manual discusses Traffic Control Plans Design beginning with general information and progressing to specific TCP design elements such as Traffic Control Devices, standard drawings, estimating, specifications and special provisions, etc.

UPDATES

This manual is updated annually. To expedite updates, this manual is available on-line. The on-line version is to be considered as an official document. As an on-line document, it will not be published and distributed as a traditional publication and there is no user list for update notifications.

It is the user's responsibility to verify they are using the most current version of the manual as their reference. Update information will be detailed on the ODOT Traffic Control Plans Unit web page.

The 10th Edition, and subsequent editions, will include indications of new or changed sections. Changes are identified on the "change sheet" on ODOT's Traffic Control Plans Unit web page. The change sheet summaries additions and changes that occur between manual revisions.

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Traffic Control Plans Design Manual

11th Edition

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General Standards and Practices

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CHAPTER 1 GENERAL STANDARDS AND PRACTICES

Chapter 1

1.0 – KEY POINTS OF THIS CHAPTER

- Safety – TCP Primary Function
- TCP Structure & Form
- TCP Design Elements
- TCP Designer Resources & Web Links

1.1 – SAFETY – A PRIMARY FUNCTION

1.1.1 – SAFETY IN TCP DESIGN

Safety is primary in TCP Design. Chapter 6 of the MUTCD repeatedly emphasizes safety management.

The principal function of a Traffic Control Plan (TCP) is to:

> *Provide for the reasonably **safe** and effective movement of road users through or around Temporary Traffic Control zones (work zones) while reasonably protecting road users, workers, responders to traffic incidents, and equipment.*

The goal of a TCP is to route road users through or around a work zone efficiently by:

- Using clear signs and pavement markings well in advance of the work zone, and adequately spaced throughout the work zone;
- Using devices that highlight or emphasize the appropriate path;
- Avoiding frequent or abrupt changes in roadway geometry; and,
- Avoiding work zone environments resulting in unanticipated, abrupt changes in speed.

ODOT, in partnership with the MUTCD, works to emphasize the purpose and function of a Traffic Control Plan and develop consistent, safe and effective TCP designs.

"TRAFFIC CONTROL PLAN" DEFINITION from the MUTCD, Chapter 6A

From Chapter 6 of the MUTCD, the following excerpts discuss the definition and function of a temporary traffic control plan.

At the Planning level:

> *"When the normal function of the roadway is suspended, TTC (temporary traffic control) planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities."*

For worker safety:

> *"Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway. At*

the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway."

The overall picture:

Consideration for road user safety, worker and responder safety, and the efficiency of road user flow is an integral element of every TTC zone, from planning through completion. A concurrent objective of the TTC is the efficient construction and maintenance of the highway and the efficient resolution of traffic incidents.

1.1.2 – ENGINEERING JUDGMENT

From the MUTCD, Chapter 1, FHWA provides the following definition for "Engineering Judgment":

*The evaluation of available pertinent information and the application of appropriate principles, provisions, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. *Documentation of engineering judgment is not required.*

A TCP Designer should use engineering judgment when adding details to the TCP to improve clarity and efficiency; and, avoid excessive delays, added costs, and improve safety.

***** While being founded on baseline principals or thresholds, some additions or modifications to the TCP may be based largely on an Engineer's individual experiences and not be previously documented. If invoking engineering judgment to make additions to the TCP, the engineer's decision process and final recommendation or solution should be well-documented including relevant assumptions. Also see *Transportation Management Plans* in Chapter 1.

1.1.3 – ODOT'S PERSPECTIVE

ODOT's perspective regarding the function of a TCP coincides with the MUTCD. If designed with the principles from the MUTCD in mind, the TCP will minimize inconveniences to traffic during construction, and should minimize the number and severity of traffic crashes.

A TCP is a *required* portion of all ODOT highway construction contracts, ODOT maintenance operations and permitted work (e.g. utility work) within State highway right of way. As a minimum, all traffic control plans should include a narrative that explains the scope of work, details including work location and duration; and, how traffic control measures and devices are to be implemented to adequately protect workers and public road users. Diagrams or engineered drawings should also be included to help convey the intended traffic control measures. Site-specific drawings are not necessarily required for all projects or work activities, but should be considered for activities where the additional detail would enhance the overall safety for the work area.

Typical Applications from Chapter 6 of the MUTCD, *Typical Application Diagrams* from Chapter 5 of the Oregon Temporary Traffic Control Handbook (OTTCH), and ODOT Traffic Control Standard Drawings (TM800 Series) are intended to provide generic temporary traffic control layouts for rudimentary work zone conditions and roadway environments. For more complex work zone operations, site-specific drawings are recommended.

For ODOT highway construction contracts, all traffic control plans must include, as a minimum:

- Standard Specifications and Special Provisions
- A Pay Item schedule
- A list of applicable ODOT Standard Drawings and Standard Details

The development of project-specific traffic control plan sheets should be included when additional details are needed to add clarity and to convey more complex traffic control and construction staging activities than what could be described in writing within the specifications. All temporary road work activities – particularly highway construction contracts – shall include a representative TCP based on the scope of work.

1.2 – TCP STANDARDS

1.2.1 - MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

ODOT uses the guidance of the Federal Highway Administration (FHWA) *MUTCD* in the design of temporary traffic control plans. Mandates within the Oregon Administrative Rules (OAR) and the Oregon Revised Statutes (ORS) require the use of the MUTCD as the reference for the specifications of uniform standards for traffic control devices for use upon highways within this state. MUTCD Section 6A.01 states:

> *"The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents."*

MUTCD Section 6B.01 states: "A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied."

Together, the MUTCD and the applicable OAR and ORS form the basis for requiring that a temporary traffic control plan be prepared for all construction or maintenance work within Oregon State highway right of way.

1.2.2 - OAR & ORS

The following Oregon Administrative Rules (OAR) and Oregon Revised Statutes (ORS) pertain to work zone and construction area traffic control:

- OAR 734-020-0005 adopts the MUTCD as the reference for the specifications of uniform standards for traffic control devices for use upon highways within this state,
- OAR 734-020-0410 requires the State Traffic Engineer's approval of all traffic signals, temporary, portable, or permanent.
- ORS 811.230, .231, .232, and .233 cover double fines and yielding to highway workers.

A TCP Designer should be familiar with these and other OAR and ORS that pertain to work zone and construction area activities.

1.2.3 – ADDITIONAL STANDARDS & REFERENCES

A number of additional resources are available and are regularly used in developing a traffic control plan. The following references should be used to help maintain consistency and uniformity in the design and implementation of a temporary traffic control plan.

- FHWA *Standard Highway Signs (SHS)* manual and *SHS Supplement* – Includes sign designs for regulatory, warning, guidance and service signing regularly used in TCPs.
- AASHTO *Roadside Design Guide* – Includes concepts and general discussions about "clear zone", longitudinal barrier systems, impact attenuators and other safety hardware devices.
- ODOT *Sign Policy & Guidelines* – Includes sign designs and functions for regulatory, warning, guidance and service signing specific to Oregon – that modifies or supplements the MUTCD and SHS.
- ODOT *Temporary Traffic Control Handbook for Operations of Three Days or Less (OTTCH)* – While not intended for long-duration roadwork activities, the OTTCH is based on the fundamental principles and standards within the MUTCD as well as Oregon-specific traffic control measures. The OTTCH is intended for work zone activities lasting less than three consecutive days – including mobile operations – for both freeways and non-freeway facilities.
- ODOT *Portable Changeable Message Sign (PCMS) Handbook* – Includes useful information regarding the function, application and proper operation of this valuable traffic control device.
- ODOT *Highway Design Manual (HDM)* – While primarily used for the design of permanent roadway facilities, the HDM includes valuable information in the design of temporary roadway alignments and other features.

1.3 – TRAFFIC CONTROL PLAN STRUCTURE

1.3.1 - WORK ZONE LIMITS & COMPONENTS

Work Zone Limits

Because Oregon enforces the doubling of traffic fines in highway construction work zones, it is important to clearly identify the beginning and end of a work zone for the travelling public, contractors and law enforcement agencies.

The MUTCD, Part 6, Section 6C.02; the *Standard Specifications for Construction*, , Section 00225.01; and, the *Oregon Vehicle Code* (ORS 811.230) define the limits of a work zone as follows:

> "…from the ***first warning sign*** or high-intensity rotating, flashing, or strobe lights on a vehicle to the ***'END ROAD WORK' sign or the last*** (traffic control) ***device***."

It is the intention of ODOT and this Design manual to clarify, "***first warning sign***" as meaning the initial, "ROAD WORK AHEAD" (W20-1) or similar advance warning sign (e.g. "BRIDGE WORK AHEAD", "SHOULDER WORK AHEAD", "UTILITY WORK AHEAD").

For the purposes of discussion and enforcement, the "*first*" or initial warning sign does not include the following:

- The standard, "ROAD WORK NEXT XX MILES" sign
- The standard, "INTERMITTENT ROAD WORK NEXT XX MILES" sign
- Messages displayed on electronic signs – e.g. PCMS or VMS

WORK ZONE COMPONENTS

A work zone is composed of four distinct areas (*Figure 1-1*):

- Advance Warning Area
- Transition Area
- Activity Area
- Termination Area

Advance Warning Area – Where traffic first recognizes a work zone is approaching. This area includes the installation of advance warning signs.

Transition Area – Where traffic is directed out of the normal travel path through signing and the placement of traffic control (channelizing) devices on the roadway. The Transition Area requires drivers to maneuver in some manner before reaching the work area. Transitions can occur as a lane or shoulder closure, lane shift, or a new (temporary) alignment via crossover or on-site diversion.

Proper merging and shifting taper lengths will provide a satisfactory degree of safety and predictability for drivers within the transition area.

Statistically, the Transition Area is responsible for the majority of work zone traffic crashes. Extra attention should be given to the design and implementation of this portion of the work zone.

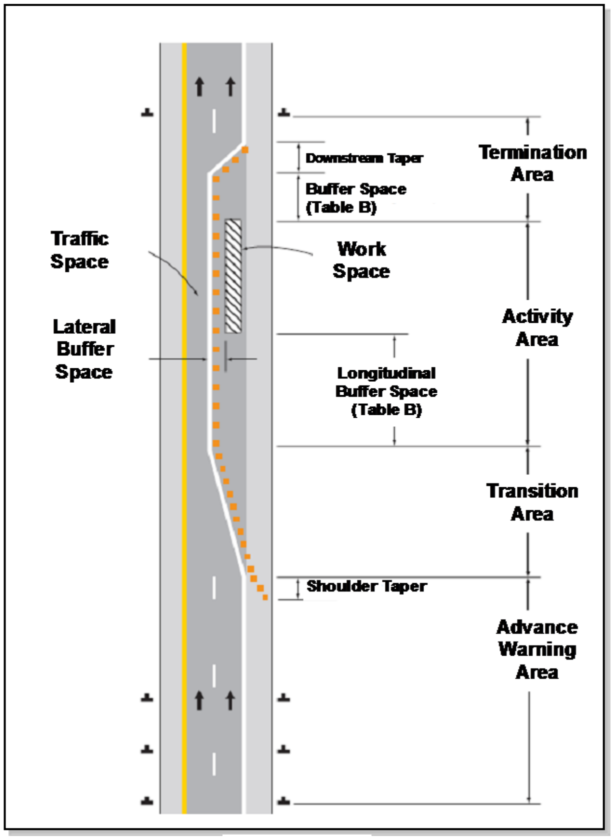

FIGURE 1-1

Activity Area – Where work is conducted. The Activity Area also includes the leading longitudinal Buffer Space before the work space. Two types of buffer spaces are used to separate traffic from the work area. A longitudinal buffer space provides a recovery area for errant vehicles prior to reaching the work area. A lateral buffer space, or “shy distance” is developed between the edge of the traffic lane and the edge of the work space.

To function properly, buffer spaces must not include any work equipment, materials or personnel.

Termination Area – Where traffic leaves the work zone, returns to the existing path of travel and resumes normal flow. Contractor equipment and workers should not be present in the downstream Buffer Space. Contractor haul vehicles may pass through the Termination Buffer Space as they leave the work site and accelerate to merge with public traffic.

OTHER WORK ZONE COMPONENTS

Additional elements are frequently used in the development of a traffic control plan, but are often more project-specific, including:

TAPERS – Tapers are created using a series of channelizing devices to move traffic from one path of travel to another. There are five common types of tapers. The three primary tapers include the *Merging (or Lane Closure)*, *Shifting*, and *Shoulder Closure* taper (*Figure 1-2*).

The appropriate length for tapers begins by determining the length, "**L**" – found on the *Minimum Lengths Table* on ***ODOT Standard Drawing TM800***. Once "**L**" is known, taper lengths are calculated.

- ***Merging Taper*** – Used to merge two traffic lanes into one lane. The length of a Merging Taper is equal to "**L**". Being based on the pre-construction posted speed, the taper allows drivers to merge safely. For freeways, the Merging Taper length "**L**" is fixed at 1000 feet.
- ***Shifting Taper*** – Used to shift traffic laterally. A Shifting Taper length is equal to **1/2** "**L**". Shifting Tapers may be longer – up to "**L**", but should not be less than **1/2** "**L**" as the taper angle can be too abrupt for drivers and can lead to panicked maneuvers and loss of control of their vehicle.

When designing the TCP, successive Merging or Shifting Tapers, or a combination of Tapers, should be separated by a reasonable distance to allow drivers to accomplish one maneuver at a time and readjust their speed. A number of ODOT Standard Drawings suggest distances varying from **2"A"** to **2"L"** between the two tapers.

- ***Shoulder (Closure) Taper*** – Used to close the shoulder of a roadway. The length of a shoulder closure taper is equal to **1/3** "**L**".
- ***One-Lane, Two-Way Traffic (Flagger) Taper*** – Set up between the activity area and a flagger station, the Flagger and the taper are used to guide traffic into the two-way, one-lane portion of the roadway within the work area. The length of a One-lane, Two-way taper ranges from 50 – 100 feet.
- ***Downstream (Termination) Taper*** – Provides a visual cue to traffic that they have passed the work area and are to returning to the original roadway configuration. The length of a Downstream Taper ranges from 50 – 100 feet.

Detours and Diversions – A *Detour* is a traffic control measure used when closing a roadway to move traffic from the existing facility to an alternate existing facility – often outside the project limits.

An *On-site Diversion* is a measure where traffic is moved out of its original alignment and onto either another part of the existing roadway, or onto a temporary surface constructed within the project right-of-way or easement (*Figure 1-2*). Traffic is diverted around the work area by way of signing, channelizing devices and pavement markings. On-site Diversions can be configured to accommodate all existing traffic lanes, a reduced number of lanes; or, a single, reversible lane controlled by a temporary traffic signal or flagging operations.

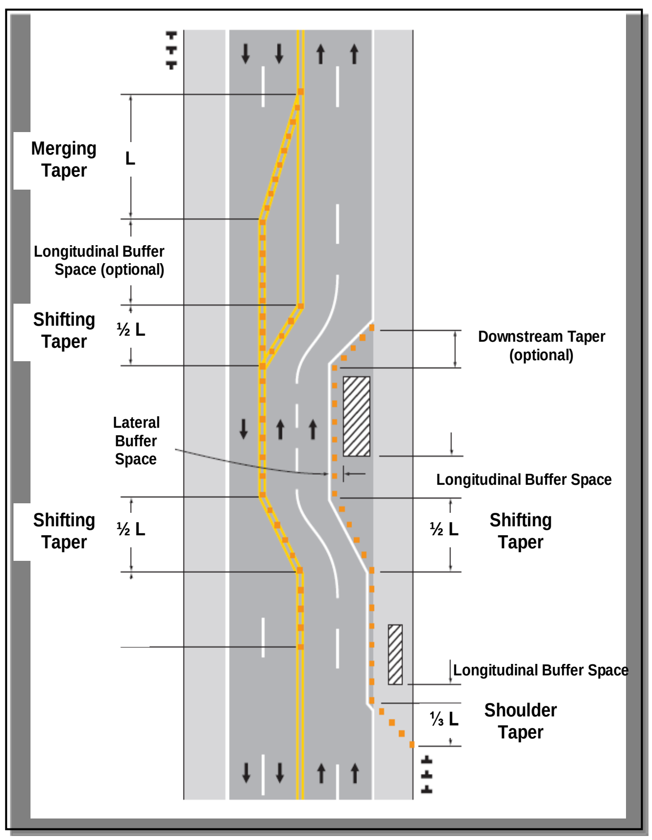

FIGURE 1-2

1.3.2 - TRAFFIC CONTROL PLAN DESIGN FORM

A Traffic Control Plan can take one of two basic forms – a "Written" TCP; or, a "TCP with Plan Sheets."

A "Written" TCP includes project-specific Special Provisions and applicable Standard Drawings. Written TCPs are common for projects with the following attributes:

- Construction details and instructions can be conveyed solely using specification language and Standard Drawings
- Project duration is shorter – typically less than a few months
- Scope of work is simple and may only include a few work activities (e.g. preservation work, or a shoulder widening project)A "TCP with Plan Sheets" should be developed for projects with the following attributes:
- All work activities cannot easily be described solely using project-specific Special Provisions or Standard Drawings
- Scope of work is complex and requires multiple, site-specific Stages; and, is typically much longer – several months to a year or more
- Construction features or activities are challenging and labor-intensive (e.g. bridge replacement, culvert installation, full roadway rebuilds, roadway realignments, signalized intersection/ramp terminal reconstructions)
- A detour route is included as part of the project

Examples of projects that would benefit greatly from the development and inclusion of project-specific TCP plan sheets include:

- Bridge replacements or culvert installations, in kind
- Interchange modifications, signalized intersection/ramp terminal reconstructions
- Full-depth roadway rebuilds, or realignments

See the sections below for more specific information regarding Specifications, Standard Drawings, and plan sheets.

1.3.3 - STANDARD SPECIFICATIONS *& SPECIAL PROVISIONS*

The *ODOT/APWA* *Standard Specifications for Construction*, project-specific Special Provisions, and applicable Standard Drawings are part of every TCP, and are the primary element explaining how the work is to be completed.

Chapter 4 – *Specifications & Standard Drawings* explains in greater detail the format, function and crafting of Specifications and project-specific Special Provisions. Chapter 4 will also discuss Standard Drawing content and function. The following is meant as a brief introduction to these valuable tools in developing a safe, efficient, and effective temporary traffic control plan.

STANDARD SPECIFICATIONS

The collection of *Standard Specifications for Construction*, commonly referred to as the, "*Standard Specs,*" is available in hard copy form and on-line on the ODOT web site under the Specifications Unit located within the Traffic-Roadway Section. The current version of the *Standard Specifications for Construction* is the 2015 edition – to be used for projects letting for contract beginning February 1,

2015. Projects currently under contract, or with a bid date prior to February 1, 2015, will still be using the *2008 Standard Specifications*.

The Standard Specifications and Special Provisions apply to all ODOT highway construction contracts. However, Designers are reminded that the Standard Specifications for Construction are also applicable to local Public Works agencies (e.g. Cities and Counties).

SPECIAL PROVISION "BOILERPLATES"

On the Specification Unit website, there are links to documents known as, Special Provision "*Boilerplates.*" Special Provision "Boilerplates" have been developed to accomplish the following:

- Provide additional project-specific instructions for the contractor
- Identify important and relevant details on Standard Drawings or on project-specific plan sheets
- Supplement the contents of the *Standard Specifications for Construction*
- Update language that has changed or become obsolete in the *Standard Specifications for Construction*, since its publication

Boilerplates are available on the Specification Unit website for downloading, editing and publishing within contract bid document packages.

"UNIQUE" SPECIAL PROVISIONS

"Unique" Special Provisions are more specific portions of contract language that refer to a single or highly specialized portion of work, device or condition. When applicable, a "Unique" is incorporated into the project-specific Special Provisions.

"Unique" Special Provisions are on the ODOT Specifications Unit website under the "Unique Specifications" link. Temporary Traffic Control "Uniques" are located under the "Part 00200" link.

CUSTOM PROJECT SPECIAL PROVISIONS

Custom Special Provisions are contract language pieces the designer writes from scratch because Standard Specification, Boilerplates, or Uniques do not include the project-specific language necessary for the given device, condition or instruction. Custom language is rare, as a designer will typically be able to modify existing Standard Specification, Boilerplates, or Unique language to fit their needs.

1.3.4 - STANDARD DRAWINGS

Oregon Standard Drawings are engineered products developed by ODOT for use on public roadways in Oregon. The Standard Drawings used for temporary traffic control in work zones are under the "TM800 – Temporary Traffic Control" series of drawings. The TM800 series drawings are available on the ODOT *Traffic-Roadway Section* web site under the, "*Visit the* Standard Drawings *Page"* link on the *Roadway Engineering* page.

1.3.5 - PROJECT-SPECIFIC CONSTRUCTION STAGING PLAN SHEETS

Some projects are complex and include design features that make it impractical to rely solely on Standard Drawings and Special Provision language to relay necessary road user safety, mobility and construction staging information to the contractor. Under these circumstances, developing project-specific construction staging sheets - commonly referred to as, "Plan sheets" –significantly enhance the success and effectiveness of the TCP.

Plan sheets are used to describe how the existing roadway area is divided up between live traffic and the construction site. Plan sheets also identify the type, quantity and location for temporary traffic control devices.

Plan sheets are likely needed when the project requires more than one *Stage* – a time during the project where temporary traffic control is arranged to allow the construction of a specific portion of the project. In subsequent Stages, traffic control devices are rearranged, traffic is moved to another portion of the roadway, and another section of the project is constructed.

A project that incorporates a detour route needs at least one plan sheet to describe the desired detour route and the location for detour signing along the detour route – which can be extensive. Additional plan sheets may be needed to include the details for any custom-designed detour signs.

Chapter 5 provides additional information regarding temporary traffic control plan sheets.

1.4 – TRAFFIC CONTROL PLAN DESIGN

1.4.1 – DESIGN CONSIDERATIONS

Chapter 3 goes in to greater detail regarding the wide variety of issues, factors and details a Designer should consider prior to beginning the design of the temporary traffic control plan. This data and these questions should be focused on the basics – the What, Where, When, How and Why's that will help a Designer develop a safe, effective, efficient, biddable temporary traffic control plan.

The following should be considered as the most critical components in optimizing the design for a temporary traffic control plan:

- ***SITE INVESTIGATION***
  Take the opportunity to learn as much as practical about the exiting features and operations of the project site.

- ***SCOPE of WORK***
  Understanding the goal of the project, the project's finished products and the constructability issues associated with completing the project on-time and on-budget.

  Chapter 3 includes a number of specific Scope of Work examples and questions the designer should be asking as they begin the development of the TCP.

1.4.2 – TRAFFIC CONTROL MEASURES

In developing a TCP, there may be several tools and strategies the Designer may employ to optimize safety and effectiveness for both road users and highway workers. These strategies are commonly referred to as, "Traffic Control Measures" (TCM). TCM can range from using a single type of traffic control device, to a complex sequence of events using multiple devices.

For example, during a paving operation, a Designer may call for the use of temporary flexible pavement markers as the TCM used to delineate the traffic lanes until permanent pavement markings can be applied.

For a complex bridge replacement project, the Designer may use a limited-duration full road closure and a short detour as the TCM. This measure may be employed in lieu of constructing the bridge in pieces and accommodating traffic movement through the work area. In this case, the structure type or the available right of way may not safely or effectively allow traffic to share the work area with construction activities.

Chapter 3 discusses Traffic Control Measures at length and provides a number of examples of other effective strategies a Designer may use in the development of a TCP.

1.4.3 - DESIGN POLICIES

The design of a temporary traffic control plan requires engineering experience and judgment when determining the use or application of a given safety measure or construction strategy. However, there are a few standards that must be applied to ensure consistency, and optimize safety and mobility within the work zone. Some of these standards are identified in the TCP Design Manual as, "Design Policies" – emphasizing the need for their consistent and habitual use in TCP design.

The following Design Policies are used to produce safe, consistent and efficient work zones for road users and construction contractors. Additional Policies and details for their use are provided in Chapter 3.

TRAFFIC CONTROL PLAN DESIGN SPEED

The ***pre-construction posted speed*** is used as the *Design Speed* for many TCP design values, including:

- Temporary alignment designs (e.g. on-site diversions, crossovers)
- Temporary sign and device spacing
- Taper lengths for lane closures and shifts, and shoulder closures
- Impact attenuator selection

See *Chapter 3* for additional details regarding this policy.

SIGN and DEVICE SPACING

The following values are used for spacing of channelizing traffic control devices (TCD) including plastic drums, conical and tubular markers:

- 10 feet – For intersection or access radii.
- 20 feet – For speeds $\leq$ 40 mph [Recommend 10 ft. spacing for speeds less than 30 mph]
- 40 feet – For speeds $\geq$ 45, including freeways

See *Chapter 3* for additional details and applications for channelizing TCD.

For temporary signing, spacing is speed-dependent as well. Spacing dimensions, "A", "B", and "C", as shown in the MUTCD and on Oregon Standard Drawings, are defined in Oregon as:

SPEED (mph)	A (ft.)	B (ft.)	C (ft.)
20 – 30	100	100	100
35 – 40	350	350	350
45 – 55	500	500	500
55 – 65 (Freeways)	1000	1500	2640

For additional device spacing information, see the, "*Traffic Control Devices Spacing Table*" shown on TM800 in the Temporary Traffic Control Standard Drawings.

CROSSOVER DESIGN

A crossover is a traffic control measure used to shift traffic from one side of a divided roadway or freeway into either the median or another portion of the roadway not under construction. A crossover often requires the construction of a temporary roadway alignment to carry traffic around the work area.

Crossovers are typically used on freeways, but may also be used on divided highways or multi-lane roads. See Chapter 3 for additional details.

VERTICAL & HORIZONTAL DESIGN CONSTRAINTS

Minimum horizontal roadway widths and vertical height constraints for work zones are critical to statewide freight mobility. See Chapter 3 for minimum horizontal widths and vertical height limitations.

1.5 – TRANSPORTATION MANAGEMENT PLAN (TMP)

FHWA 'FINAL RULE ON WORK ZONE SAFETY and MOBILITY' – 23 CFR 630 SUBPART J

Published on September 9, 2004, the Federal Highway Administration released updates to the work zone safety regulations under 23 CFR 630 Subpart J – referred to now as the, "Final Rule on Work Zone Safety and Mobility." The Rule updates and broadens the former regulation at 23 CFR 630 Subpart J to address more of the current issues affecting work zone safety and mobility. The changes to the regulation encourage the broader consideration of the safety and mobility impacts of work zones across project development and the implementation of strategies that help manage these impacts during project delivery.

The updated rule applies to all State and local governments that receive Federal-aid highway funding. All of these agencies were required to comply with the provisions of the rule no later than October 12, 2007.

A key requirement in the Rule is the development and inclusion of a *Transportation Management Plan (TMP)* as part of the project development and contract administration processes.

A *TMP* might be thought of as a, "project diary" – a tool used by the agency to document and track critical design and implementation decisions made over the course of project development. Referring to and using the contents of the TMP, the TCP can be developed to minimize traffic delays and improve safety for all road users and construction workers. Documented decisions, stakeholder partnership agreements, and previously-explored staging options can all be recalled during construction if a proposal is made to modify the TCP, staging or construction schedule that might compromise the integrity of those decisions or the TCP.

The complete Rule is available on the FHWA web site under the, "Resources" web page of the "Work Zone" section. Also search for, "Work Zone Safety and Mobility" or, "23 CFR 630 Subpart J".

1.5.1 – TRANSPORTATION MANAGEMENT PLAN DOCUMENT

The *TMP* and amount of detail within it is relative to the scope of work – the more complex the project, the more details and information should be included in the TMP. Examples of documented details include:

- Scope of work for individual Stages
- Staging alternatives (rejected and advanced)
- Specific materials, equipment needs or construction techniques
- Critical timeframes or constraints
- Traffic analysis data and impact scenarios

In addition to the more obvious TCP-related issues, stakeholder agreements, public notification strategies, project site conditions/restrictions, constructability concerns, budgetary compromises and other issues should also be included in the TMP.

The FHWA has identified two different categories of TMPs to differentiate between complex projects and routine projects.

Within the New Rule language, a "significant" project is one that meets the following criteria:

- "…alone or in combination with other concurrent projects nearby is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable based on State policy and/or engineering."
- Project is on an Interstate highway within a designated Transportation Management Area (TMA).

ODOT added a third criterion in determining if a project is considered, "significant":

- All projects with a construction budget greater than $5 million.

As a "significant" project, the TMP must include all of the following:

- A temporary Traffic Control Plan (TCP)
- Transportation Operation (TO) strategies – Efforts to minimize or mitigate traffic congestion, delay, volumes, peak hour surges, etc., during construction
- Public Information (PI) campaigns – Communication strategies to notify affected stakeholders and the traveling public, and inform them of project schedules, changes, alternate routes and mobility options.

For projects that do not qualify as a "significant" project, the FHWA recommends agencies consider including both TO and SI strategies in their TMPs, when practical. Satisfactory documentation should still be kept for all design decisions that affect the TCP and construction schedule.

TMP development should begin as early as the Project Scoping phase. Because the TMP is a living document, it will continue to grow and evolve throughout the life of the project design phase. Upon completion of the design – during the "Plans, Specs & Estimate" (PS&E) phase - the TMP should be distributed to Project Team members (including Consultant staff) and the agency's Construction Project Manager or Coordinator.

The TMP is ***not*** to be included in the bidding documents. Upon award, a copy should be distributed to the Project Manager's office and the awarded contractor. Refer to the information and decisions documented within the TMP if changes to the Traffic Control Plan are proposed by the contractor.

A template for developing a Transportation Management Plan ("TMP Guidance Manual") is available on the ODOT Traffic Control Plans Unit website.

1.6 – WORK ZONE INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

1.6.1 - INTELLIGENT TRANSPORTATION SYSTEMS

Advances in technology have made it possible to monitor traffic conditions and construction operations, and relay that information to road users in real time. Oregon and other agencies across the U.S. are using this technology in permanent locations to monitor traffic and alert motorists of changing roadway conditions ahead. This same technology, however, can also be used within the work zone environment as a temporary feature.

ODOT currently uses permanent ITS to report real-time roadway conditions on major state highways (see www.tripcheck.com). ODOT uses permanently installed communication equipment such as Variable Message Signs (VMS) to alert the traveling public of potential congestion, delays, emergency situations and Amber Alerts.

ODOT is adapting these permanent technologies for use in its temporary highway construction work zones. Using Portable Changeable Message Signs (PCMS), portable traffic sensors and other system components, ODOT aims to provide real-time alerts, travel time data, and detailed work zone information to approaching motorists. ODOT has defined these new temporary work zone systems as, "Portable Traffic Management Systems" (PTMS).

Oregon has recently demonstrated these systems on a handful of select projects. ODOT has included a number of the successfully tested systems on its Qualified Products Lies (QPL) and is encouraging their inclusion into many of ODOT's future highway construction contracts.

PTMS used in Oregon work zones will be designed to measure fluctuating traffic volumes and speeds within the work zone. Using predetermined thresholds, the PTMS can then relay applicable warnings or other project-specific information to approaching motorists.

Through the use of the PTMS, ODOT hopes to improve overall work zone safety be reducing crashes and injuries, by minimizing traffic delay, and improving response time should there be a work zone incident. *Chapter 3* includes additional PTMS information.

1.7 – TRAFFIC CONTROL DEVICES (TCD)

1.7.1 - USING TCD TO CREATE A SAFE WORK ZONE

Traffic Control Devices are used to regulate, warn, and guide traffic safely through a work zone. When there is consistent, uniform usage of TCD, work zone safety is increased. A safe, efficient and uniform work zone performs two vital functions:

- Reduces the frequency of accidents
- Reduces the severity of accidents

1.7.2 - TCD PRINCIPLES

Properly selecting and implementing TCD for a given work zone is paramount in providing road users with information needed to safely navigate a work zone. Using the following five principles in selecting and setting up traffic control devices in a work zone, drivers will pass through the work zone with few surprises, maximizing work zone safety for all. Traffic Control Devices must:

- Fulfill a need
- Command attention
- Convey a clear and simple meaning
- Command respect from the road user
- Give adequate response time

Chapter 2 discusses TCD in detail and provides additional guidance for their proper use in work zones.

1.7.3 TCD CRASH TESTING

All traffic control devices used in a work zone on the National Highway System (NHS) are required by the FHWA to be successfully crash tested – or deemed, "crashworthy". If an errant vehicle strikes a TCD, it is crucial that the vehicle and its occupants are as protected as practical from impact with the device. A device being, "crashworthy" means the device has successfully completed standard material and crash testing, and met standard minimum evaluation criteria.

Upon successful crash testing and submittal of results to FHWA, the device may also receive a letter from FHWA stating the device's "Eligibility for Federal Aid Reimbursement". The purpose of this document is to outline the hardware eligibility review process when a request is submitted under the AASHTO Manual for Assessing Safety Hardware (MASH) criteria, which is recommended for crash testing of new devices, and for consideration of modified devices under MASH or NCHRP Report 350. It describes the information that should be submitted when requesting a review for Federal-aid reimbursement eligibility, as well as providing links to the appropriate sites where further detailed information may be found.

ODOT must have both the proof of successful crash testing and the FHWA letter of "Eligibility for Federal Aid Reimbursement" before the device can be considered for inclusion onto the ODOT QPL or used on an Oregon State highway. Standard crash testing procedures and evaluation criteria can be found within the following resources:

- National Cooperative Highway Research Program (NCHRP) Report 350 for devices tested prior to January 1, 2010

- Manual for Assessing Safety Hardware (MASH) for new or modified devices tested after January 1, 2010
- "Eligibility for Federal Aid Reimbursement" Process
- FHWA Work Zone Device Crash Testing – Self-Certifying Process (See Appendix A)

A list of devices that have met MASH and NCHRP Report 350 requirements can be found on the FHWA web site in the *Safety* section under the *Road Hardware* page.

1.7.4 - CATEGORIES OF TCD

Under the NCHRP Report 350 and MASH standards for crash testing, work zone devices have been classified into four categories, each having its own testing requirements:

Category 1 – Low-mass devices. Devices typically self-certified for crashworthiness.

Category 2 – Devices with higher mass. Frequently crash tested. Examples include signs/supports, small portable (balloon) lighting,

Category 3 – Much higher mass and requires correct installation and protection. Mandatory crash-testing. Examples include concrete barrier,

Category 4 – Devices posing the greatest risk to motorists – Examples include trailer-mounted devices (PCMS, portable signals, Arrow boards, large portable light plants). FHWA crash-testing pending.

See *Chapter 2* for more information regarding TCD Categories and crash testing discussions.

1.7.5 - THE QUALIFIED PRODUCTS LIST (QPL)

All temporary traffic control devices used within Oregon State Highway right of way must be listed on the ODOT Qualified Product List (QPL). The QPL is a comprehensive listing of all products found to be acceptable by ODOT for use with specific categories in roadway construction and maintenance.

NOTE: All TCD moved onto the QPL can be considered as, "crashworthy". Therefore, a device chosen from the QPL requires no further proof of crashworthiness. It should also be noted that the FHWA requirement for Category 4 device crash testing is pending. ODOT has a long, successful record in using these devices within public right-of-way. Further, current ODOT standards and best practices call for additional delineation for these devices when in use, and have specific requirements for removing the devices from the roadway when not in use.

An exception to the use of a device *not* on the QPL would be for devices currently being used as an experimental feature – where the device is temporarily included on the unpublished "Conditional Use List" – and has not yet completed the formal QPL review process. The TCP Unit in Salem conducts a cursory review of such products and, using engineering judgment and reviewing product documentation, makes a determination if the device would be eligible for trial as an experimental feature.

If, during a review of the product submittal, the TCP Unit sees deficiencies or product functionality that indicate a strong possibility for product failure or harm to public traffic or workers, the device will be "Rejected" – and not allowed on the Conditional Use List of the QPL. If the performance or safety of a product on the Conditional Use or Qualified Products List is raised by other staff within ODOT, the product's status and continued use will be suspended until such time as the TCP Unit can investigate the issue and work with the manufacturer to correct the concern.

1.8 – MOBILITY

1.8.1 – MOBILITY PROCEDURE MANUAL

The *Mobility Procedures Manual* describes a set of standards and processes that meets Agency goals for traffic mobility and safety. With respect to work zones, it can best be thought of as a working tool for ODOT planning, project development, construction, and maintenance offices.

The *Mobility Procedures Manual* discusses *delay thresholds* for construction travel delay for Oregon's highest level of importance facilities and its main highway freight corridors. Within the manual, a "*corridor delay threshold"* is defined as the maximum *additional* amount of delay created by all construction and maintenance projects on a given corridor**.** The total corridor delay is the additional delay caused by all active construction projects on the corridor *plus* the normal delay experienced during peak travel periods.

Delay can be minimized and contractor efficiency maximized by conducting, "Work Zone Traffic Analysis" as part of the project development phase of the TCP. The analysis is used to determine the best times in a given day for a contractor to close a lane(s) to conduct work and to minimize public traffic delay. The results of the analysis help to form the, "Lane Restrictions" – incorporated into ODOT highway construction contracts – notifying contractors when they can and cannot conduct work on a highway within a lane(s) closure.

See the Mobility *Procedures* Manual for additional information regarding work zone mobility analyses and over-dimensional freight accommodation strategies.

1.8.2 – COORDINATING TRAVEL DELAY ESTIMATES

Since the total travel delay resulting from combined construction and maintenance projects on a corridor should be below the "corridor delay threshold," coordination of all corridor activities is essential. Each ODOT Region employs a Mobility Liaison who is responsible for this coordination. ODOT Region Mobility Liaisons and additional mobility information are listed in Chapter 3, under Section 3.3- TCP Design Policies.

1.9 – DESIGNER RESOURCES & WEB LINKS

1.9.1 - TCP DESIGNER WEB LINKS

There are multiple ODOT, federal, and non-government websites available that include valuable temporary traffic control information. Because website locations are highly dynamic, a web link to a list of useful TCP-related websites is available on the ODOT Traffic Control Plans Unit website (below).

http://www.oregon.gov/ODOT/HWY/TS/traffic_control_plans.shtml

1.9.2 – TRAFFIC CONTROL PLAN CHECKLIST

Appendix D contains a Traffic Control Plan Checklist that can be used by designers. The checklist is meant to be a comprehensive list of traffic control items and measures that a designer could use within a project. The list does not cover all items and measures, but it gives the designer a great starting point.

Traffic Control Plans Design Manual

11th Edition

Chapter 2
Temporary Traffic Control Devices

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CHAPTER 2 TEMPORARY TRAFFIC CONTROL DEVICES (TCD)

Chapter 2

2.0 – KEY TOPICS COVERED IN THIS CHAPTER

- ✔ Purpose & Principles of Traffic Control Devices (TCD)
- ✔ Crashworthy Devices
- ✔ TCD Categories
- ✔ Detailed Descriptions of TCD

2.1 – PURPOSE & PRINCIPLES OF TCD

The primarily purpose of Traffic Control Devices (TCD) is to provide for the safe movement of traffic through or around the work zone. Safety for roadway users and workers within the work zone is enhanced through uniform usage of TCD. Temporary traffic control devices are used to:

- Regulate
- Warn
- Guide

When temporary traffic control devices are installed consistently within the work zone, driver expectancy and compliance can be optimized. The consistent and proper application of TCD in the work zone performs two vital functions in a successful work zone:

- Reduce the frequency of crashes
- Reduce the severity of crashes

Individuals assigned the responsibility of assuring safe and effective work zones are knowledgeable in the general principles behind temporary traffic control devices.

TCD used in work zones should exhibit the following characteristics. These characteristics are considered key principles for temporary traffic control devices:

1) Fulfill a need
2) Command attention
3) Convey a clear & simple meaning
4) Command respect from road user
5) Give adequate response time

It is imperative TCD are consistent and correctly applied within work zones to provide the road user necessary information to negotiate the work zone safely.

Inappropriate TCD are devices not needed for the current conditions within the work zone, and should be turned away from traffic, covered, or removed from the roadway. Legibility and visibility of the devices should be maintained through the life of the project. Damaged, dirty or improperly functioning devices must be repaired or replaced in a timely manner to maintain their effectiveness.

2.2 – CRASHWORTHY DEVICES

The Federal Highway Administration (FHWA) policy requires all TCD used in a work zone on the National Highway System (NHS) be crashworthy. FHWA adopted the testing guidelines established by the AASHTO Manual for Assessing Safety Hardware (MASH).

MASH is an update to and supersedes NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features,* for the purposes of evaluating new highway safety hardware. An implementation plan for MASH, adopted jointly by AASHTO and FWHA, states that all highway safety hardware accepted prior to the adoption of MASH (January 1, 2010), using criteria contained in NCHRP Report 350, may remain in place and may continue to be manufactured and installed on the NHS.

Highway safety hardware accepted using NCHRP Report 350 criteria is not required to be *retested* using MASH criteria. If a Report 350 approved device is updated or modified, affecting its structural characteristics or its performance (e.g. changes in materials, physical shape, size, weight, etc.), the device may require retesting under the MASH criteria.

New highway safety hardware not previously evaluated must utilize MASH for testing and evaluation. New MASH testing procedures include changes to design vehicles, variety in barrier design, safety performance, levels of roadway utilization, and criteria for impact severity. It provides a broad range of testing to establish a uniform basis for the application of roadside TCD to the level of use of the particular roadway.

All TCD used on Oregon State Highway construction projects must be listed on the ODOT Qualified Products List (QPL). ODOT ensures each device meets the established crashworthy guidelines before a device is used on the NHS. Signal poles are exempt. Each device is reviewed according to the ODOT Product Review Guidelines before the device is deemed Qualified and placed on the QPL. Occasionally, a device is categorized as "Conditional" and placed on the Conditional Use List. The Conditional Use List is used for products that meet established crashworthy guidelines, but when ODOT wants to evaluate the product controlled conditions before moving them onto the Qualified list. A designer or contractor may use devices on the Conditional Use List, but the Project Manager or Contractor may have to conduct a field evaluation.

"Crashworthy" means a device has met the established testing and evaluation criteria of MASH (or Report 350 for older or existing devices) and has received a "Letter of Acceptance" from the FHWA.

Work zone traffic control devices have been classified into four categories by the FHWA, each having its own testing requirements.

Category 1 – Low-mass devices with a known performance history. Vendors may self-certify the crashworthiness of these devices. Category 1 devices include tubular markers, conical markers, and plastic drums.

Category 2 – Devices with a higher mass and can pose a greater risk to the public if struck. Because of their higher mass, Category 2 devices typically require crash testing (e.g. Barricades, sign supports, and most temporary signing).

Category 3 – Category 3 devices pose a more significant risk to the public if not adequately protected or installed correctly. Category 3 devices require more complex crash testing. Examples include impact attenuators, concrete barrier, and guard rail systems, etc.

Category 4 – These devices pose the greatest risk to motorists as temporary TCD. Category 4 devices are usually trailer-mounted and should be shielded from traffic, when practical. At a minimum, if used on the roadside and not placed behind a barrier system, these devices should be heavily delineated using other Category 1 and 2 retro-reflective devices. Currently, Category 4 devices do not require crash testing, as FHWA is in the process of developing specific crash testing standards for them.. Examples of Category 4 devices include sequential arrow boards, PCMS, portable traffic signals, and automated flagger assistance devices (AFAD).

Crashworthy Test Level*:* In general, devices used on State Highways should be tested to the appropriate speeds used on the Highway. It is recommended to use Test Level 3 (TL-3) or higher devices for all highways, regardless of the posted speeds. Test Levels are defined in the AASHTO Roadside Design Guide, NCHRP Report 350, and MASH.

- **Test Level 1 (TL-1)** devices can be used on highways with speeds of 35 mph or less.
- **Test Level 2 (TL-2)** devices can be used on highways with speeds of 45 mph or less.
- **Test Level 3 (TL-3)** devices are used on highways with speeds greater than 45 mph.

NOTE: Lights are ***NOT*** to be added to any channelization device (drums, barricades, etc.) in Oregon. To eliminate the need for large, potentially hazardous batteries, ODOT does not include supplemental warning light devices on its portable channelization devices.

2.2.1 - AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION (ATSSA)

The ATSSA "Quality Guidelines for Temporary Traffic Control Devices and Features" is a set of guidelines users should refer to in evaluating the condition of TCDs in the field. The guidelines are written into the Standard Specifications and the Contractor is contractually obligated to use devices that meet the guidelines. Use new or "Acceptable" TCD for all installations. Replace TCD not meeting the "Acceptable" criteria.

2.3 – CATEGORY 1 DEVICES

CATEGORY 1	
Self-Certified Crashworthy	**Examples of Devices Included**
• Lightweight devices < 100 lbs. • No potential for device to penetrate vehicle windshield or cabin • No significant effect on control or trajectory of an impacted vehicle	• Tubular and Conical Markers • Plastic Drums • Temporary Delineators • Pavement Markers

2.3.1 - TUBULAR AND CONICAL MARKERS

The most commonly used temporary traffic control devices for delineating the roadway and channelizing traffic through the work zone are tubular markers and cones. Tubular markers are typically a two-part device with a separate rubber base weighing between 12 and 18 pounds. Cones are often one or two-piece devices. Two-piece cones have a rubber base similar to tubular markers.

Tubular Marker

Tubular markers are effectively used to override existing pavement markings for shorter-duration applications (daily shift work or stationary work in place less than three days). For longer operations, the existing pavement markings are removed and temporary pavement markings are applied. While Section 6F.77 of the 2009 MUTCD calls for the maintenance of pavement markings for all "*long-term stationary work zones*", ODOT recognizes that this is not always practical or cost-effective. Section 6F of the MUTCD also states:

> *Warning signs, channelizing devices and delineation shall be used to indicate required road user paths in TTC zones where it is not possible to provide a clear path by pavement markings.*

Conical Marker

For most pavement preservation projects, or other projects constructed in short time segments, removing exiting markings and applying temporary markings is not practical. Therefore, under the allowances suggested in Chapter 6F of the MUTCD, exercise judgment in selecting either temporary pavement markings or channelization devices to provide guidance for drivers in the work zone.

Blue Tubular Marker

Tubular Marker types:

- **Standard Tubular Markers -** Orange plastic with silver-white reflective bands. Rubber base used as ballast.
- **Surface Mounted Tubular Markers –** Similar to a standard tubular marker, but installed with an adhesive base to restrict movement of the device.
- **'Blue' Tubular Markers -** Blue plastic with blue reflective bands. Used to delineate selective business accesses within a work zone.

When applied on an ODOT construction project, standard spacing for tubular markers and cones is speed-dependent and are spaced at either 20 or 40 feet apart. At speeds of 45 mph or greater, the 40 ft. spacing is used. For low-speed conditions ($\leq$ 25 mph) or around intersection and access radii, a spacing of 10 feet is recommended.

2.3.2 - TEMPORARY PLASTIC DRUMS

Plastic Drum

Temporary Plastic Drums are the largest, most visible of the "soft," (deformable) channelization devices. Like tubular markers and cones, plastic drums are used to delineate travel lanes, identify work areas, construct lane closure tapers, and delineate PCMS and temporary traffic signal installations. Due to their larger size and higher target value, plastic drums are effective in creating a visual separation between the work area and live travel lanes. Because of this advantage, plastic drums are used extensively on Oregon high-speed divided highways and are required on Oregon freeways for some functions.

Alternating bands of orange and silver-white retro-reflective sheeting are used on plastic drums. This "encapsulated lens, wide-angle, retro-reflective" sheeting provides excellent visibility for the drums in the daytime or nighttime and in a variety of inclement weather conditions.

Due to their proximity to traffic, drums can have the tendency to shift slightly out of place at the passing of larger vehicles or during high wind conditions. To compensate, drums include a rubber ring (weighing at least 10 lbs.) installed around the base to add ballast to the drum without impeding its crashworthiness. However, a second ring can be added to the drum base to resist further movement. No other means of ballast are allowed to anchor drums.

2.3.3 - TEMPORARY DELINEATORS

Type W-1

Type Y-1

Temporary delineators are used to supplement normal pavement edge delineation (tubular markers, striping, etc.) to indicate the roadway alignment. The mounting height of the reflector should be approximately four feet above the edge of the roadway surface. Temporary Delineators should be used on temporary roadway alignments as required by the MUTCD (Ch. 3F) and as shown on the Standard Drawings (TM 570, etc).

"Type W-1" (white) delineators are installed along both sides of a two-way roadway, and along the right side of a one-way roadway. The left side of a one-way roadway will be delineated with "Type Y-1" (yellow) delineators.

Traffic delineator spacing and installation details are shown on Standard Drawings TM570, TM571, TM575, and TM576.

2.3.4 - TEMPORARY PAVEMENT MARKINGS & MARKERS

Temporary pavement markings are used to provide guidance for traffic passing through a work zone where the normal traffic path has been disrupted by construction staging.

Temporary markings are used for long term stationary work zones greater than three days. Use channelization devices for short term stationary work zones and mobile work zones. Temporary markings are also used to enhance and delineate runs of temporary concrete barrier and temporary on-site diversions. The decision to use a certain temporary pavement marking or marker should follow the guidance in the MUTCD, ODOT Traffic Line Manual, and ODOT Pavement Marking Design Guidelines and be supported by the Region Traffic Engineer.

TEMPORARY STRIPING

The most common type of temporary pavement markings is temporary striping (paint). Temporary striping is a fast, economical, and effective means of providing required markings, and can be easily paved over.

Temporary striping for Exit Ramp

Temporary and permanent striping must be accounted for during all aspects of construction staging. Determine the best placement for temporary striping while also considering the placement of permanent striping at the completion of the project. Staging may incorporate a combination of permanent and temporary striping.

Temporary striping must meet the same layout requirements for permanent striping. See the ODOT Traffic Line Manual for additional striping details.

Consider the duration of the project when calculating quantities for Temporary Striping. If the project is expected to last through multiple seasons – particularly over the winter, a second or even third application of striping may be needed. Inclement weather, sanding treatments, snowplows, and studded tire wear can have a significant impact on the durability and visibility of Temporary Striping.

It is essential to consider roadway delineation as part of a temporary Traffic Control Plan. Pavement markings are critical in providing clear and positive guidance for drivers as they pass through a work zone.

STRIPE REMOVAL

Stripe removal is an important aspect to consider during plans development. According to the Standard Specifications, stripe removal may be accomplished by sandblasting, hydro-blasting, steel shot blasting, or grinding. Grinding of striping is *not* permitted on final permanent wearing surfaces. Grinding may be permitted on existing wearing surfaces if the project includes paving over the existing surface at some point in the project after the temporary markings are no longer needed on the existing surface.

If temporary striping is used, removal of conflicting existing pavement markings and reflectors is required. Include adequate quantities of "Stripe Removal" in the TCP to account for existing marking removal.

If durable materials (e.g. thermoplastics) are to be used for permanent striping, ensure that the placement of temporary striping will not adversely affect placement of the durable materials. It may be necessary to identify in the Special Provisions (or on plan sheets) to off-set temporary markings so as to avoid the application of the durable markings in their permanent location.

TEMPORARY STRIPING ON STAGE SURFACES

Often, the total depth of the new pavement is too thick to complete the entire section in one lift. Lifts of pavement are placed one at a time. Drivers may be required to drive on an intermediate lift until the final lift (finish lift, or wearing surface) can be placed. Traffic may be shifted onto a temporary diversion (a temporary surface adjacent to the existing roadway) to allow for construction of the new pavement without having traffic in the active work area.

The interim driving surface will require temporary pavement markings until the next lift can be placed and markings can be applied.

Occasionally, temporary striping is needed on the final lift to allow completion of other road work before permanent striping is applied and traffic is shifted to its final position. When temporary striping is needed on the final lift, to minimize damage to the pavement surface, Standard Specifications – Section 00225.43(g) – instruct the contractor to do the following:

- Place temporary tape or simulate lines using pavement markers.
- When durable striping will be used for permanent markings, apply a reduced application of temporary striping (paint) immediately adjacent to the location for the permanent striping. The paint will be allowed to wear off without having to grind off the paint.

As a Designer, be aware of the planned material for the permanent markings and make any necessary adjustments to the TCP.

TEMPORARY PAVEMENT LEGENDS, CROSSWALKS, & STOP BARS

Pavement Legends (e.g. Right Turn or Left Turn Arrows, “ONLY”, “RR XING”) are applied to the pavement prior to an intersection or decision point and are used to inform the driver of the direction that they are allowed to take in a particular lane or to warn them of an approaching condition. Existing and temporary pavement legends, crosswalks, and stop bars should be maintained during construction. Pavement legend examples include Right-Turn or Left-Turn arrows in dedicated turn lanes, “SCHOOL XING”, “ONLY” or “RR XING” legend, where applicable. Bicycle legends may be included in designated bicycle lanes or along shoulders.

Quantities and payment for pavement legends are made by “each”.

Temporary pavement markings (striping and tape) are also used for crosswalks and stop bars in areas where work obscures existing markings or markings are relocated due to staged construction. Do not use temporary pavement markers to represent crosswalks or stop bars.

To calculate the quantity of striping needed for a crosswalk, use the following process:

1) Measure the length of the crosswalk
2) Multiply the distance by two (to account for the two parallel bars)
3) Multiply this quantity by three (each 12-inch bar is made of three 4-inch temporary stripes)

Use the same process for each stop bar, excluding Step 2) above.

Quantities and payment for temporary crosswalks and stop bars is made by the “square foot”.

STRIPING QUANTITIES FOR MULTIPLE SEASON PROJECTS

Some construction projects extend through the winter months and must "winter over." Winters in Oregon can be very harsh on pavement markings, especially in work zones. Consider additional striping quantities when the project is expected to extend into or beyond the winter months, to account for additional applications.

If the project runs for multiple seasons, adjust temporary striping quantities to account for multiple application(s) of temporary striping. The ADT and geographical location of the highway segment can affect the quantities for temporary striping.

DURABLE STRIPING

Durable striping (e.g. methyl methacrylate, thermoplastics or other polymer-based products) is used exclusively for permanent striping. When staging traffic from their original lanes to a temporary alignment this striping may conflict with the temporary alignment.

In this case, decide which of the following techniques is the safer, more practical and cost-effective method for protecting and guiding traffic:

- Removing the existing durable markings and replacing them later
- Covering durable markings with temporary, non-reflective, removable tape ("blackout" tape)
- Place channelization devices (cones, tubular markers, drums) to create new lanes for the shifted traffic

A strategy for dealing with durable markings should be based on factors such as duration needed for the temporary markings, quantity of durables in conflict, location of the project, age of the existing durable markings, traffic volumes, and complexity of the temporary traffic shift.

Discuss the decision with the Region Construction office and other stakeholders to avoid unnecessary removal of the durable striping.

TEMPORARY TAPE

Temporary Tape may be used in lieu of temporary striping. When consideration is needed for damage to the roadway surface, temporary tape can be an excellent alternative material. Temporary tape is commonly applied to concrete roadways, bridge decks or other finished-grade surfaces that are not being overlaid as part of the project.

Three classifications of temporary tape exist:

- Removable
- Non-Removable
- Removable, Non-Reflective ("Blackout")

Temporary Removable Tape – Provides an effective, short-term (3-6 months) alternative to striping with the added benefit of leaving behind minimal traces or damage to the pavement surface.

Temporary Removable Tape is typically used in lieu of temporary striping or pavement markers on concrete pavements, including bridge decks.

Similar to temporary striping, temporary removable tape is useful in a number of applications:

- Skip and solid lines during staging
- Used on existing or new bridge decks to avoid damage
- Temporary crosswalks or pavement arrows
- Used as an option for finish lift AC paving

Temporary Non-Removable Tape – Provides an equally effective alternative to striping; however, due to its adhesive nature, is better suited to a pavement surface that is to be removed or overlaid later in the contract.

Temporary Non-Removable Tape is used for several unique applications:

- To secure pavement markers for Emulsified Asphalt Concrete (EAC) or Cold In-place Recycled (CIR) preservation projects
- Used as temporary markings prior to an AC overlay

Temporary Removable, Non-Reflective Tape – Commonly referred to as "Blackout" tape, it is typically used to temporarily cover durable markings. When a facility has existing durable markings, consider using removable, non-reflective tape as an alternative to grinding off the existing markings. This is desirable when the existing pavement surface is not being affected and a final wearing course is not being applied as part of the scope of work.

Chapter 6F of the MUTCD does not allow existing striping to be painted over with black paint or bituminous material. The standard accepted practices for long-term projects are to remove all inappropriate striping, or to cover existing striping with temporary removable, non-reflective tape. The intent is to mask the existing durable striping. When staging is completed, the "blackout" tape is removed and the existing durable striping is retained.

While non-reflective tape is more expensive than temporary striping, the removal and replacement of durable markings is significantly more expensive. In addition, coordinating the reinstallation of durable markings is difficult due to limited availability of durable marking contractors.

PAVEMENT MARKERS

Pavement Markers are used to simulate or supplement temporary striping. The raised reflective surfaces of the markers make them effective devices especially at nighttime or during wet weather.

Pavement markers are available in three different forms:

- Reflective Pavement Markers (commonly known as, "buttons")
- Flexible Overlay Pavement Markers (commonly known as, "tabs" or "stick-n-stomps")
- Flexible Oiling Pavement Markers (with a disposable plastic cover protecting the reflector)

Temporary Reflective Pavement Markers

The markers are either mono-directional or bi-directional, meaning they have reflectors on one side or on both sides.

Mono-directional markers are typically used to simulate skip lines in multi-lane sections or to supplement a painted line. See the ODOT Temporary Traffic Control Standard Drawings for examples of pavement marker use.

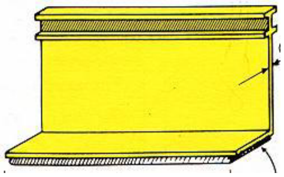
Bi-directional markers are used to delineate the centerline of a two-lane roadway, or the double-yellow markings in the median or turn-lane of a multi-lane, non-freeway section.

Reflective markers can be installed on either AC or concrete surfaces; however, if installed on AC surfaces, a bituminous adhesive should be used. If installed on a PCC surface, an epoxy adhesive should be used.

When specifying temporary pavement markers to be used on new or existing open graded AC pavements, the adhesive has a tendency to penetrate into the pavement. Remove marker without damaging the pavement surface.

NOTE: Field personnel should use caution in the quantity of adhesive used to install pavement markers. Too much adhesive can make removal of the marker difficult, as well as leave large quantities of unsightly adhesive on the roadway surface.

Flexible Overlay Pavement Markers



These are used primarily during pavement preservation projects (HMAC overlays, EAC, CIR, etc.) to simulate the existing striping. These types of preservation projects obliterate centerline striping, thus requiring temporary pavement markings until permanent striping can be replaced.

The quantity of flexible markers and the method by which they are installed will depend on both the type of work being done and the ADT of highway section. There is no difference in the pay item, whether an oiling cover is provided or not. The markers are measured and paid for as "each".

Flexible Oiling Pavement Markers:

These are used primarily during preservation projects such as Emulsified Asphalt Surface Treatments (EAST), commonly referred to as, "chip seals". Flexible markers are used to simulate the existing striping that is covered by the paving process. The markers are identical to the Overlay marker, except it has a plastic cover to protect the reflective face. The cover is removed after the oil is spread onto the roadway.

The quantity of flexible markers and the method by which they are installed will depend on both the type of work being done, the duration the devices will be needed, and the ADT of the highway section.

2.4 – CATEGORY 2 DEVICES

CATEGORY 2	
FHWA Crashworthy	**Examples of Devices Included:**
Device is not expected to produce significant vehicular velocity change, but may otherwise be hazardous.	• Barricades – Type I, Type II, and Type III • Pedestrian Channelizing Devices (PCD) • Sign Stands – Portable, TSS, and Posts • Tripod mounted devices

2.4.1 - TYPE I, II AND III BARRICADES

Barricades are used for several purposes including:


Type II

- Type I and II barricades are typically used on pedestrian facilities and multi-use paths for delineating closures and as pedestrian signing supports.
- Type III barricades are regularly used for the following:
  - Delineating signs mounted on Temporary Sign Supports (TSS)
  - Delineating portable changeable message signs(PCMS), sequential arrow boards, or a temporary portable traffic signal trailers
  - Placed at regular intervals in a closed lane to remind drivers the lane is closed to traffic
  - Placed in the roadway in advance of and at the point of road closures


Type III

The most common Type III barricades can be specified in 4-ft and 8-ft widths, depending on the application and the space available for placement. See the ODOT Temporary Traffic Control Standard Drawings for additional details.


4-ft Type III

PLACEMENT: In the ODOT Standard Drawings and on TCP sheets, barricade labels include a designation as to where on the roadway the barricade is to be placed. The designations, "**R**", "**L**", "**LR**" and "**C**" represent "Right", "Left", "Left-Right", and "Closure", respectively.

- Type "**R**" barricades are placed on the right side of traffic and traffic is expected to pass the barricade on the left when facing the barricade.
- Type "**L**" barricades are placed on the left side of traffic and traffic is expected to pass the barricade on the right when facing the barricade.
- Type "**LR**" barricades are typically placed in the center of a multi-lane roadway section and traffic is expected to pass on either side of the barricade.
- Type "**C**" barricades are used at roadway closure points.


Type III "C"

When shown on TCP plan sheets, include the proper designation for each barricade:

- For an 8-ft Type III barricade on the *right side* of the road, use the following designation:
    - **8' III(B)R**

  The stripes on the panels will point down and to the left. If a narrower barricade is needed due to width restrictions, replace the **8'** with **4'**.

- For an 8-ft Type III barricade on the *left side* of the road, use the following designation:
    - **8' III(B)L**

  The stripes on the panels will point down and to the right.

- For placing *two* 8-ft Type III barricades for a road closure, use the designation:
    - **2 – 8' III(B)C**

  The stripes on the panels will slope down and toward the center of the barricade.

<u>Signs and Lights on Barricades</u>

The MUTCD, Section 6F.03, allows the installation of temporary signs on Type III barricades, if barricade/sign combination is crashworthy. Installing temporary signs on barricades is not an ODOT standard practice.

Temporary signs that must be installed in the roadway for durations exceeding three consecutive days should be installed on a Temporary Sign Support (TSS). The use of the TSS allows the temporary sign to be installed 7 feet above the pavement surface for added visibility. The barricade is added in front of the TSS, as per ODOT Temporary Traffic Control Standard Drawings, to provide higher target value, additional delineation and visibility of the sign – particularly at night.

All barricades used on State Highways must be selected from the QPL and conform to ODOT Temporary Traffic Control Standard Drawings. See the Standard Drawings for examples of the Barricades placed in various work zones.

ODOT requires barricades to have retro-reflective sheeting on one side of the barricade panels only. Sheeting on both sides of the barricade is not allowed for barricades used on State Highways.

Adding flashing warning lights on barricades is not an ODOT standard practice. Other agencies may choose to include them on barricades. However, the combination of the light and barricade must be deemed crashworthy and comply with all applicable DEQ requirements for the power supplies.

2.4.2 – PEDESTRIAN CHANNELIZING DEVICES

Considered a 'channelizing' device, the Pedestrian Channelizing Device (PCD) differs from traditional channelizing devices such as cones and drums in that the PCD is an interconnected system of devices. Much like a run of temporary concrete barrier, the PCD is meant to function as a system of individual vertical panels or barricades linked together into contiguous segments.

The PCD is considered a Category 2 device because of its intention to be connected together.

PCD are required to be ADA-compliant and meet ADA and PROWAG specifications for users in wheelchairs, needing walking assistance, and for visually impaired pedestrians.

Pedestrian Channelizing Devices are not intended to function as a re-directive barrier. PCD products are typically made of light-weight, low-density, polyethylene (LDPE) plastic formed into either hollow or solid panel-style segments that can be moved by hand. Metal, plastic or recycled rubber legs or bases are used to support the system – which can also be ballasted using 20-lb sandbags on the support legs.

Below are examples of some of the Pedestrian Channelizing Devices currently on the ODOT Qualified Products List (QPL):




See Chapter 3 for additional information regarding the application of PCD within a temporary traffic control plan.

2.4.3 - TEMPORARY SIGNS

Exhaust the following resources when determining the text, configuration, sizing, color, usage and placement for Temporary Signs:

- ODOT "Sign Policy & Guidelines for State Highway Signs"
- "Standard Highway Signs" (SHS) manual published and maintained by the FHWA
- Manual on Uniform Traffic Control Devices (MUTCD)

Temporary signage is used to convey regulatory, guidance, and warning messages. Appropriate signing must be visible and legible during construction activities, and updated, covered or removed, as activities change. Temporary signs can be moved about within the work zone, as needed; or, installed in fixed locations for the duration of the project. When the design of a sign is not provided in the documents listed above, a separate design will be needed and must be included in the contract plans.

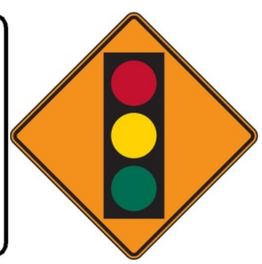
2.4.4 - SIGN SHEETING

In designing a TCP, the use of temporary signs is expected. However, a wide variety of temporary signs and sign designs may be used within a traffic control plan and it is important to convey that specific information to the users of the TCP.

Within the Standard Specifications, Section 02910, there are definitions for the different colors and sheeting types to be used on each sign. For example, a "STOP" sign, a "DO NOT PASS" sign, or a "ROAD WORK AHEAD" sign will all be a different color and require different sheetings to build the sign correctly.

In addition, while most diamond-shaped warning signs are fluorescent orange, it should be noted that not all diamond-shaped warning signs are designated as, "Type O4"! Below are some specific and unique sign Types from Section 02910 that TCP Designers should be aware of and use in the development of their traffic control plans:

- **"O3"** – There are a few specific type "O3" signs. Type "O3" signs use an orange, ASTM Type III or Type IV sheeting background with black non-reflective permanent legend and red retro-reflective symbols (e.g. STOP or Yield Ahead Symbol sign).
- **"O4"** – Most work zone signs are designated as Type "O4". Type "O4" signs use fluorescent orange, ASTM Type VIII or Type IX sheeting background with black, non-reflective permanent legend.
- **"O5"** - A few signs require removable legends. Type "O5" signs use fluorescent orange Type VIII or Type IX sheeting background with black, non-reflective removable legend.
- **"O6"** - The Signal Ahead symbol sign is a Type "O6" sign. Type "O6" signs use fluorescent orange Type VIII or Type IX sheeting background with black, non-reflective permanent legend and red, yellow, and green Type VIII and Type IX circles.
- **"O8"** - The Speed Reduction symbol sign is a Type "O8" sign. Type "O8" signs use fluorescent orange Type VIII or Type IX sheeting background with black, non-reflective screened or cut-out permanent legend and silver-white Type VIII or Type IX symbol.


Other standard highway signs are available for use during temporary traffic control. Examples include Regulatory, Guide, and Service signs, these signs design and sheeting will match the permanent sign. One exception to this is that any Type "Y1" (yellow) sign can be fabricated using Type "O4" (orange) sheeting for work zone applications.

Roll-up signs are allowed to be used for signs in work zones. Roll-up sign sheeting complies with current retroreflectivity standards.

2.4.5 - SIGN FLAGS AND SIGN FLAG BOARDS

Sign Flag Boards installed on a SPEED XX sign

Sign Flags (flexible fabric) and Sign Flag Boards (rigid plywood) can be used to draw a driver's attention to a temporary sign. Sign flags are required on all portable roll-up signs, per the MUTCD.

Sign flag boards (with Type "O4" sheeting) can be used to enhance the visibility of a temporary sign that may otherwise go unnoticed. For example, a temporary Speed Zone sign (see photo) looks like a permanent sign, but would be displaying a lower speed. It is important for drivers to notice this reduction, and using the flag boards can help achieve this. Critical detour signing or other regulatory signs (Temporary STOP signs, etc.) can also benefit from the added target value.

Sign flag boards are specified for Freeway Projects, Detour warning signs, and Road Closed warning signs in the ODOT Specifications. Use sign flag boards sparingly, particularly for temporary signs that are already made using fluorescent orange sheeting.

2.4.6 – ROAD WORK XX MPH AND LOOSE GRAVEL XX MPH SIGNS

Definition

The "ROAD WORK XX MPH" sign provides an advisory travel speed through the work zone based on the work activity and the roadway conditions. The "XX" number on the sign should be a safe, reasonable speed for drivers given the current work zone conditions or configuration.

The "LOOSE GRAVEL XX MPH" sign is used specifically for Emulsified Asphalt Surface Treatment ("Chip Seal") pavement preservation projects or other projects where the roadway surface is temporarily covered by or made up of an unpaved surface.

Application

Typical values for "XX" are 10 – 20 mph below the pre-construction posted speed. However, the reduced speed on these signs does *NOT* allow a Designer to use a reduced Design Speed, nor is the displayed speed on this sign a regulatory speed. The displayed speed is only advisory.

The "XX" portion of the sign may be placed directly on the sign or added as a Velcro placard. The "XX" portion of the sign shall have a fluorescent orange background with black, non-reflective legend.

Do not use white sheeting and black legend for the "XX MPH" placard on these signs.

Avoid the overuse of these signs, as it can accelerate the loss of their effectiveness. Use sound engineering judgment when including these signs in the TCP.

Responsibility

In determining the appropriate speed for the "XX" placard on the signs, seek assistance from ODOT Region Traffic staff or the ODOT Traffic-Roadway Section.

A 10 mph reduction below the pre-construction posted speed is most commonly used for the value of "XX". Larger reductions are heavily dependent upon the type of work being conducted and other traffic control measures in place on the project. If conditions or configurations within the work zone change, the speed on the "XX" placard can be adjusted to suit those changed conditions.

If values greater than 20 mph below the posted speed are needed, the traffic control plan should be revisited and additional measures implemented to enhance safe traffic speeds through the work zone.

As examples, a 40 mph "XX" placard may be used in a 55 mph work zone due to a temporary curvilinear alignment or a narrowed roadway. Or, a LOOSE GRAVEL XX MPH sign may display a 35 mph placard on a 55 mph roadway during a chip seal operation to minimize the likelihood of flying gravel.

2.4.7 - SPECIALTY SIGNS

There are a number of ODOT specific "Specialty Signs" that are frequently included in a TCP. These signs are used to provide additional information to the traveling public as a courtesy.

PROJECT IDENTIFICATION SIGN (CG20-8)

The "YOUR TAX DOLLARS AT WORK" Project Identification sign is used to identify an ODOT and OTIA highway construction project. From the current ODOT Special Provisions in Section 00225, if all of the following criteria are met, the Project ID sign is to be included in the TCP:

- Project duration exceeds one month
- Highway segment ADT > 500
- Project budget exceeds $1 million

For Urban projects where space is limited, a smaller sign may be used (left sign):

Project ID signs should be installed in advance of all other work zone signing, including the initial "ROAD WORK AHEAD" sign. For ODOT construction projects, the Engineer (ODOT Construction Project Manager) typically determines the sign legend once the contract is awarded. The "KEEPING OREGON ON THE MOVE" rider is included with the Project ID sign. For more information on Project Identification signs, refer to Chapter 6 of the ODOT Sign Policy ODOT & Guidelines Manual available on the ODOT Traffic Section website.

BUSINESS ACCESS SIGN (CG20-11)

The "BUSINESS ACCESS" sign is used to identify a private business access which may be obscured or otherwise impacted by construction. In combination with the "Business Access" sign, blue tubular markers are used to improve the visibility and delineation for the business access while under construction.

2.4.8 - SIGN SUPPORTS

WOOD SIGN POSTS

Wood posts are the most common type of support for temporary signs. Details for the installation of Temporary Signs on wood posts can be found in the ODOT Standard Drawings for Temporary Traffic Control (Series 800) and for Signs, Illumination and Signal Support Structures (Series 600).

SQUARE TUBE SIGN SUPPORTS

Square Tube sign supports are an alternative to wood posts for the installation of Temporary Signs. Square tube sign supports are listed on the QPL. Sizing and gauge of the posts based on the sign size table provided by the post manufacturer. Metal square tube sign post installation details may be found in the ODOT Standard Drawings for Temporary Traffic Control (Series 800) and for Signs, Illumination and Signal Support Structures (Series 600).

5'x 8' Project ID sign on 2 metal Square Tube Sign Posts

Metal posts are a popular alternative to wood due to cost, ease of installation and the ability to reuse the posts at the conclusion of the project.

TEMPORARY SIGN SUPPORT (TSS)

A Temporary Sign Support (TSS) is a crash-worthy wooden support that can be used in lieu of in-ground wood or metal post installations. TSS can be repeatedly positioned to maximize the effectiveness of a temporary sign. A temporary sign support is useful when:

- A sign must be placed in the roadway, on a shoulder, paved island or other rigid surface
- Roadside ground is too hard or soft for an in-ground installation
- A sign is expected to move several times over the life of the project
- A sign is in place for a short duration (i.e. less than one week)
- The location of in-ground signs would conflict with underground utilities

Two-Post TSS

See the ODOT Temporary Traffic Control Standard Drawings for TSS details. Contractors must build a TSS as shown in the Drawings for it to be crashworthy. A TSS is crashworthy from all four directions. However, a TSS should **never** be tipped over. A TSS has not been crash-tested in this orientation. Single-post and Double-post designs are shown on the Standard Drawings.

When not in use, the sign on the TSS should be covered; or, the TSS can be turned away from traffic or removed from the roadway completely.

When a TSS is exposed to live traffic; and, not behind guardrail or concrete barrier or removed a substantial distance from the roadway, the TSS must be delineated by placing a Type III barricade (4-ft or 8-ft wide) in front of it. See additional details on the ODOT Standard Drawings.

The maximum total sign area allowed on a double-post TSS is 40 ft^2 (e.g. the 4' x 8' and 1' x 8' Project ID sign combination). For the single-post TSS, the maximum total sign area is 9 ft^2. Due to dead load and wind loading limitations, and unknown crash-testing results, larger signs should not be installed on a TSS. A structural support (bridge, sign bridge, luminaire post, etc.), steel breakaway support (e.g. TBB), or equivalent, should be used.

PORTABLE SIGN SUPPORT

The Portable Sign Support (PSS) is used to mount a roll-up sign for short-term or intermittent work. According to the MUTCD, roll-up signs on Portable Sign Supports may be in place for a maximum of 72 consecutive hours. However, ODOT construction contracts limit the use of roll-up signs to ***48*** consecutive hours to avoid having signs left in place over a weekend.

Roll-up signs are most useful for operations that occur on a daily basis – installed in the morning, and then taken down in the evening at the end of the work shift. It should be noted that when the sign is taken down at the end of a shift the "48 consecutive hour" clock starts over. This practice may be repeated for the duration of the project as long as the sign is not left in place for more than 48 ***consecutive*** hours. If the sign is needed longer, it should be installed on a TSS or in-ground post. All signs should be turned, covered or removed when their messages are not applicable or appropriate to the work environment.

Portable Sign Support with roll-up sign and sign flags

CONCRETE BARRIER SIGN SUPPORT

Barrier sign supports are used to install temporary signs on concrete barrier where space for a TSS or post-mounted sign is not available. See the ODOT Temporary Traffic Control Standard Drawings for design details for this support.

Concrete Barrier Sign Support

The barrier sign support can be used on either standard 32-in barrier or the taller 42-in “Tall F” barrier. The maximum total sign area allowed on the current barrier sign support is 9 ft^2.

If installing the initial “ROAD WORK AHEAD” sign on a barrier sign support in the median, **do not** include either sign flag boards or the “FINES DOUBLE” (or other) rider. Sign flag boards and the “FINES DOUBLE” rider can be added to the “ROAD WORK AHEAD” sign on the right shoulder, if the sign group is installed on a post or TSS.

EXISTING SIGN SUPPORTS

Temporary signs may be added to or replace existing signs installed on existing highway sign supports and structures with the appropriate approval from the local road jurisdiction. ODOT approval includes working with the ODOT Sign & Structures Engineer or equivalent.

2.5 – CATEGORY 3 DEVICES

CATEGORY 3	
FHWA Crashworthy	**Examples of Devices Included:**
Devices or hardware expected to cause significant velocity change or other harmful reactions to impacting vehicles.	• Temporary Impact Attenuators • Temporary Pre-cast Concrete Barrier • Temporary Guardrail, Connections, Transitions, and End Terminals • Temporary Bridge Rail • Breakaway Sign Supports

2.5.1 - TEMPORARY CONCRETE BARRIER

Temporary concrete barrier is one of the most common temporary traffic control devices used in longer-term construction work zones. It provides traffic with positive separation from the work area and effective protection for construction workers.

Several factors should be considered when determining the need or quantity of temporary concrete barrier in the traffic control staging plan.

Temporary Concrete Barrier is primarily used to:

- Provide positive separation between the work area and live traffic
- Provide a well-protected work area for construction personnel
- Protect opposing traffic streams from cross-over crashes
- Protect traffic from deep excavations or hazards adjacent to the traveled way
- Contain or redirect errant vehicles away from roadside obstructions or active work areas

FABRICATION and PLACEMENT

Standard "F" Barrier must meet the fabrication specifications shown on ODOT Standard Drawing RD500 and in Section 00820 of the Standard Specifications for Construction.

For temporary concrete barrier to perform as designed, and to remain crashworthy, it must be placed according to the following:

- Placed on a flat, pavement surface (asphalt or concrete)
- A 3-foot wide, unobstructed surface behind any unsecured concrete barrier for deflection if impacted
- Secured***** concrete barrier must maintain a 1-ft clear space behind the back face of the barrier
- Each barrier segment must be pinned to the adjacent segment

***** If when placing barrier adjacent to obstructions or hazards – e.g., bridge falsework, abutments, sheet piling, retaining walls, deep excavations – a 3-ft clearance cannot be provided, barrier must be secured to the pavement surface and include a 1-ft clearance from the obstruction/hazard. See ODOT Standard Drawing TM830 for barrier securing details.

NOTE: For barrier on concrete bridge decks, see the ODOT *Bridge Design and Drafting Manual* (BDDM), Section 1.1.21.4, and Standard Details DET3295 and DET3296 for placement information.

Where the barrier run terminates, include details or instructions to the contractor to protect the exposed blunt ends of the concrete barrier using one of the following measures:

- A temporary impact attenuator (Sand barrel array, or Narrow site system)
- A Truck-mounted impact attenuator (TMA) – typically for three days or less
- A temporary connection between the barrier run and other railing system (e.g. guardrail, bridge rail, or other concrete barrier) – See ODOT Standard Details for connections
- Overlap exposed end with adjacent barrier run (see ODOT Standard Detail)
- Bury the blunt end in a roadside cut slope

TALL (42") CONCRETE BARRIER

With its 42-in height, Tall "F" barrier is primarily installed in the medians and on the shoulders of Interstate freeways and the State Highway Freight System. Tall "F" is used at locations with high truck volumes (DHV > 250); or, at locations with geometry that could result in a serious crash if a heavy vehicle penetrated the barrier (e.g. alignments with curve radii < 28^0 [205 ft.]).

Tall "F" barrier must meet the specifications shown on ODOT Standard Drawing RD545. The same placement requirements for Standard "F" barrier apply to Tall "F" barrier.

Tall "F" barrier provides effective protection against median crossover crashes – particularly from large trucks. In Test Level 3 (TL-3) and 4 (TL-4) testing, Tall "F" barrier performed very well, seeing deflections of approximately 32 inches.

In the TCP, Tall "F" barrier may be used as temporary barrier. However, when used as temporary barrier, Tall "F" barrier is often left on the project and used as permanent barrier. Due to the limited availability and greater difficulty with moving this type of barrier, it is impractical to specify Tall "F" barrier to be used ***exclusively*** as temporary barrier.

For securing "Tall F" barrier to the roadway, see ODOT Standard Drawing TM830 and RD516.

2.5.2 - TEMPORARY GLARE SHIELDS

Temporary glare shields are installed along the top of concrete barrier between opposing traffic lanes. Glare shields are used to prevent opposing headlight glare from impairing driver visibility. Glare shields are typically installed where traffic maneuvers through a curvilinear alignment (e.g. freeway crossover) resulting in headlight beams aiming more directly into the path of oncoming vehicles. Space glare shields along the top of concrete barrier in accordance with *Table 2.1*, below.

CURVE RADIUS (ft)		Blades per Section	Spacing (ft)
From	To		
Tangent Sections		5	2' 6" ±
∞	1500	6	2' 1" ±
1500	750	7	1' 10" ±
750	500	8	1' 7" ±
500	350	9	1' 5" ±
350	275	10	1' 3" ±

GLARE SHIELD SPACING – Table 2.1

2.5.3 – TEMPORARY GLARE SCREEN

Temporary glare screens are installed along the top of concrete barrier between a traffic lane and the work zone. Do not mount glare screens on concrete barrier located between opposing traffic lanes. Glare screens are used to prevent traffic from slowing down due to gawking to view adjacent construction activities.

Glare screens are typically installed in bridge projects on freeways where construction activities are near traffic, to prevent drivers from slowing down to view the activities.

Temporary Glare Screens are measured and paid for as, "per foot".

2.5.4 - REFLECTIVE BARRIER PANELS

Reflective barrier panels are 4-in wide, 36-in long corrugated aluminum panels with either fluorescent orange or silver-white reflective sheeting covering one side of the panel (see photo, right).

Reflective barrier panels are used to delineate the face of concrete barrier and enhance their conspicuity.

Barrier panels are typically installed in curvilinear sections of a barrier run; however, the beginning and ending curves of a temporary barrier run are most beneficial in assisting drivers through the unfamiliar alignment.

Reflective barrier panels are measured and paid for as, "per each".

2.5.5 - TEMPORARY IMPACT ATTENUATORS

Temporary impact attenuators (or "crash cushions") are crashworthy devices that mitigate the effects of errant vehicles striking fixed objects. Temporary impact attenuators, when struck, absorb the energy of the vehicle and dissipate it within the system in various ways – by breaking apart (drum arrays), rapidly collapsing and decelerating (TMAs, gating narrow-site systems), or deflecting slightly and redirecting the errant vehicle (non-gating narrow-site systems). Work zone impact attenuators are listed on the ODOT QPL under "Impact Attenuator, Temporary" and can be separated into the following types:

- Sand Barrel Drum Array – An array of sand-filled plastic drums (modules). See ODOT Temporary Traffic Control Standard Drawings for additional details.
- Narrow-Site Systems – An attenuator style used specifically to protect blunt ends of concrete barrier, bridge rail, columns or other fixed objects within the clear zone with a narrow width (~2-ft). Most narrow-site systems are approximately two-feet wide, making them valuable and practical for protecting traffic where a full-size drum array attenuator will not physically fit.
- Truck Mounted Attenuator (TMA) – A TMA is a mobile impact attenuator attached to a work or shadow vehicle used to protect objects or small, active work areas, or exposed hazards. Because of its portability, a TMA can be used to protect moving work areas or short-duration activities (AC or concrete repairs). TMAs should be placed in advance of the object or workers being protected, as recommended by the manufacturer and approved by the Engineer. A TMA is not intended for the long-term protection in a single location.

See Section 6F.86 of the MUTCD for additional information regarding temporary impact attenuators.

2.5.6 - TEMPORARY BARRIER AND GUARDRAIL CONNECTIONS

Use temporary connections to connect different barrier systems together. Temporary connections may be used as alternatives to impact attenuators, overlapped or buried ends, or other treatments. Several devices are available to connect temporary concrete barrier to other systems including existing barrier, bridge rail and guard rail sections.

BARRIER-TO-GUARDRAIL CONNECTORS

Some barrier installations may need to be connected to guardrail or other railing system. This requires a secure connection between the two runs to prevent errant vehicles from snagging the joint between the two systems. See ODOT Standard Drawing RD530 for examples of barrier-to-barrier connections.

Temporary Connectors are paid for under the “Temporary Protection & Direction of Traffic” (TP&DT) lump sum pay item. Connectors are measured as “per each”.

BRIDGE RAIL CONNECTORS

Frequently, bridge rail is terminated by attaching the rail to a run of guardrail to protect the hazard. See ODOT Standard Drawings BR203 for an example of this type of connection. This connection detail may be used for temporary or permanent applications.

2.5.7 - OTHER BARRIER SYTEMS

For work zone activities that are in place for a limited time (< 1 day), there are two additional traffic control devices used for protecting the work area and public traffic.

MOVABLE (“ZIPPER”) CONCRETE BARRIER

Movable Barrier is typically used for staging projects requiring multiple and frequent moves of the concrete barrier.

Movable Barrier is a specially-shaped barrier made of multiple, smaller, interlocked segments. The system is moved using a special transfer machine designed to pick-up, move, and put down the barrier in a single pass. The barrier and machine are included in the contract as a single pay item.

Product-specific impact attenuators are used for the Movable Barrier, attach to the end of the barrier run and are moved by the machine in the same manner as the barrier. Movable Concrete Barrier has a slightly higher deflection when struck by an errant vehicle (~ 5-ft, mid-run with unsecured ends). Use caution in placing this barrier system less than 5-feet from a work area or hazard. Do not secure Movable Barrier systems to the roadway.

ODOT currently owns a transfer machine and over two miles of Movable Concrete Barrier. If it is advantageous to include this device on the project, consult with ODOT Region 1 in Portland.

MOBILE BARRIER SYSTEM

A Mobile Barrier System may be very useful and advantageous for providing positive protection between workers and traffic; and, optimizing efficiency for projects on high-speed roadways that include multiple small work areas (< 150-ft). Installing, moving and removing temporary concrete barrier would not be practical for these types of projects.

2.6 – CATEGORY 4 DEVICES

CATEGORY 4	
FHWA Crashworthy or protected	**Examples of Devices Included:**
• Portable, primarily trailer-mounted • Need to be shielded or, at a minimum, delineated • FHWA continues to monitor in-service crash performance • MASH encourages the design and testing of crashworthy versions • Good placement practices	• Sequential Arrows ('Arrow Boards') • Portable Changeable Message Signs (PCMS) • Automated Flagger Assistance Devices (AFAD)Portable Traffic Signals • Portable Light Plants (*Not flagger station lighting*)

2.6.1 - TEMPORARY ELECTRICAL SIGNS

SEQUENTIAL ARROW SIGNS

Sequential Arrows (arrow boards) are large truck or trailer-mounted lighted signs used to indicate the direction traffic needs to merge as part of a lane closure. Several approved sequential arrows are listed on the ODOT QPL.

Sequential arrows shall ***only*** be used to indicate a lane closure. Do not use a sequential arrow sign to indicate a traffic shift. Do not use a sequential arrow to indicate a "Keep Left" or "Keep Right" condition. Sequential arrows are measured and paid for as either "per each" or on an hourly basis. See Section 6F.61 of the MUTCD for additional information.

PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)

PCMS are large lighted signs used to display programmable, dynamic messages that reflect work zone conditions to be encountered by approaching traffic. PCMS can be mounted on either a trailer or work vehicle. Trailer-mounted PCMS can display three lines of text. Depending on the size of the unit, a vehicle-mounted PCMS can display either two or three lines of information. Several approved PCMS are included on the ODOT QPL.

Installation and delineation details for a PCMS can be found in the ODOT Temporary Traffic Control Standard Drawings.

ODOT has published a quick reference field guide "Oregon Portable Changeable Message Sign Handbook**"**, which provides guidance for the operation of portable changeable message signs (PCMS), including proper messages, application and placement of the devices.

Messages displayed on a PCMS should be complete, independent thoughts. Avoid displaying a message that relies on the second message to complete the thought. In practice, one message (*panel*) should be used to describe a situation or condition. The second panel should be used to convey supplemental information, an additional warning or direction for drivers.

Standard practice for a PCMS dictates that a maximum of two alternating panels are to be displayed on a single PCMS. However, under limited circumstances, it may be necessary to use an additional panel to address a specific segment of drivers or complex thought (e.g., oversize vehicles, or a complex detour). In no case should there be more than three panels on a single PCMS. If more than three panels are needed, an additional PCMS should be installed in sequence. If a second PCMS is installed, do not install any temporary signing between the two PCMS to maintain the integrity of the complex PCMS message sequence.

Due to limitations in the number of characters, abbreviations may be required. Abbreviations should follow the guidance in the MUTCD on Tables 1A-1, 1A-2, and 1A-3. Messages may include distance information expressed in feet or miles. Each panel is limited to three lines with eight characters per line (including spaces). Additional PCMS information can be found in Section 6F.60 of the MUTCD.

A PCMS may be used to display arrows and chevrons to simulate a sequential arrow board. Do not combine arrows/chevrons with text on the same panel. Arrows and chevrons used on a PCMS must comply with the graphical guidance given in the MUTCD. Animation, other graphics, logos, web sites, etc, shall not be displayed on a PCMS.

When including suggested messages on a TCP sheet, use the following format:

TRAFFIC SHIFT 1 MILE	LANES SHIFT LEFT

PORTABLE CHANGEABLE MESSAGE SIGN
(Suggested Message)
(Locate As Directed)

2.6.2 - TEMPORARY TRAFFIC SIGNALS

A temporary traffic signals is typically used to control the flow of traffic through a one-lane, two-way work area. Signals are often used in lieu of flaggers due to the duration of the two-way, one-lane operation.

The use of a temporary signal is limited to applications where a number of criteria are examined and can be met, as follows:

Temporary Traffic Signal - Spanwire

- ADT is typically below 3500
- Analysis shows delays of less than 20 minutes
- Adequate sight distance can be provided between STOP bars at each end of the work area
- Cost comparison made between the signal and flagging show the signal being more economical
- Other environmental conditions that would favor the signal over human flagger control

Public roadways between the limits of the temporary signal must be considered. The intersecting roadway can either be incorporated into the operation of the signal with the addition of another signal head or the roadway can be closed and a detour route determined.

Private accesses (driveways, businesses) within the signalized area should not be allowed. Attempts should be made to provide a reasonable alternative access. However, depending on volumes, right-of-way constraints, economic impacts and political climates, it may be necessary to incorporate the private access into the signal as described above.

Other road users, including pedestrians and bicyclists, should be considered when designing a temporary signal. If a significant number of other road users can reasonably be expected, then the project and the temporary signal needs to accommodate them. Bike lanes, bike detection, separate bike/ped facilities are some of the options available to designers.

Temporary Signals can be used for the following work zone conditions:

- One-lane, two-way configurations
- During the installation of a new permanent signal
- To control traffic through an intersection being reconfigured
- For the reconstruction of an interchange ramp terminal

Temporary traffic signals are often selected over flagging when construction staging will require the one-lane, two-way traffic operations for several weeks or more*. In lieu of two flaggers 24-hours/day and two Advance flaggers 8-hours/day during peak times, temporary signals are preferred for:

- Two-lane bridge replacements
- Rock fall or side slope excavation projects

* Use of a temporary traffic signal becomes more cost-effective where one-lane, two-way traffic staging lasts approximately 28 consecutive days or more.

The design of the temporary signal may be prepared by an ODOT Region Tech Center Signal Designer, a consulting engineer, or by qualified staff within the individual agency.

Approval for the installation of a temporary signal on a State highway is granted by the State Traffic Engineer. Similar to a permanent signal, a plan showing the locations of all portable traffic signal equipment, as well as any other traffic control devices to be used in conjunction with the portable traffic signal must be submitted for approval. Approval for temporary signals on city or county roadways is granted by the responsible Traffic Engineer within these individual agencies.

2.6.3 - PORTABLE TRAFFIC SIGNALS

Portable traffic signals are temporary traffic signals mounted on a trailer. Portable traffic signals are subject to all of the same requirements for temporary traffic signals, including State Traffic Engineer review and approval.

Portable Traffic Signal

Portable traffic signals should be considered when a temporary signal is needed for a limited duration, ideally less than one month. Portable traffic signals are also ideal when electricity is not readily available. Most portable traffic signals are powered by batteries, recharged by generators or solar panels.

Portable traffic signals should not be used at locations where there is more than one travel lane in each direction. However, they may be permissible on divided four-lane roadways, two lanes in each direction, if a separate set of signal heads is provided for each additional travel lane. Portable traffic signals typically should be used at locations where the posted construction speed is less than 35 MPH; however, for limited applications, speeds up to 55 mph may be applicable. When not in use, signal indications and all related traffic control devices should be either removed or covered.

Portable traffic signals are no longer limited to two phase operations. Newer signal technologies are allowing multiple phases and wireless connectivity. Under proper conditions, a portable signal can be used at intersections for limited durations. At most intersections, a temporary traffic signal (span wire) is usually a better option.

Use portable traffic signals from the QPL. Refer to the ODOT Traffic Control Plan Standard Drawings for additional guidance as to the layout and additional TCD needed for the signal.

2.6.4 - FLAGGER STATION LIGHTING

Flagger Station Lighting shall be reasonably glare-free. Flagger Station Lighting must come from the QPL. Flagger station lighting illuminates the Flagger during nighttime operations, while minimizing the glare experienced by approaching drivers.

2.6.5 - AUTOMATED FLAGGER ASSISTANCE DEVICES (AFAD)

The AFAD is an automated device used as an option to control traffic within a two-way, one-lane work zone operation. The AFAD is a trailer-mounted device that includes a remotely controlled gate arm that can be raised or lowered across a single travel lane to control the flow of traffic. In addition, 12" red and flashing yellow signal lights are installed on the trailer; steady "red" to alert drivers of a STOP condition; and, flashing "yellow" to allow drivers to proceed through the work area.

Currently, ODOT allows the use of AFADs from the QPL to be used in its work zones with a number of application and operational conditions. ODOT has adopted these conditions based on recently published standards and guidance in the 2009 MUTCD. ODOT has developed both a Standard Detail (DET4700) and Special Provision language addressing the use of AFADs within an ODOT highway construction project.

ODOT practice in using AFADs differs from the 2009 MUTCD by disallowing the use of a single AFAD trailer at one end of the work zone to be operated by a Flagger who is simultaneously flagging traffic at the other end of the work area.

Review the current AFAD Special Provision language and the Standard Detail for additional design standard and practice information. See Sections 6E.04 and 6E.05 of the MUTCD for more information regarding AFADs.

2.7 – SPECIALTY TCD BID ITEMS

2.7.1 – PEDESTRIAN CHANNELIZING DEVICE (PCD)

Use pedestrian channelizing devices (PCD) for providing a continuous, ADA-compliant accessible pedestrian facility during construction. PCD are orange/white retro-reflectorized, 32" tall lightweight continuous barriers designed to be ADA compliant and to channelize pedestrians. Pedestrian channelizing devices are interlocked to form a rigid, stable, continuous guidance system through or around a work site.

PCD may be used at the following locations:

- Street or sidewalk construction activities adjacent to or in the vicinity of pedestrian facilities (e.g. pole base, footing or other excavations)
- As channelization for sidewalk diversions

See ODOT Standard Drawing TM844 for typical applications for the PCD and accompanying signing. Use Pedestrian Channelization Devices from the ODOT QPL. The Pedestrian Channelization Device bid item is paid for "per foot" by the total length of the installed system.

Pedestrian Channelizing Devices should be used on both sides of a facility when providing a continuous, ADA compliant route. The PCD may be omitted on one side of a continuous, ADA compliant route if that side of the route has a detectable edge and there is no falling or tripping hazard. When an ADA compliant route is not necessary, but the PCD is used to channelize pedestrians through or separate them from a work zone, the PCD may be used on either side of the route.

When pedestrians are not expected but there is still a need for a soft barrier between public traffic and the work area, use Work Zone Fencing.

Obsolete **"Work Area Delineation Fencing" (Non-ADA)**

Pedestrian Channelization Device (PCD)

2.7.2 - OVERHEIGHT VEHICLE WARNING SYSTEM (OVWS)

The OVWS is a warning system used to alert over-height vehicles of an upcoming restricted vertical clearance. The device relies on microwave and infrared technologies to signal a vehicle whose physical height exceeds that of the posted height restriction. The OVWS provides both an audible and visual warning. The PCMS displays instructions as to an alternate route around the restriction.

The OVWS are most effective on high-volume facilities with a significant percentage of truck traffic. Interstate freight routes are prime facilities.

Typically, the request to use this device comes from members of the Project Development Team who are familiar with the construction limitations and the available roadway facilities around the project site. Use OVWS from the QPL.

2.7.3 – PROTECTIVE NETTING

Protective netting refers to the material used to protect traffic passing below a bridge under construction. When construction occurs over travel lanes, or when there is the danger of construction equipment, tools, material, or debris falling onto pedestrians or traffic, use protective netting.

Protective netting may also be called for on projects where an overhead work area crosses an active stream, creek, river or other body of water.

Construction activities using protective netting may include:

- Overpass construction (e.g. deck preparation, rail work, protective fencing, painting, etc.)

- Sign bridge construction
- Bridge falsework
- Bridge maintenance
- Tunnel repair/construction

Contact the ODOT Bridge Section to determine design details, measurement/payment, and necessary specifications for protective netting.

2.7.4 - FALSEWORK ILLUMINATION

Falsework Illumination refers to a temporary lighting system attached to the falsework of a structure under construction, where the falsework is located adjacent to live travel lanes and/or extends over the travel lanes. Falsework Illumination typically consists of a long string of amber-yellow lights framing the falsework portal that traffic passes through.

Falsework Illumination is paid for as part of the “Temporary Protection & Direction of Traffic” (TP&DT) lump sum pay item.

2.7.5 - POLE BASE COVERS

Pole base covers protect pedestrians from open footing excavations created as part of the installation of a utility pole. Pole base covers are typically comprised of utility grade plywood sheeting.

Pole Base Covers are paid for as part of the “Temporary Protection & Direction of Traffic” (TP&DT) lump sum pay item.

Traffic Control Plans Design Manual

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Chapter 3
Traffic Control Measures (TCM)

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CHAPTER 3 TRAFFIC CONTROL MEASURES (TCM)

CHAPTER 3

3.0 – KEY POINTS COVERED IN THIS CHAPTER

3.1 – Traffic Control Measures (TCM)

3.2 – Design Considerations

3.3 – Design Practices & Policies

3.4 – Design-Related Specifications

This chapter is intended to introduce Designers to three key components of Traffic Control Plan (TCP) design:

- The concept of a Traffic Control Measure (TCM)
- The broad array of considerations that must be examined when developing a TCP
- The variety of design policies and standard practices used in designing a TCP

3.1 – TRAFFIC CONTROL MEASURES (TCM)

A Traffic Control Measure (TCM) can be considered as the combination of a work zone traffic control strategy with temporary traffic control devices used to implement a temporary traffic control plan during a highway construction project. Ultimately, traffic control measures are used to optimize the safety and efficiency of both public traffic and the construction operations of a contractor.

TCM considered and implemented within a TCP are often proportional to the scope and complexity of the work, and can range from one or more simple devices, to an extremely complex system of devices, technologies and human resources. A TCM may employ a singular traffic control device, but the lone device may provide the needed level of warning, functionality, and safety. A complete traffic control plan commonly incorporates multiple traffic control measures.

Examples of commonly used TCM include:

- PCMS providing road closure notifications
- Flagging in a 2-way, 1-lane work area activity
- Freeway lane closures
- Temporary median crossovers
- Rolling slowdown procedures
- Advance Flaggers for extended traffic queues
- Temporary concrete barrier
- Smart work zone systems (see "*PTMS*")
- On-site diversions
- Weekend road closure with Detour

By each project's unique nature, they present the TCP Designer with a broad range of design challenges. This chapter focuses on common considerations the Designer should explore in putting together a TCP and the traffic control measures they might select for their plan.

3.2 – DESIGN CONSIDERATIONS

A wide variety of considerations should be made in developing a safe, effective, efficient and buildable traffic control plan. Before a Designer puts pencil to paper, or before the first click of the mouse button, several pieces of data should be collected, and several questions should be asked and answered.

TCP Designers should seek a thorough understanding of each project. Then, as development begins, Designers should carefully investigate each facet of the project – looking for details, conditions, restrictions, opportunities and other factors that need to be addressed to optimize the design of the TCP and overall safety for the project.

Beyond traffic control measures, designers should be considering details and issues related to factors that may have some impact on how the TCP is developed and eventually implemented, such as the following:

- Scope of Work
- Complexity
- Project/Stage durations
- Facility Type
- Existing features/operations
- Traffic characteristics and behaviors
- Location/Geography/Climate
- Opportunities to include positive protection measures
- Construction Schedule
- Worker Exposure to traffic
- Positive Protection options
- Environmental constraints
- Staging and Constructability
- Alternative contracting options
- Interagency/Stakeholder impacts

3.2.1 - SITE INVESTIGATION

One of the first tasks for a TCP Designer should be to visit the project site and examine the surroundings, conditions, traffic operations, adjacent facilities and overall character of the site.

During site visits, the Designer should consider collecting the following:

- ☐ Pictures and video throughout the project limits
- ☐ Posted speed(s) and physical limits for each speed zone
- ☐ Available right-of-way
- ☐ Geometry/alignments, Sight distances, Lane count and configurations
- ☐ Facility type: Urban/rural, freeway/non-freeway, arterial, freight route
- ☐ Roadside inventory: Existing signs, utilities, bicycle/ped facilities, landscaping, transit stops
- ☐ Historic structures, designated preservation/archeological sites
- ☐ General notes on traffic movement/behaviors and other operational observations
- ☐ Inventory of local businesses, accesses, and any unique features
- ☐ Waterways, or other environmentally sensitive features

Collecting recent traffic counts for the main roadway and connecting highways, is also very helpful. Knowing traffic volume percentages for each vehicle classification – particularly heavy trucks – is beneficial in selecting appropriate measures and locating them properly within the project site.

Other Designer resources also include the ODOT Video Log, Google Maps, Google Earth, and aerial photography. However, as these resources may not be current, their accuracy, reliability and value should be limited to conceptual design purposes. Construction plans and any, "digital terrain models" (DTMs) for any recently-completed projects on, overlapping, or adjacent to your current project may provide more current "existing" features.

DRIVER EXPECTANCY

Considerations should also be made for the concept of, "*Driver Expectancy*" in the design of the TCP. Different facility types yield different types of drivers and behaviors. Drivers will *expect* certain levels of operation, performance, visual recognition, and advance warning for different types of roadways.

Freeway drivers expect faster speeds, wider lanes, longer sight distances, and more advance signing. Urban arterial drivers might expect narrower lanes, lower speeds, bus stops, pedestrian and bicycle traffic, on-street parking and multiple accesses.

On commuter routes, drivers can frequently exhibit, "inattention blindness" – looking at the road ahead, but not really 'seeing' the details due to subconscious focus on other issues (work, family, schedules, etc.) – and driving the route on "auto-pilot". This condition may warrant additional efforts by the Designer to get drivers' attention as they enter and drive through the work area.

Work zones on each facility type will warrant different traffic control measures and devices. For example:

- Temporary concrete barrier is used more frequently on freeways, and is used to separate traffic from workers and/or roadside hazards, or between opposing traffic flows.
- Freeways will not use flagging operations to stop or control the flow of traffic.
- Two-lane, two-way highways are more likely to use cones, tubular markers or plastic drums to separate traffic from the work space.
- Flaggers and/or Pilot cars are commonly used in one-lane, two-way work zones to safely control vehicle movement.

The overriding premise is that the work zone is temporarily changing the roadway environment, and mitigations and strategies must be employed to alert ***<u>all</u>*** drivers of these changes. If even for a brief moment, it is the duty of the TCP Designer to develop a traffic control plan that can change driver behavior, provide adequate advance warning and guidance; and, conform to normal driver expectations until they are safely on the other side of the work zone.

PROJECT LOCATION and SITE TOPOGRAPY

The physical features of a roadway facility play an important part in the development of a traffic control plan. From selecting staging strategies to the type of devices or pavement markings used, the location and terrain of your facility can be highly influential.

Be aware of the variety of environments across the state that will affect the design of the TCP. Desert climates with higher temperatures and remote locations can affect the performance of certain TCD and make the expedient delivery of additional or replacement devices difficult. Marine (coastal) environments, with their tendency toward inclement weather (fog, rain), can present unique challenges in selecting and placing traffic control devices. Mountainous regions can generate problems for larger, heavier vehicles and may require additional mitigation strategies within the TCP. Populated urban centers and environmental features such as rivers, lakes, rock formations, wildlife habitats, historical monuments and archeological/preservation sites can create their own unique construction or staging complexities.

TCP Designers should work with staff within their agency to learn about site-specific factors or features that may influence the TCM included in the design of the TCP.

ACCESS MANAGEMENT

Designers should look for potential impacts to private or public accesses within the project limits that may occur at any time during the project. Consider what traffic control measures may be necessary to limit or mitigate those impacts.

Within the ODOT/APWA Standard Specifications for Construction (see *Section 00220*), some access types can be closed for short durations. From the results of traffic analysis (e.g. ODOT's Work Zone Traffic Analysis) and in working with Project Development Teams and affected stakeholders, some accesses may be closed for longer durations (See ODOT Special Provision "Boilerplate" Section 00220.40). Nevertheless, the TCP Designer must include mitigations for these impacts within the TCP. By using language in the project Special Provisions and through the inclusion of detailed plan sheets, a designer can provide specific instructions to the contractor for addressing these access closures or modifications.

3.2.2 - PROJECT SCOPE

In tandem with understanding the details of the project site, the Designer must clearly understand all facets of the project – what work is being done, anticipated duration for the project, when the project is expected to begin/finish, and most beneficially – a construction schedule.

Knowing what work is being done and how the project is to be built will help the Designer develop a traffic control plan that will optimize safety, mobility and constructability.

Take into account all of the work activities being done for your project. Pay particular attention to aspects of the work that involve complex construction or use highly specialized materials or equipment. Work with the Construction Project Manager to learn what you can about any challenging portions of the project.

Designers should also be looking for opportunities to provide positive protection to separate workers from traffic – or for staging options that might enhance the ability to provide positive protection. The more details you know about your project, the more potential strategies you can develop, the more applicable and effective your traffic control measures will be.

The TCP Designer should answer a number of questions regarding the scope of work to maximize the design and strengthen the integrity of the TCP. Below, are some example lists of questions for given scopes of work.

- ***BRIDGE REPAIR or BRIDGE REPLACEMENT***
  - Building a new bridge or repairing an existing bridge?
    - If new, is the bridge being built in a different location or in the same location?
    - What are the plans for demolition and removal of the existing bridge?
  - How is the existing bridge configured and can traffic be staged during work?
  - Are there in-water work limitations?
  - Can traffic capacity on the bridge be reduced during construction?
  - Are alternative routes available for one/both directions?
  - Can the road be closed and traffic detoured?
  - Is the construction schedule being accelerated?
  - Are there geometric, topographical or other environmental constraints?
- ***PAVEMENT PRESERVATION***
  - What is the roadway type – freeway, high-speed, urban, mountainous, etc.?
  - What is the extent of the work – overlay, grinding, and full-depth reconstruction?
  - What type of material is being used to repair/replace the existing pavement?
  - Can multiple lanes be closed to accelerate the work?
  - Can the road be closed completely?
  - How extensive is the access control within the project limits?
  - Should the project be accelerated?
- ***NEW ROAD CONSTRUCTION or MODERNIZATION***
  - Are geometric changes being made to the alignment?
  - Is capacity being added to the new facility – widening, etc.?
  - Is the control of traffic being changed - adding, removing a traffic signal(s)?
  - Are local public services (transit, mail, schools, police/fire) being affected?

LEVEL OF COMPLEXITY

The complexity of a TCP is often proportionate to the scope of work. The complexity of the TCP, however, may be applied to the entire project, or to an isolated aspect of the project that would benefit from a higher level of detail. Ultimately, a TCP should include sufficient detail and information allowing field staff or a contractor to adequately protect pubic traffic and workers; and, complete the scope of work in a reasonable time at a reasonable expense.

NOTE: A "*simple*" project may benefit from added complexity within the staging plan and TCP. For example, adding one or more plan sheets may clarify a unique construction feature or process that would otherwise be difficult to convey through Special Provision language or a Standard Drawing. The added time to generate plan sheets during project development, may result in decreased time and costs during construction of the project.

3.2.2 - PROJECT DURATION

Many traffic control measures depend on the duration of the project – or the duration a hazard might be exposed to traffic. The construction schedule – individual parts or the whole – plays a key role in the development of the TCP.

Work zone hazards present for short durations (3 days or less), can be protected or managed using measures that might differ from those used to address longer-duration conditions – often using more portable devices or an increased spacing of channelizing devices to maximize a worker's limited time on the roadway.

Project Duration, with a broad array of additional factors, must be considered in selecting the appropriate traffic control measures for long-term construction projects or for short-duration work activities, including:

- Facility type & location (urban, rural)
- Traffic volumes
- Posted, Running speeds
- Crash history, Known safety issues (ODOT: SPIS sites?)
- Worker exposure to live traffic, Positive protection options
- Availability and practicality of a detour

These factors in mind, the anticipated duration of a project can affect selected traffic control measures:

- 24-hour Flagging operations vs. Temporary traffic signal
- Temporary concrete barrier vs. Channelizing devices
- Temporary pavement markings vs. Channelizing devices
- On-site diversion vs. Road closure with detour vs. In-place staging plan
- Static, rigid, post-mounted temporary signs vs. Roll-up signs on portable sign supports

DEVICE QUANTITIES

For projects with durations greater than one year, quantities for many of the TCP pay items should be adjusted to account for replacement. Over time, pavement markings, channelizing devices, impact attenuator repairs, etc. become worn, faded, dirty, damaged, or can be vandalized. With increased exposure to traffic, devices are more likely to be struck and may require repair or replacement. For projects with long durations, small increases in the TCD quantities should be made for devices susceptible to these conditions.

For a project that "***winters over***" – the project extending or shut down through the winter – inclement weather, low temperatures, and traction devices can all be very hard on devices left on the project site. Pavement markings and channelizing devices may need to be replaced, repaired, or at least freshened up.

As such, a Designer should consider adding a small percentage to pay item quantities for those devices left exposed to live traffic over the winter months:

- Channelizing devices: Consider +10-20% depending on proximity to live traffic
- Pavement markings (paint stripe): Consider a second application for temp. stripes

- Pavement markers (reflective, flexible): Consider replacement amount for high traffic areas
- Temporary signs: Not typically adjusted for winter shutdowns

3.2.3 - PROJECT SCHEDULES

Be especially aware of accelerated construction schedules or projects with time-critical components that must be completed within a specific timeframe. Examples include projects with detours, bridges on critical highways or freight routes, or interstate routes with high volumes of traffic. Projects with an aggressive completion schedule or time-critical components may include unique construction materials or equipment that will subsequently require unique TCM to accommodate construction. Maintain regular communication with the Project Manager's office and Project Development teams, watching for atypical construction strategies that may require special traffic control measures within the TCP.

Within ODOT, shorter-duration projects can occasionally have bid dates adjusted to accommodate other projects or anticipated workloads. Smaller projects may also be combined with larger projects for various reasons – cost, funding opportunities, seasonal timing, politics, etc.

Occasionally, an "Emergency" project will need immediate attention. Abide by fundamental design protocols, as much as practical, in the development of the traffic control plan. Do not use a project's "emergency" status to default to sub-standard practices or poor engineering judgment resulting in an unsafe project. A safe, effective TCP can be developed – even for the most emergent project. Use human and material resources wisely to aid in the expedited development of the TCP.

3.2.4 - COMMUNICATION AND INTERACTION

COMMUNICATION

Maintain frequent communications with the Project Leader and other members of your Project Development Team regarding any relevant details that may affect the TCP. The project leader should also be able to update you with any inquiries or comments from stakeholders, or agreements made between the agency and stakeholder groups.

It is equally valuable, as the design progresses, to interact regularly with the designated Construction Project Manager or a representative from their office. Project Managers are an extremely valuable resource in developing a buildable staging plan. Project Managers can provide insight into construction techniques, anticipated durations for a variety of work activities, quantities needed for various traffic control devices, and other guidance that may not be readily apparent to the TCP Designer.

Regular communication should also take place with appropriate discipline representatives within your agency – e.g. Bridge, Roadway, Environmental, and Right-of-way Sections, etc. These technical groups can provide additional data used to simplify or streamline the TCP by eliminating impractical or unfeasible staging concepts.

CONSTRUCTABILITY REVIEW

Consider conducting a Constructability Review as an effective tool to refine or correct your preliminary traffic control plan. The Constructability Review is a method used to collect valuable, practical feedback from potential contractors regarding the constructability of your draft TCP.

Typically, a short list of contractors is invited to review a set of the Concept or Preliminary Plans for a given project. Contractors are asked to provide comments, suggestions or recommendations as to whether the current plans are feasible or if there is a safer, more efficient or cost-effective way to construct the project. Constructability Reviews are not difficult to conduct and they frequently yield invaluable feedback for the Project Development Team and the TCP Designer.

3.2.5 - TRAFFIC CONTROL PLAN FORM

Traffic Control Plans can be separated into two distinct categories – A "Written" plan, or a TCP that incorporates project-specific Plan Sheets.

A TCP Designer should consider the following project characteristics in determining the type of traffic control plan to develop and what level of complexity should go into that plan.

➢ ***"WRITTEN" TCP***

A "Written" TCP includes, as a minimum, the current Standard Specifications for Construction, the appropriate Standard Drawings; and, the most current version of the Special Provision ("boilerplates" – downloaded from the Specifications Unit website. See Chapter 4).

In compiling and editing the Special Provision, the TCP Designer will include only the appropriate language from the following sources:

- Special Provision "boilerplates"
- Any additional necessary references to other Special Provision sections
- Any necessary Unique Special Provision

A "Written" plan, by definition, does not include project-specific traffic control plan sheets. Examples of a "Written" TCP include pavement preservation projects or other projects with:

- Few stages
- No detours or temporary roadways
- A short list of Pay Items
- A shorter duration (< 6 months ±)
- Scope of work easily conveyed through Special Provisions and Standard Drawings

➢ ***TCP with PLAN SHEETS***

The second form of Traffic Control Plan includes project-specific ***plan sheets*** in addition to the information included in a "Written" TCP. The plan sheets are used as a graphical representation of the construction staging plan. The sheets provide additional information or instructions to the contractor as to how to break up (or "***stage***") the construction of the project while still providing safe, efficient passage for live traffic.

Traffic Control Plans with Plan Sheets are common for projects with:

- Multiple stages/phases

- Detour routes and/or temporary roadways (e.g. on-site diversions)
- An extensive list of Pay Items with medium to large quantities
- Medium to long durations (several months to years)
- Complex Scope *not* easily conveyed through Special Provision or Standard Drawings

3.3 – TCP DESIGN POLICIES & PRACTICES

This section discusses a number of the more significant policies and practices relating to the design and implementation of a traffic control plan. For additional information, or questions regarding the interpretation or application of these policies, please contact the ODOT Traffic Control Plans Unit in Salem, or visit the ODOT Traffic-Roadway Section website and look for a link to the "TSAMU" and then for the Traffic Control Plans Unit website.

3.3.1 – POSITIVE PROTECTION

The FHWA defines 'Positive Protection Devices' as devices that contain and/or redirect vehicles and meet the crashworthiness evaluation criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350. The determination of when to use positive protection can be based on either a project-specific engineering study or the application of ODOT guidelines and tools included in this section and are based on engineering judgment.

Both the project-specific study and agency guidelines typically consider the actual work zone conditions expected combined with the function and features of the various devices that may be included in the TCP.

The AASHTO Roadside Design Guide (RDG) states "the design and selection of work zone safety features should be based on expected operating speeds and proximity of vehicles to workers and pedestrians." Additional factors that may impact the decision are provided in this section.

In the early development of the TCP, a process should be used to evaluate different opportunities for positive protection; as well as, selecting the appropriate traffic control measures and devices to provide the desired level of positive protection.

Designers should look for opportunities to separate workers from live traffic – first examining options such as detours or on-site diversions to essentially remove worker/traffic conflicts. Subsequent options may include the use of temporary concrete, steel or other rigid barrier systems. As project scope and work site environments dictate, positive protection options such as additional clear zone, or limiting worker exposure to live traffic (e.g. night work, where traffic volumes are lowest).

POSITIVE PROTECTION DEVICES

Numerous products and devices can be used to provide different degrees of positive protection in a work zone. Chapter 2 discussed the features and some of the applications for these types of devices. Devices more commonly used in Oregon for positive protection and their additional considerations are included below:

Portable Concrete Barrier – For long-duration activities, where work space is limited and either worker/traffic exposures or road user/work area hazard exposures are present on a regular basis.

> ***Other Considerations*** – Adequate space is required for barrier deflection, or the barrier needs to be pinned to the pavement surface. Adequate space is needed for equipment to install/move/remove the barrier. Barrier must be placed on rigid pavement surface (AC, PCC) to remain crashworthy. Adequate contractor ingress/egress points will be needed either at barrier ends, or mid-run. All exposed ends must be treated with some manner of impact attenuation or protection.

Steel Barrier – While not widely used in Oregon and not currently on the ODOT QPL, steel barrier is gaining ground in its consideration as a positive protection device. Steel barrier has several advantages over concrete barrier – including ease and low-cost of transportation, speed and quantity of installation per hour, durability, portability once on-site, and weight per foot to minimize bridge dead-loading. When anchored, steel barrier equals concrete barrier in providing a safe and effective positive protection device with minimal deflection.

> ***Other Considerations*** – To meet or improve upon the deflection of concrete barrier, steel barrier must be anchored to the pavement using proprietary anchoring details. Unanchored, steel barrier can deflect between 6-8 feet when impacted by a full-size pickup truck.

Moveable Concrete ("Zipper") Barrier – Moveable barrier is most effective for projects where lane configurations must change regularly – e.g. reversing peak traffic flows, multiple longitudinal work areas (e.g. micro-silica deck pours, bridge deck joint replacements) – and other locations where barrier is warranted, but the shorter duration of the activity makes placement of standard concrete barrier challenging and risky.

> ***Other Considerations*** – ODOT owns a barrier moving machine and approximately 3.5 miles of the specialized barrier. A great deal of advance coordination, communication and project planning is needed to successfully include the system in a highway construction contract.

Truck Mounted Impact Attenuators (TMA) – The TMA can be used in a wide array of work zone applications including, mobile operations, short duration and stationary activities for less than three days. Where other types of barrier systems may not be practical due to the short work duration, or a localized work space, the TMA is effective in providing adequate positive protection for workers under these conditions.

> ***Other Considerations*** – TMAs require an adequate roll-ahead distance to keep the workers or work space in front of it safe in the event the TMA is struck. Intrusion into the work space in front of the TMA should also be considered for high-speed work areas where the TMA spacing may be greater.

POSITIVE PROTECTION CONSIDERATIONS

Effective as of December 4, 2008, the FHWA published the Temporary Traffic Control Devices Rule (*23 CFR 630, Subpart K*) that provides additional information and emphasizes the need to appropriately consider and manage worker and road user safety as part of the project development process. The Rule provides guidance on key factors to consider in reducing worker exposure and risk from motorized traffic. It also requires highway agencies to consider positive protection where such devices offer the highest benefits to worker safety, such as situations where workers may be at increased risk of serious injury from exposure to traffic.

Designers should carefully consider the following factors in determining positive protection options, along with the examples of situations where positive protection devices may be required:

(1) **Project Scope and Duration** – The MUTCD defines "long term" projects as those longer than three days. However, common practice tells us projects in place longer than two weeks benefit most from the use of barrier – offsetting the time, energy and exposure of equipment and workers in placing and removing the barrier devices.

(2) **Anticipated Traffic Speeds** – Risk of serious injury to workers increases exponentially as traffic speeds increase in a work zone. For Oregon, a high-speed work zone is one where posted speeds are 45 mph and higher. Consideration should also be made for the 85^{th} percentile speeds for a given highway section. For projects where free flow traffic conditions exist, or where limited sight distances can be expected, consideration of these average traffic speeds will be especially critical.

(3) **Anticipated Traffic Volumes** – Much like higher traffic speeds, risk of injury to workers increases as the volume of traffic increases. However, high-speed traffic and high traffic volumes may occur separately. As volumes increase – pushing volume/capacity ratios close to 1.0 – congestion will help to regulate traffic speeds and likely slow traffic down. The risk to workers can come from the presence of a much higher number of vehicles, impatient drivers, limited sight distances, sudden braking and varying driver responses, etc. Urban areas are subject to these conditions – particularly urban freeways where the expectation is for consistent free-flow conditions.

(4) **Vehicle Mix** – A traffic stream with a higher percentage of large trucks can raise the warrants for positive protection measures – particularly where intrusion into the work area by a larger, heavier vehicle would have far more significant consequences to the work activity.

(5) **Type of Work Activity** – Depending on the physical activity itself, the amount of exposure to workers can warrant more significant positive protection measures. Activities placing workers immediately adjacent to live traffic for extended periods of time can provide some of the greatest benefits in using positive protection. Shadow vehicles with truck-mounted impact attenuators can help shield workers in situations where work spaces are small and move frequently along a highway section.

(6) **Traffic Worker Offsets and Exposure Durations** – Similar to the Type of Work mentioned above, the lateral placement of workers with respect to live traffic streams should be a consideration for the use of positive protection. When a lateral "Buffer Space" or adequate clear zone (see ***Clear Zones in the Work Zone*** in this Section, below) cannot be provided, positive protection can provide the greatest benefit to protecting workers from live traffic intrusions.

(7) **Limited Escape Routes** – Projects with limited or no available escape routes for workers present the greatest threat to workers in cases of an errant vehicle in a work zone. Work in tunnels, on bridges and other confined spaces best represent this condition.

(8) **Time of Day** – One of many Project Team considerations focuses on when to conduct the work given in the Project Scope – whether the work is done in the summer or year-round, on weekdays or weekends, during the daytime or at night. Often, the determination is based on when traffic volumes are low enough to allow lane closures or other decreases in traffic capacity that would minimize delay and optimize mobility through the work zone. Nonetheless, considerations should also be made for conducting work at night – where visibility and conspicuity are diminished, drivers tend to be more tired or drowsy; and inclement weather can further reduce visibility for road users and workers. If working at night, along with supplemental lighting, positive protection measures should be considered. For additional information, see the *NCHRP Report 476 – Guidelines for Design and Operation of Nighttime Traffic Control for Highway Maintenance and Construction*. Also see the *ATSSA Nighttime Lighting Guidelines for Work Zones*.

(9) **Road User Roadway Departures** – Considerations for the use of positive protection should be made for work zones where conditions increase the risk of exposure to roadside hazards for road users. Hazards such as vertical drop-offs, side slopes greater than 4:1, structures and structural falsework, construction materials and larger equipment can present additional risks to road users for serious injury.

The *AASHTO Roadside Design Guide* (RDG) suggests vertical drop-offs greater than three inches as a warrant for positive protection. In examining this warrant, the other considerations listed in this Section should also be weighed in determining the need for the positive protection, as well as the method used to provide that protection.

(10) **Potential Hazard from Positive Protection Device Itself** – According to the *AASHTO Roadside Design Guide*, Chapter 9, deciding to implement a positive protection device to protect a work zone hazard should be weighed against the potential for the device to be a greater hazard than the hazard being protected.

For example, one should ask if a vehicle driving over a given drop-off would result in a more severe crash than if the vehicle struck a positive protection device.

Another example would be to consider the scenario where a positive protection device is placed such that the "buffer space" or clear zone is decreased, and then asking if an errant vehicle would be better off striking the device rather than having the normal amount of open space (and reaction time) to possibly correct their speed and/or trajectory.

(11) **Work Zone Geometrics or Restrictions** – Consider temporary changes to either roadway geometry or the physical size (e.g. width, height) of the path vehicles must travel in as they pass through or around the work zone. Severe curves, abrupt changes or shifts in roadway alignment, narrow lanes or shoulders, restricted sight distances, or other changes that strain normal driver expectancies can significantly increase risk for both workers and road users in the work zone. If dramatic geometry changes are unavoidable, effective safety mitigations may include additional advance notification of the conditions (e.g. PCMS) and the placement of positive protection devices.

(12) **Contractor Accesses** – For longer term projects where the contractor may have accesses to the work site from the main highway, considerations should be made for accesses midway through a run of concrete or steel barrier. In addition to the accesses being well delineated – and perhaps signed using a Portable Traffic Management System (PTMS) – any exposed ends of the barrier system must be protected with an appropriate impact attenuator.

(13) **Roadway Classification** – While positive protection, when warranted, is suitable for all roadway types, high-speed facilities with a higher level of importance and greater dependence on mobility and access management, should be more heavily considered. For example, in Oregon, freeways would warrant placement of concrete barrier to divide opposing directions of traffic when one direction of traffic is moved onto a crossover or staged to share the existing pavement with the opposing traffic stream.

(14) **Impacts to Project Cost and Duration** – While often not a *primary* reason for selecting between two different traffic control measures, cost is a legitimate factor and must be considered as part of the overall decision-making process for providing positive protection.

While at first glance, concrete or steel barrier may appear to be the best solution, if many miles of barrier are needed, it may become cost-prohibitive within the scope of the project. Other positive protection measures may require additional effort, greater degrees of coordination, or additional political backing; but, the trade-off may be a substantial reduction in project cost and almost negligible reductions in safety.

As examples:

- Current right-of-way widths and low traffic volumes might allow for the construction of a single-lane on-site diversion instead of using large quantities of barrier.
- A limited full road closure is paired with a local, parallel detour route – minimizing out-of-direction travel while still supporting freight mobility needs.
- A one-direction detour is used for opposing traffic, allowing for a full-width crossover for the affected direction of traffic that would have been adjacent to the work area.

Keep in mind, in some instances construction of a temporary facility may take longer than employing the "traditional" measure, but if the temporary facility can ensure a much safer and more efficient environment for both the contractor and for road users, the additional time (and perhaps added cost) may be justified.

As project scopes are investigated, factors weighed, and opportunities explored, Project Development Teams should also consider seeking additional support from upper level managers within the agency (e.g. ODOT Area and Region Managers) when a particular measure or staging concept is the preferred means, yet presents some potentially significant increased costs for the project.

POSITIVE PROTECTION DEVICE SUPPORT TOOL

From the *ATSSA Guidelines on the Use of Positive Protection in Temporary Traffic Control Zones*, the "*Decision Support Tool for Selecting Various Positive Protection Devices"* table (see ***Table 3.1***, below) gives Designers guidance on the variety of devices available and an equally variable set of conditions where applicability, benefits, costs and other factors can be compared, evaluated and used to select the protection device best for their project.

Table 3.1 – Positive Protection Device Selection Decision Support

Positive Protection Device	Most Appropriate Projects and Locations For Use	Relative Costs and Benefits	Other Considerations
Portable Concrete Barriers	Longer duration stationary projects; areas with limited room for barrier deflection such as bridges and tunnels; drop-off conditions; worker exposure concerns	Substantial installation and removal costs; provide greater benefit on stationary activities compared with those that move such as pavement resurfacing	Require space for placement equipment; contractor access to work area; protection for exposed barrier ends
Ballast Filled Barriers	Low-speed urban projects; projects with limited space for concrete barrier placement equipment; areas with room for larger deflection, if needed (some water filled barriers are designed to minimize deflection)	Potentially lower installation and removal costs as they can be placed and removed by hand when unfilled	May be filled with water or sand; consider ballast material transport options, handling, and disposal, along with potential temperature issues (mitigated with environmentally sensitive anti-freeze)
Steel Barriers	Short-duration projects such as pavement rehabilitation and maintenance; areas with room for larger deflection (if anchored, deflection can be minimized). May also be used on long-term projects	Lower transport costs due to their lightweight, stackable design, quick installation	Lateral displacement is generally 6 to 8 feet (depending on impacting vehicle); may be anchored to minimize deflection
Moveable Concrete Barriers	Longer duration projects; projects where the traffic control configuration is changed frequently (where lanes are opened and/or closed on a daily or nightly basis)	Substantial cost and effort to install; provide benefit on projects where lane configuration changes often	Reconfiguration of the barrier can be accomplished quickly and safely; may be used to optimize directional capacity
Shadow Vehicles with TMAs	Mobile, short-duration, and short-term stationary projects such as striping, signal maintenance, vegetation control, pavement patching and repairs, and joint and crack sealing; locations where other barriers may be impractical due to the mobility of the operation	Costs include those for truck, attenuator, and driver – undamaged attenuator may be reused on other projects to spread costs	Adequate roll ahead distance is required to protect workers; consider the potential for motorists to access area between shadow vehicles and workers
Vehicle Arresting Systems	Longer term projects where the installation is used over an extended period, such as nightly closure of a roadway over an extended period; used to close an entire area and stop errant vehicles from intruding	Fixed end anchors require substantial effort to install; temporary anchors provide a lower cost solution for short-term applications	Requires adequate buffer space to allow vehicle to slow to a stop; consider work vehicle access to the closed area

3.3.2 – TCP DESIGN EXCEPTION PROCESS

While there is no formal Design Exception process for most of the components of Traffic Control Plan design, designers should gain appropriate approvals and document assumptions, thought processes and design decisions when they differ from normal practices or current design standards.

Many of the design standards contained within the temporary traffic control discipline originate from the MUTCD. Reductions of these standards should be avoided. However, it is understood that in the field of temporary traffic control, with confined or otherwise challenging work areas, some latitude must be granted. In most cases, where the documented standard cannot be met, despite due diligence, the solution may lie in the Designer optimizing the design feature given the available resources.

For example, if the design for a temporary on-site diversion requires a curve radius using a design speed well below the pre-construction posted speed, the designer should thoroughly document the decision to do so. Designers should contact the Engineer of Record to discuss the design and reasons for any substandard components. Communicate design decisions of this nature with your supervisor and with the Project Manager. If additional feedback is needed, Designers may contact the Traffic Control Plans Engineer in Salem to discuss the design, options or mitigations.

For ODOT Designers, if modifications to critical temporary roadway design elements (roadway alignments, pavement designs, etc.) are needed that do not meet published minimum standards from this manual, the Highway Design Manual (HDM) or other applicable policies, filing an exception through the formal Roadway Design Exception process is recommended.

3.3.3 – ABRUPT EDGES

Abrupt edges result from a variety of highway construction activities:

- Paving operations
- Cold Plane Pavement Removal ("grinding")
- Excavation or trenching (longitudinal)
- Removal of existing concrete barrier (keyed-in or grout pad)

Abrupt edges must be mitigated within the TCP. Depending on the nature of the abrupt edge, a number of methods are available to protect traffic.

PAVING

Longitudinal and transverse paving joints produce abrupt edges. Depending on the depth of the pavement surface(s) being applied, the contractor is required to employ various traffic control measures to protect traffic as outlined in the ODOT/APWA Standard Specifications, subsections 00745.61 *Longitudinal Joints* and 00745.62 *Transverse Joints*.

For longitudinal joints, when the nominal thickness of HMAC being paved is greater than 2 inches, then the Contractor has to schedule the work so that at the end of each day there are no drop-offs. When the nominal thickness of HMAC being paved is less than 2 inches, then the Contractor can only leave a longitudinal joint the length of HMAC paved in one shift. If neither requirement is met, the Contractor must protect the joint with a wedge of HMAC.

These specifications are important because they will affect staging plan assembly and the quantity of temporary traffic control devices needed.*Unique Special Provision – Abrupt edge (paving)*

The Unique Special Provision "*(00220) Abrupt Edge (Paving)*" includes additional information regarding mitigations for abrupt edges. Be sure to include the appropriate language from this Unique Special Provision when your project includes paving operations that may create longitudinal abrupt edges.

Several ODOT Traffic Control Plan *Standard Drawings* contain instructions, requirements, and practices to be used to protect abrupt edges created by paving operations, and are shown in specific details within those drawings:

- 2-Lane, 2-Way Roadways drawing – "2-Lane, 2-Way Roadway Overlay Area"
- Multi-Lane, Two-Way, Non-Freeways drawing – "Typical Abrupt Edge Delineation"
- Two-Lane Freeway Projects detail – "Divided Freeway One Lane Closure Preservation Work Area"
- Multi-lane Freeway Projects drawing – "Divided Freeway Two Lane Preservation Work Area"

COLD PLANE PAVEMENT REMOVAL ("GRINDING")

Depending on the depth of the pavement surface being removed, the contractor is required to employ various traffic control measures to protect traffic as outlined in Standard Specification Section 00620.40 Pavement Removal. The way pavement is removed may have an impact on the duration of the contract. The method should be accounted for to help determine time based pay item quantities – i.e. Flaggers.

EXCAVATION OR TRENCHING

If an abrupt edge results from trenching or excavation (pavement reconstruction, longitudinal trenching, etc.), there are requirements for the contractor as well. Be sure to include the appropriate language from the Unique Special Provision "00220 – Abrupt Edge (Excavation)".

3.3.4 – BICYCLE AND PEDESTRIAN ACCOMMODATION

As part of the Oregon DOT's commitment to bicycle and pedestrian transportation, considerations should be included in the design of temporary traffic control plans to provide, safe, efficient and accessible facilities for bicyclists and pedestrians.

When existing sidewalks and/or bicycle facilities exist within the project limits, and these facilities are affected during construction, adequate temporary facilities, and access to them, ***shall*** be provided as part of the TCP. Temporary bicycle and pedestrian facilities should, to an equal or better degree, replicate the existing facilities, as nearly as practical.

Where it becomes impractical to provide a temporary facility, alternative measures should be developed and implemented to accommodate these road users, including strategies such as:

- Alternate/detour routes on existing facilities
- Partnership with local transit providers (e.g. Tri-Met, Chariots, LTD)
- Shuttle services through private vendors

Chapter 6D of the MUTCD comprehensively covers pedestrian safety considerations for temporary traffic control. The same level of considerations discussed in the MUTCD for walking is applicable to other modes of transportation through mthe work zone, including bicycling.

The following examples represent lessons learned that Designers should be aware of as they develop their TCP designs for bicycle and pedestrian accommodation. Each of these traffic control measures or work zone conditions must be able to accommodate bicycles and pedestrians, or identify an alternative means to do so:

- **Temporary and Portable Signals**: Design may require pre-emptive push-buttons and associated signal timing. If a crosswalk is closed at a signalized intersection, each applicable Pedestrian Crossing Signal Head should be covered and the existing push-buttons disabled.
- **Closure of Shoulders, Sidewalks, or Bike Lanes**: Provide equal or better facilities to allow safe, efficiently travel through or around the work zone. Take into consideration that two-way, one-lane work zones often provide minimal operational widths for vehicles, and may omit a standard shoulder normally used by bicycles, pedestrians or other road users.
- **Urban/Suburban Intersections**: The project often involves work on all four corners of the intersection. In some urban/suburban environments, viable detours or the location for adequate temporary facilities may be limited. In these cases, additional development efforts should be made to provide for construction easements with additional width that would allow for the construction of a temporary pedestrian facility adjacent to the work area – one that would minimize out-of-direction travel and encourage pedestrian use.
- **Construction Details and Staging Considerations**: TCPs must provide enough detail to allow for the construction of the project, but also accommodate bicycles and pedestrians. For intersection projects, in particular, the TCP must break up intersection work into enough Stages that would minimize out-of-direction pedestrian travel. To meet this goal, one corner of an intersection should be affected at a time.

  Plan sheets developed specifically for pedestrian accommodation should be drafted at a larger scale (e.g. 1"=50') and should include details for intersection curb ramps, closure points, detour routes, surfacing design/designation, and ADA-specific accommodations.

The TCP should include bid items and quantities necessary to implement the details shown in the plans, including

- Temporary surfacing – e.g. cold mix AC, cement-treated base (CTB)
- Materials for temporary sidewalk ramps – e.g. cold mix, drainage pipe, QPL products, etc.
- Channelizing devices – Pedestrian Channelizing Devices (PCD), surface-mounted channelizing devices, QPL products, other ADA-compliant devices, where applicable.

3.3.5 – PEDESTRIAN ACCOMMODATION DESIGN

Work zones can affect a variety of pedestrians in a variety of ways – making the design and accommodation of pedestrians in work zones challenging for TCP Designers.

The principles discussed in the *standards* in the MUTCD, Section 6C, the ODOT/APWA Standard Specifications, and ODOT Standard Drawings address minimal requirements needed to accommodate pedestrians in work zones. Additional technical requirements and details can be found in the 1990 Americans with Disabilities Act (ADA) and the Public Rights-of-Way Accessibility Guidelines (PROWAG).

For site-specific conditions or configurations not addressed by the aforementioned references, the TCP Designer must provide additional design details within the traffic control plan.

When a work zone affects the safety, accessibility or movement of pedestrians, the TCP must provide specific traffic control measures and accessible features to accommodate all pedestrian traffic. Pedestrians require a useable, traversable, clearly defined path through or around a work zone.

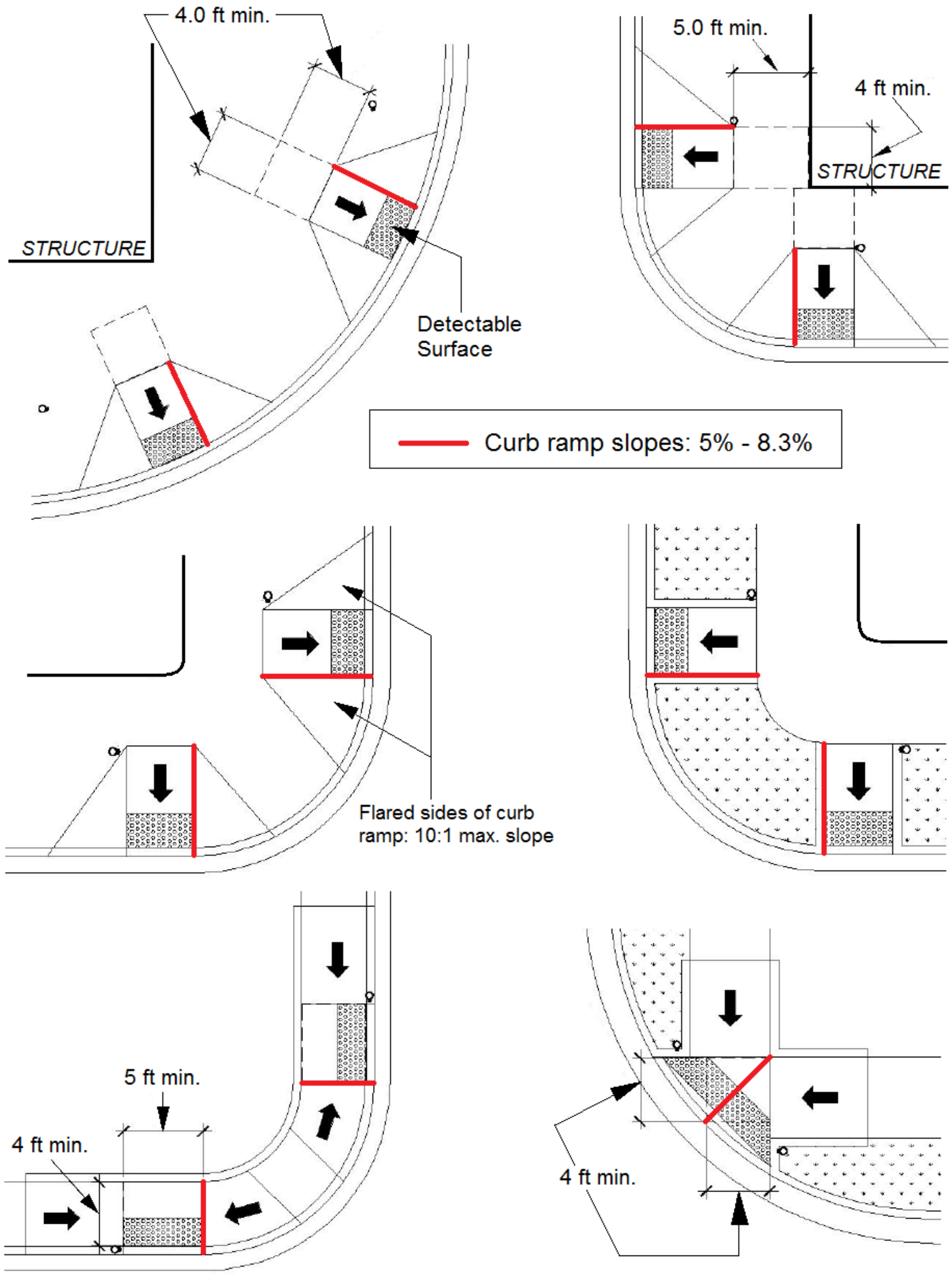
- *Accessible Features* – sidewalk curb ramps, landing pads, transit platform edges, etc.
- *Detectable Warning Features* – textured pavements (e.g. "truncated domes"), curbs around fountains or pools, hazardous vehicular pathway warnings (e.g. bollards), hand railings, etc.

When accommodating pedestrians in highway construction work zones, address the following:

- Do not lead pedestrians into conflicts with public traffic, construction vehicles, equipment, or operations; or, hazardous materials
- Provide a convenient, contiguous and accessible path that equals or exceeds, as practical, the existing pedestrian facilities.
- Investigate the potential presence of visually impaired pedestrians in the work zone and provide appropriate accommodation, as necessary.
- Provide temporary facilities that meet ADA-compliant technical requirements from the PROWAG, Chapter R3 – including the following:
    - 5% - 8.3% slopes for crosswalk curb ramps (see *Figure 3.1*, below)
    - 2% max cross slopes on sidewalks, curb ramps and landings
    - 60-in. sidewalk widths; or, 36-in. widths with 60-in. x 60-in. landings every 200-ft
    - Continuous and detectable surfaces with no vertical drops or edges

- Coordinate with local agencies, as necessary, if alternate pedestrian routes would utilize their facilities. Ensure pedestrian access and TCD placement on their facilities are approved prior to your project being released for advertisement.

CURB RAMP DETAILS – Figure 3.1



PEDESTRIAN CHANNELIZING – SELECTION & PLACEMENT

In cases where pedestrians cannot be removed from the work area using an alternative detour route, it may be necessary for pedestrians to share the roadway environment with either or both live traffic and the construction contractor.

Providing a well-delineated, ADA-compliant pathway will be critical in safely and effectively guiding pedestrians through the work zone. To aid Designers in determining a suitable channelizing device for separating pedestrians from either public traffic or construction work areas, refer to the table below:

PEDESTRIAN CHANNELIZING DEVICE SELECTION TABLE – Table 3.2

POSTED SPEED (mph)	PEDESTRIANS ANTICIPATED		PEDESTRIANS NOT ANTICIPATED [3]	
	Between Traffic & Pedestrians	Between Work Area & Pedestrians	Between Traffic & Pedestrians	Between Work Area & Pedestrians
40 or LESS	[1] Pedestrian Channelizing Devices (PCD)	[1] PCD, chain link fence, concrete barrier	[2] Channelizing devices, PCD	[2] Channelizing devices, PCD, chain link fence, concrete barrier
45 or MORE	Concrete barrier, Pedestrian detours, Separate temp. facility	[1] PCD, chain link fence, concrete barrier	[2] Channelizing devices, PCD	[2] Channelizing devices, PCD, concrete barrier

(1) Assumes pedestrian traffic shares same surface as vehicular traffic. If pedestrian traffic uses a raised, curbed sidewalk, or sidewalk separated from the roadway, PCD is not needed.

(2) Includes cones, tubular markers, plastic drums. Devices should be spaced at 10-ft, maximum. PCD may also be used, but not required. Barrier placement likely based on protection for vehicular traffic. Chain link fence adjacent to high-speed traffic should be avoided.

(3) Where pedestrian facilities do not exist, indications of pedestrian traffic are not visible, and local resources can confirm immeasurable pedestrian volumes.

Table 3.2 should be used as initial guidance in determining appropriate channelizing devices for accommodating pedestrians within a work zone. Suggestions are based on posted speeds and anticipated pedestrian traffic volumes; however, additional factors should be considered and weighed in making a final device selection, including:

- Project Duration – Longer projects can warrant placement and cost of more substantial pedestrian control measures.
- Facility Type & Traffic Volumes – Divided highways, arterials and other high-volume facilities often attract transit services and higher pedestrian volumes; and thus more likely warranting ADA-compliant devices for pedestrian management.
- Availability of Viable Alternate Routes – The length, terrain, costs to provide and access to alternate routes can make on-site pedestrian routes, using PCD, more practical.

- Pedestrian Exposure Risks – In lieu of an off-site pedestrian detour, creating detailed, controlled pedestrian routes can reduce the risk of exposing pedestrians to potentially hazardous situations.
- Constructability Issues – In some cases, construction activities will preclude on-site pedestrian routes, regardless of protective measures. Alternative means of pedestrian transport should be considered and weighed – e.g. public transit, shuttle services, etc.
- Available ROW Widths – As with constructability issues, some locations will not have adequate width to provide safe, effective, ADA-compliant pedestrian facilities. Alternative measures should again be explored.

  In contrast, where pedestrian facilities *could* be accommodated in proximity to the work area, consider including additional width as part of construction easement applications – that, if widened, the additional width could be used for placement of temporary pedestrian facilities.
- Benefit/Cost Ratios – Device quantities vs. Other Measures: While not a primary consideration, costs between measures must be compared and weighed in combination with other issues discussed previously.

DEVICE PLACEMENT

Placement of pedestrian channelizing devices will vary depending on a number of factors, including the location of pedestrians with respect to the hazard(s) – e.g. live traffic, construction activities, work area hazards, etc.

Between Pedestrians and Traffic – Consider using PCD between pedestrians and vehicular traffic when the following conditions apply:

- Pedestrians and motor vehicles must share the same roadway surface. If the existing pedestrian facility is the shoulder (paved/unpaved) of the roadway, and the existing width of the shoulder is unaffected by construction, the use of PCD is optional.
  - If pedestrians travel on a raised, curbed sidewalk; or, a sidewalk separated from the roadway, PCD are optional.
- Pedestrians are routed through a parking lot or similar area where vehicles may not anticipate pedestrian traffic. Pedestrians should be protected using PCD on each side of the pathway exposed to vehicular traffic.
- Schools or other public venues may result in sudden, large volumes of pedestrians in a concentrated area or section of the work zone.

Between Pedestrians and Work Area - Consider using PCD between pedestrians and the construction work area when the following conditions apply:

- Pedestrian traffic must pass along-side the work area. The "work area" may include active or inactive work, the storage of equipment and materials, or empty space for contractor access/staging purposes.
- If work area hazards are present on both sides of the pedestrian pathway, PCD should be placed on both sides of the pathway.
- Schools or other public venues may result in sudden, large volumes of pedestrians in a concentrated area or section of the work zone.

As a general "rule of thumb", pedestrian channelizing devices (PCD) should be placed between pedestrian traffic and any potential hazard from either motor vehicle traffic or construction work areas, as described above.

Contact the ODOT Traffic Control Plans Unit for additional assistance with project-specific PCD applications.

SIGNING

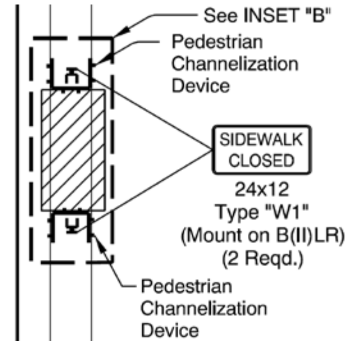
Providing adequate, complete and consistent signing for temporary pedestrian pathways is equally critical in helping ensure effective pedestrian accommodation in a work zone.

Several standard signs are available for use in signing sidewalk closures, instructions for alternate crossing points and/or alternate pedestrian routes. Designers should use the following resources in developing their pedestrian traffic control plan details:

- Standard Highway Signs and Supplement
- MUTCD - Chapters 2 – Signs, and 6 – Temporary Traffic Control
- ODOT Sign Policy & Guidelines

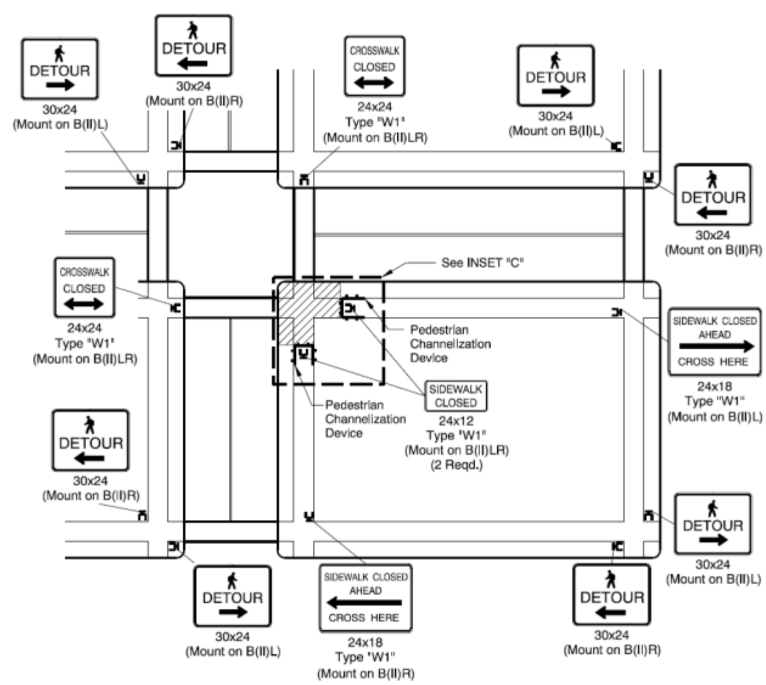
In signing a temporary pedestrian facility, Designers should focus on three important components:

(1) **Closure Points**: Using Pedestrian Channelizing Devices (PCD) is an effective means for keeping pedestrians from venturing beyond the intended point of closure. This is especially crucial where closure points are immediately adjacent to an active work area or a location that would result in significant injury or death for the pedestrian. In severe cases, chain link fencing and other similar strategies may be warranted. See [ODOT Standard Drawing TM844] for examples of Closure Points and signing and devices used at those locations.



(2) **Positive Guidance**: Through signing and devices, an alternative route must be conveyed to pedestrians. Without adequate, clear direction, pedestrians may choose their own route – a route that may lead to serious injury. The use of standard signs, and those displaying regulatory messages is strongly recommended. Warning signs should be used to alert pedestrians of changed conditions, where guidance and services signs reserved for their respective functions. Regulatory signs are predominantly used at closure points and at points where it has been determined safest for pedestrians to travel.

(3) **Continuous Route Signing**: Adequate, clear signing must be continued at reasonable intervals along the *entire* alternate route. "Reminder" signing may be needed at each intersection, or at key turns along the route. In some cases, multiple closure points may be necessary to construct a single, desired alternate route for pedestrians.



3.3.6 – BICYCLE ACCOMMODATION DESIGN

When a highway construction work zone affects the safety, accessibility or movement of bicyclists, the TCP must provide traffic control measures to accommodate bicyclists through or around the work zone.

The principles discussed in the *standards* in the MUTCD, Section 6C; the ODOT/APWA Standard Specifications, and the ODOT Standard Drawings also apply to accommodating bicycles in a work zone. For site-specific conditions or configurations not addressed by the aforementioned references, the TCP Designer may need to provide additional bicycle facility-specific details within the traffic control plan.

If the existing roadway, to be affected by the project, includes a marked bicycle lane or a wide shoulder used by bicycle traffic; or, the highway is a designated bicycling route, bicycling traffic should be provided with a convenient and accessible path that replicates, as nearly as practical, the most desirable characteristics of the existing bicycling route. This may include bicycle pushbuttons, separated bike lanes, and bike detours.

When accommodating bicyclists in highway construction work zones, address the following:

- Do not lead bicyclists into conflicts with public traffic, construction vehicles, equipment, operations; or, hazardous materials
- Provide a convenient, contiguous and traversable path equal to or better than the existing bicycling route. For posted speeds of 40 mph or lower, this route may include sharing the road with motor vehicle traffic.
- Coordinate with local agencies, as necessary, if alternate bicycling routes would utilize their facilities. Ensure bicycle traffic and TCD placement on their facilities are approved prior to your project being released for advertisement.

When separate bicycling facilities or alternate routes are ***not*** viable options, measures should be developed and included in the TCP to alert motor vehicles of the presence of bicycle traffic within or immediately adjacent to live traffic lanes.

SIGNING

Bicycle–specific signing should be used in cases where the following conditions exist during the construction of your project:

- A significant number of bicycles can be expected.*****
- When an existing bicycle facility (e.g. bike lane, multi-use path) is impacted by construction and cyclists must share a traffic lane.

More specifically, include the “Bicycles ON ROADWAY” (CW11-1) sign (see the ODOT Sign Policy & Guidelines, Chapter 6) for the conditions described above, and for locations and situations such as:

“Bicycles ON ROADWAY” (CW11-1)

- Shoulders, bike lanes or sidewalks are closed or removed as part of construction activities
- Rural Areas: Consider cyclist touring routes, larger cycling events (e.g. Cycle Oregon). These locations may not be readily recognizable as a cycling route.
- Designated Bicycle Routes and Scenic Bikeways: Several highways around Oregon carry a significant volume of cyclists year-round – e.g. Oregon Coast Highway (US 101), John Day Highway (US 26), OR99W, Santiam Highway (OR 22), etc. Visit the Oregon Parks and Recreation Department website for additional information.

In addition, include the “Bicycles On Roadway” *Unique Special Provision* language from the Specifications Unit website into your project Special Provisions. The Unique Special Provisions also includes additional information regarding the application and installation of the signs. The CW11-1 sign is suitable for rigid substrates or for roll-up signs.

* Contact local agencies, Chambers of Commerce, and other resources in an effort to determine bicycle traffic numbers. While ***one*** bicyclist is important, however, volumes from 1 to 100 or more per day will warrant different mitigating measures.

NOTE: The Unique Special Provision, “*00220-00225 Emulsified Asphalt Surface Treatment*” (for ‘chip seal’ preservation projects), modifies the “Bicycles on Roadway” Unique Special Provision.

Temporary signing can also be helpful in identifying the location or beginning and ending of a temporary bicycle path or lane. While standard sign designs should be considered first, project-specific sign designs may be necessary. The following are some examples of potential temporary bicycle facility signing.

CHANNELIZING DEVICES

When construction staging creates a situation where a shoulder can be maintained between the live traffic lane and the work area, often the channelizing devices (cones, tubular markers, drums) are placed along the traffic lane to delineate the work area.

However, when bicycle traffic is anticipated through the work zone, placement of these devices can hinder the safe passage of bicyclists – even forcing them to ride on the wrong side of the devices – in the active work area!

Depending on project-specific needs, Designers may need to include additional details making accommodations for this road user clear to contractors and construction administration staff. As the TCP develops, the benefits of generating project-specific plan sheets may become more apparent – particularly in accommodating pedestrians and bicyclists. As shown in the example (below-right), a number of methods can be used to provide this additional detail and clarity.

The use of closely-spaced (5'-10') ***surface-mounted*** tubular markers also provides a bit of an additional deterrent to bicyclists by fixing the devices to the pavement surface and decreasing the spacing.

3.3.7 – CLEAR ZONES IN THE WORK ZONE

The clear zone concept applied to work zones differs from clear zone concepts applied to permanent roadways. Due to the nature of a work zone, the amount of horizontal clearance is often limited. Further, driver awareness is often heightened. As a result, lateral clear zone requirements are generally less. Work zone clear zones do not override the permanent clear zone – meaning existing roadside features should not be removed to meet work zone clear zone requirements. Engineering judgment is regularly used to determine tolerable clear zone widths in work zones. Depending on site restrictions, it may only be feasible to provide an operational clearance – often as little as two feet.

As Designers consider staging needs and opportunities for positive separation between workers and traffic, maximizing lateral clear zones should be explored as a feasible inclusion.

ODOT provides suggested minimum clear zone distances (see *Table 3.3*, below). However, actual clear zone distances should be maximized, where possible. When clear zone distances are critical within a given project or Stage, distances should be identified within the project documents – shown on the plans (e.g. cross sections), or clearly described in the project Special Provisions.

Clear zone determinations should take into account traffic speeds, volumes, roadway geometry, available right of way, and duration of work. Any specific clear zone widths needed for construction should be documented in the project file.

STORED EQUIPMENT & MATERIALS

According to ODOT/APWA Standard Specifications (Section 00220.02), stockpiled materials and inactive construction equipment and vehicles not behind barrier should be stored a minimum of 30 feet from the traveled way for all projects. The work zone clear zone concept applies to exposed hazards in the work zone – exposed barrier ends, stored equipment, drop-offs, fixed objects, etc. For practicality purposes, the work zone clear zone concept does not apply to construction vehicles and materials being used for active construction operations.

DROP OFFS

Drop-offs or abrupt edges are inevitable during some construction activities. Protecting drop-offs with temporary concrete barrier or not within the clear zone depends on the depth of the drop, the proximity to live traffic, speeds, volumes, roadway geometry, and duration of the exposed hazard.

At a minimum, drop-offs within the clear zone should be delineated according to the *Typical Abrupt Edge Delineation* detail shown on ODOT Standard Drawing TM800. Excavations within four feet of the traveled way shall be protected according to Standard Specification 00220.40(d). See the AASHTO Roadside Design Guide for additional information regarding concrete barrier warrants.

SUGGESTED MINIMUM CLEAR ZONE DISTANCE – Table 3.3

Pre-Construction Posted Speed	Minimum Distance (ft)*
35 MPH or less	10
40 MPH	12
45 or 50 MPH	16
55 MPH	20
60 MPH or greater	30

***** Clear zone distances shown are measured from the edge of the nearest live traffic lane to the hazard or obstacle.

CONSTRUCTION VEHICLE CONTRAFLOW

In developing the traffic control plan, the staging of the project should consider construction vehicle access points to the highway, and circulation patterns both within the work area and to/from the work site (e.g. delivering or hauling away construction materials). In implementing the TCP, Agency personnel should monitor contractor operations if contraflow conditions exist on the project site.

Construction vehicles accessing the highway within a closed lane or shoulder should travel in the same direction as adjacent public traffic whenever possible to avoid confusing motorists – particularly at night or during inclement weather. Exceptions are made for compaction rollers, motor graders, bulldozers and other equipment that must move in both directions; and, during two-way, one-lane traffic control (e.g. flagging, temporary signals) where traffic is alternating directions through the work area.

Construction vehicles traveling toward oncoming traffic in a closed lane on the driver's right side – can violate driver expectancy, cause confusion and potentially lead to a crash. When construction vehicles must move against oncoming traffic (e.g. picking up lane closure devices) construction vehicles should normally back up at a controlled speed to avoid confusing traffic and to avoid turning their vehicle around in the work area.

Construction vehicles often travel freely in the opposite direction of traffic when work is taking place:

- Within a wide median area
- On a separate roadway
- Behind concrete barrier or guardrail

MITIGATIONS

When it is not possible or practical for construction vehicles to travel in the same direction as adjacent traffic, construction vehicles may drive within a closed lane in the opposite direction of adjacent traffic if the following criteria are considered and addressed in some manner (e.g. special provision language, plan sheet details, additional TCD pay items):

- Using a barrier system to separate the work area from live traffic
- Limiting work to daytime hours to maximize visibility
- Using overhead work area lighting at night to increase visibility and reduce driver confusion.

  NOTE: Contractors may propose construction vehicles turn off their headlights when driving toward oncoming traffic while within the work area. To legally operate the vehicles at night without headlights, the work area shall be illuminated to a minimum of 2 foot-candles per square foot (**OSHA 1926.600(7)**).
- Limiting the speed of construction vehicles to 20 mph or less (the slower the better)
- Maximizing the separation between live traffic and construction vehicles
- Using larger channelizing devices (e.g. Plastic drums) to separate work area from live traffic
- Reducing channelizing device spacing

- Minimizing dust and flying debris (e.g. Temporary glare screens)
- Using Type "O4" Truck Crossing (W11-10) warning sign or a PCMS to warn traffic about construction vehicles in the work area.
- Temporarily reducing the legal posted speed of the highway. Use the Work Zone Speed Reduction Request Form and seek State Traffic-Roadway Engineer approval before posting a reduced regulatory speed.
- Identifying safe and efficient locations where construction vehicles can turn around without accessing the highway.
- Identifying specific ingress and egress access points to the work area. Designers may incorporate a Portable Traffic Management System (PTMS) into the TCP at the location of each egress site to warn approaching traffic with real-time warning messages of entering vehicles. See *Chapter 2* and *Chapter 3* for more information about *Portable Traffic Management Systems*.

3.3.8 – CROSSOVER DESIGN AND "ON-SITE DIVERSIONS"

A crossover is a construction staging technique used to shift traffic from one side of a divided roadway onto a portion of roadway not under construction – typically sharing the remaining roadway with opposing traffic. A specific type of crossover, known as an "on-site diversion", moves traffic onto a temporary alignment constructed either in the median or adjacent to the original alignment. Crossovers are an effective method for completing construction of a roadway by replacing or repairing the roadway or a structure while maintaining traffic in both directions. A crossover also provides an effective means for providing long-term positive separation between workers and live traffic.

In some cases, based on the results of proper Work Zone Traffic Analysis, the existing capacity of a facility may be reduced to minimize the amount of temporary roadway needed for the on-site diversion and for additional right of way.

Construction of an on-site diversion typically consists of a temporary roadway alignment (possibly construction of a temporary structure, as well). The limits of the on-site diversion extend from the initial reversing curve (Curve 1, see *Figure 3.2* below) leaving the existing roadway to the final reversing curve tying the alignment back into the existing roadway (Curve 4).

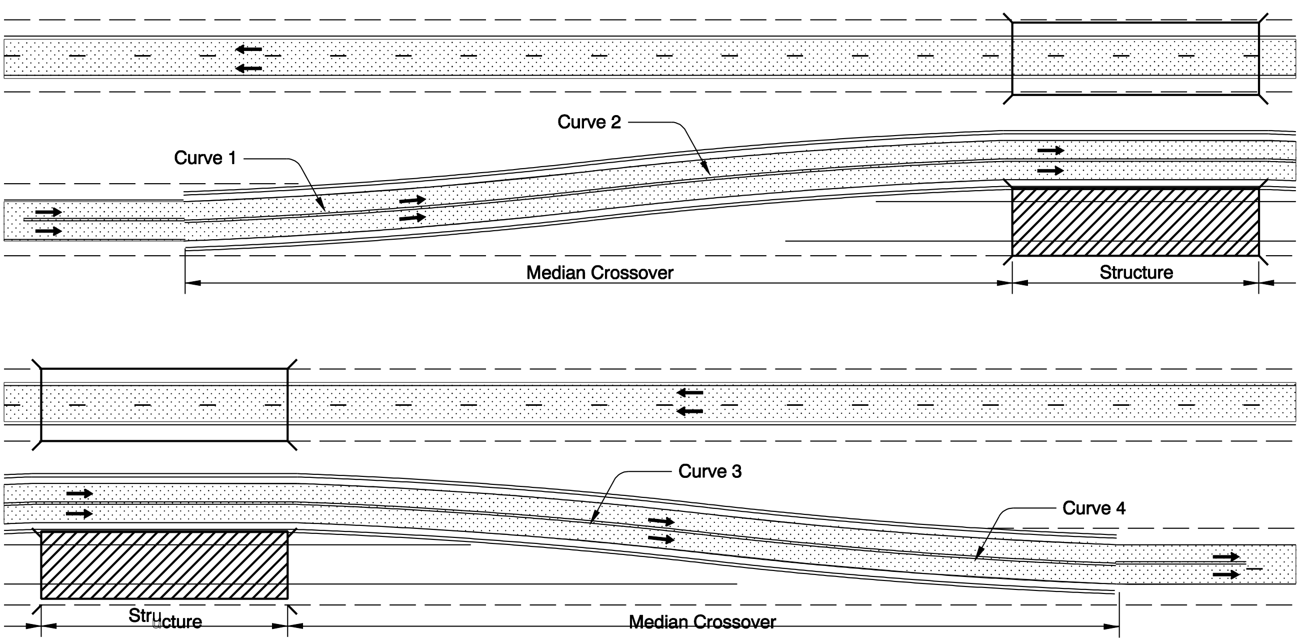


Figure 3.2

On-site diversions are typically used on freeways, but may be used on divided highways with limited at-grade accesses. Lane closures and traffic shifts are typically used on multi-lane non-freeways with two-way continuous left-turn medians, but diversions are an option for long-term stationary work.

An engineered alignment and cross-sections should be developed for the crossover. Temporary crossover alignments do not need to incorporate spirals, spiral segments or partial spirals.

However, spiraled curves should be considered when the existing alignment is located on a curve. TCP Designers should provide at least one cross-section taken somewhere along the crossover alignment and show this on the TCP plan sheets, see *Figure 3.3*.

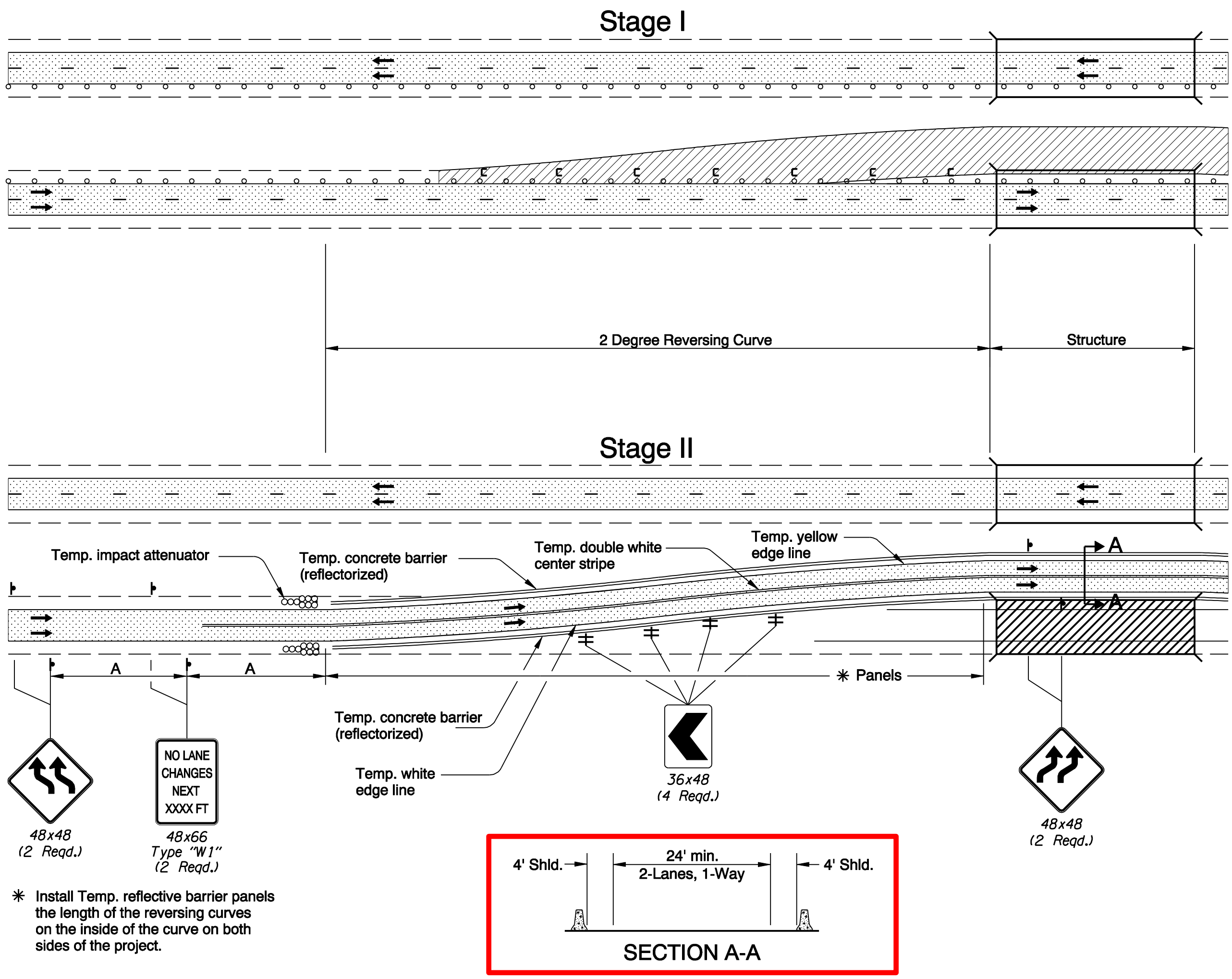


Figure 3.3

CROSSOVER DESIGN

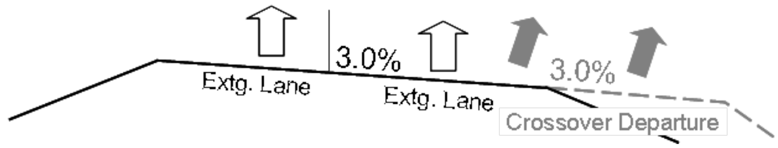
In determining the radius of curvature for crossover alignments, the Designer should begin with the *Comfort Speed* table (*Table 3.4, below*). For radii of Curves 1 and 4 (Figure 3.3a), use the existing mainline superelevation rate in the lane adjacent to the crossover departure and return points. It is not practical to build temporary pavement on mainline to develop superelevation for the crossover departure and return curves. Therefore, Designers should attempt to use curves based on the superelevation rate of mainline at these points.

Example 1: Given: Pre-construction posted speed = 65 mph. Mainline super = normal 2.0% crown at centerline.

If crossover is built in the median, as shown, from *Table 3.4*, the minimum radius for Curves 1 and 4 would be **2292 ft.** ($2^0$30') = 66 mph Comfort Speed at 2.0% superelevation.

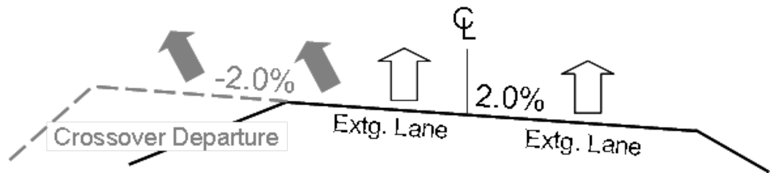
Example 2: Given: Pre-construction posted speed = 55 mph. Mainline super = 3.0%.

If crossover is built off the right shoulder, from *Table 3.4 (below)*, the minimum radius for Curves 1 and 4 would be **1273 ft.** ($4^0$30') = 55 mph Comfort Speed at 3.0% superelevation.



Example 3: Given: Pre-construction posted speed = 60 mph. Mainline super = 2.0%.

If crossover is built in the median, as shown, from *Table 3.4 (below)*, the minimum radius for Curves 1 and 4 would be **2546 ft.** ($2^0$15') = 61 mph Comfort Speed at -2.0%***** superelevation.



* Because traffic is travelling counter to (across) the +2% superelevation, the effect is similar to a driver traversing a -2.0% adverse superelevation.

CROSSOVER DESIGN CONSIDERATIONS

- Where physical space within the work area allows, Designers should select flatter curves in the design of the crossover.
- For driver comfort and ease of negotiating the crossover, Designers should attempt to match the radii of all four curves in the diversion alignment. Be particularly aware of the volume of truck traffic expected to use the alignment. Large trucks are especially sensitive to sharp reversing curves and adverse superelevation rates.
- If existing mainline superelevation rates exceed 5.0%, or radius of curvature exceeds 12^0, see the *ODOT Highway Design Manual* (HDM), *Table 3-5*.
- The use of spirals, spiral segments or partial spirals may be necessary to transition from the existing mainline alignment to the temporary crossover alignment.
- If Crossover departures and return points are in close proximity to existing entrance or exit ramps, include details on plan sheets showing placement of channelizing devices (typically, plastic drums) mimicking acceleration lanes or exit gores, as necessary.
- Include minimum acceleration lane lengths and a terminal taper for Entrance ramps.
- If Exit ramps are too close to the return point of a crossover, closing the Exit ramp and diverting traffic to the next exit is recommended. Include as appropriate detour route(s) and all necessary signing for the ramp closures.
    - Diverting traffic to an earlier exit is also acceptable, but can surprise drivers. Include additional advance warning signs (e.g. PCMS) if using earlier exits for the detour.

COMFORT SPEED										
CURVE		SUPERELEVATION								
DEG	Rad (Ft)	-2.0%	0.00	+ 2.0%	+2.5%	+3.0%	+3.5%	+4.0%	+4.5%	+5.0%
01° 00'	5729.58	76	81	86	87	88	90	91		
01° 15'	4583.66	72	76	81	82	83	84	86	87	88
01° 30'	3819.72	68	73	77	78	79	80	81	82	83
01° 45'	3274.05	65	770	74	75	76	77	78	78	79
02° 00'	2864.79	63	67	71	72	72	73	74	75	76
02° 15'	2546.48	61	64	68	69	70	71	72	72	73
02° 30'	2291.83	59	62	66	67	67	68	69	70	71
02° 45'	2083.48	57	60	64	64	65	66	67	68	68
03° 00'	1909.86	55	59	62	63	63	64	65	66	66
03° 15'	1762.95	54	57	60	61	62	62	63	64	65
03° 30'	1637.02	52	56	59	59	60	61	61	62	63
03° 45'	1527.89	51	54	57	58	59	59	60	61	61
04° 00'	1432.40	50	53	56	56	57	58	58	59	60
04° 30'	1273.24	48	51	53	54	55	55	56	57	57
05° 00'	1145.92	46	49	51	52	53	53	54	54	55
05° 30'	1041.74	45	47	50	50	51	51	52	52	53
06° 00'	954.93	43	46	48	48	49	50	50	51	51
06° 30'	881.47	42	44	46	47	47	48	49	49	50
07° 00'	818.51	41	43	45	46	46	47	47	48	48
07° 30'	763.94	40	42	44	44	45	45	46	46	47
08° 00'	716.20	39	41	43	43	44	44	45	45	46
08° 30'	674.07	38	40	42	42	43	43	44	44	44
09° 00'	636.62	37	39	41	41	42	42	43	43	43
09° 30'	603.11	36	38	40	40	41	41	42	42	42
10° 00'	572.96	36	37	39	39	40	40	41	41	42
10° 30'	545.67	35	37	38	39	39	39	40	40	41
11° 00'	520.87	35	36	38	38	38	39	39	40	40
11° 30'	498.22	34	36	37	37	38	38	39	39	39
12° 00'	477.47	34	35	36	37	37	38	38	38	39

COMFORT SPEED – Table 3.4

CROSSOVER WIDTHS

- Use 4-ft shoulder widths in multilane crossovers if existing mainline shoulder widths cannot be accommodated.
- For design purposes, provide horizontal widths between positive barriers (concrete barrier, guardrail or other rigid barrier) through crossovers from *Table 3.5*, below.

DAYLIGHT	**SINGLE LANE** (ft.)	**TWO LANE** (ft.)
Interstate/Multi-lane	19	28
Other 2-lane NHS Route	16	28

CROSSOVER WIDTHS – Table 3.5

If narrower crossover widths are needed on a State highway, contact the appropriate ODOT Region Mobility Liaison and Motor Carrier Transportation Division (MCTD) to discuss design and mitigation options.

See the “Freight Mobility Daylight Width” and “Freight Mobility Nighttime Width” maps from the ODOT Motor Carrier Transportation Division (MCTD) website for additional route and freight restriction information.

OTHER CROSSOVER DESIGN CONSIDERATIONS

- Consider filing for a temporary Speed Zone Reduction Order for crossovers. Approval of the reduction is not guaranteed. The approval will be based on site conditions during staging and the scope of work. See the Temporary Speed Zone Reduction section in this manual for additional information.
- Add appropriate Advisory Speed (W13-1) riders below advance Reverse Curve (W1-4), Two Lane Reverse Curve (W1-4b) and Three Lane Reverse Curve (W1-4c) symbol signs to indicate advisory speeds through the crossover curves.
- Issuance of a Temporary Speed Zone Reduction does NOT warrant a reduction in the TCP Design Speed. See the “DESIGN SPEED” section below.
- Consider drainage issues for crossovers. Flat crossovers or crossovers using concrete barrier on both sides can generate areas of standing water resulting in the chance of vehicles hydroplaning. If using concrete barrier, the TCP should indicate barrier with “scuppers” to facilitate drainage of surface water.
- Disallowing lane changes through a crossover can be advantageous in controlling speeds and complex movements within the crossover. To preclude lane changes, on the plan sheets, include appropriate signing and identify a 4” double, solid white stripe along the centerline of multi-lane crossovers.

  Appropriate signage can include:

  - Use “NO LANE CHANGES NEXT XXXX FEET” (OR22-16), or “STAY IN LANE” (R4-9) signs with Type “O4” “XX FT” (W16-2aP) plaque for crossover distances less than 1500 feet.
  - Use “NO LANE CHANGES NEXT 1/X MILE” (OR22-17), or “STAY IN LANE” (R4-9) signs with Type “O4” “XX MILES” (W16-3aP) plaque for crossover distances of 1/4 mile or greater. Use distances in 1/4 mile increments.
  - Sign use should be consistent throughout the project, do not mix and match the “STAY IN LANE” and “NO LANE CHANGES” signs.

    Start double solid white striping at the first regulatory sign (e.g. “NO LANE CHANGES…”), and stop the double solid white striping at the end of the specified distance.

3.3.9 – DESIGN SPEED

The ***Pre-construction Posted Speed <u>shall</u> be used as the "Design Speed"*** for the following alignments and applications within the design of a temporary traffic control plan, unless otherwise indicated in this manual:

- Temporary roadway alignments, crossovers and on-site diversions
- Spacing between signs and traffic control devices
- Temporary impact attenuator selection
- Taper lengths for lane shifts, lane and shoulder closures
- Temporary sign letter heights

The "***Design Speed***" of a temporary alignment should not be below the pre-construction posted speed unless site conditions demand a reduced design. Designers should consult with their Engineer of Record before reducing the design speed. ODOT designers should discuss reduced designs with their Engineer of Record and the Construction Project Manager.

Through a signed Temporary Speed Zone Reduction Order, the regulatory ***posted*** speed through a work zone may be reduced (Typically 10 mph for a freeway. And, up to 20 mph (in two – 10 mph steps) for an urban, 2-lane non-freeway.

A Temporary Speed Zone Reduction will *<u>not warrant or result in a reduction in the Design Speed</u>*.

3.3.10 – DETOURS

A traffic detour can be a very effective traffic control measure within a TCP. By closing the road to live traffic, positive protection for workers is maximized. Detours can also allow for improved finished products as contractors can work in a single work space without the need to construction the project in multiple smaller pieces. Consider developing a detour for the project under the following conditions:

- The physical work area cannot support live traffic and construction activities concurrently.
- When the accelerated completion of a project is desired, having uninterrupted use of the entire work site can facilitate a time-critical schedule.
- Construction constraints (e.g. vehicle weight or size restrictions) require specific vehicle classes to be precluded from the work zone.

Effective detour designs must consider, address and incorporate the following:

- Detour routes must accommodate height, width, weight, length, off-tracking and other physical characteristics of the design vehicle – the largest vehicle expected to use the detour.
- Appropriate and adequate detour signing for the entire route in both directions. Roundabout detour signs should use a curved stem arrow in accordance with the MUTCD.
- For conditional or periodic detours, using multiple PCMS can provide real-time advance warnings or notifications. Include additional emphasis in the TCP – see 2015 Standard Specifications, Section 00225.41(e) – for the contractor to cover inappropriate signing and change PCMS messages as detour conditions change.

- Confirm agreements with local cities, businesses and residences regarding the proposed detour route(s) – including any mitigation strategies or limitations.
- Early coordination and approval with the ODOT Motor Carrier Transportation Division (MCTD) as to the proposed detour route(s).

TCP Designers should be prepared to respond to local agency requests to mitigate impacts the detour may have on their community. They may ask for additional signing, channelization, or other TCD to enhance guidance of vehicles through their area (e.g. "BUSINESS ACCESS" signs, blue tubular markers, other temporary guide, warning or service signs).

3.3.11 – DEVICE SPACING

The placement of temporary traffic control devices (signs, channelizing devices, pavement markings) is critical to allowing drivers to see, read, interpret and react to the devices.

Devices too closely spaced can be confusing and make it difficult to process all of the information. Devices too far apart – particularly channelizing devices – can confuse drivers as to where they are supposed to drive, and what hazards they should avoid.

Drivers may forget individual messages if signs are spaced too far apart. Proper spacing helps maintain the context and integrity of messages, warnings or guidance signs and devices provide.

Proper spacing for channelizing devices and temporary signing is provided in the ODOT Temporary Traffic Control Standard Drawings. The, "*Traffic Control Devices (TCD) Spacing Table*" on Standard Drawing TM800 shows the standard spacing for both low-speed and high-speed work zone conditions.

REDUCED SPACING

Channelizing device spacing around radii at intersections, business accesses, driveways or other locations where additional emphasis is desired may be reduced to 10 feet. See ODOT Standard Drawing TM800 for details.

Reduced spacing may also be used on low-speed facilities (30 mph or less). If done, include additional language in the project Special Provisions, or show the reduced spacing on plan sheets to reinforce this preference.

INCREASED SPACING

Increases to device spacing can also be made based on construction needs for specific operations or work tasks. For example, during freeway paving operations – where traffic speeds can be higher – allowing construction material delivery vehicles (e.g. AC or PCC dump trucks) to exit the traffic stream at higher speeds can be beneficial in control excessive speed differentials and surprising traffic with sudden slowing in the live traffic lane. To allow these vehicles to exit the lane at a higher speed, the channelizing devices are placed further apart. TM880 shows these devices at a spacing of 80 feet (normally 40 feet) in the area where these vehicles would be entering the work zone to deliver construction materials.

SPECIAL PROVISIONS

Some device spacing is addressed in the Standard Specifications or Special Provision 'Boilerplate' and is reserved for specific types of work or devices. Spacing requirements described in the Special Provisions supersede spacing requirements shown on the Standard Drawing "TCD Spacing Table"*****.

* See Section 00150.10(a) of the ODOT/APWA Standard Specifications for Construction for information regarding the Order of Precedence for TCP documents and drawings.

3.3.12 – "DO NOT PASS" SIGNING

Through interpretation of Chapters 2B and 3B of the MUTCD, ODOT requires the installation of "DO NOT PASS" and "PASS WITH CARE" signs at the respective limits of existing 'No Passing' zones anytime work obliterates centerline pavement markings.

Additional requirements are included in the following Unique Special Provisions used for pavement preservation projects on State highways:

- "00225 – MHMAC and HMAC Preservation Projects"
- "00220-00225 – CIR and EAC"
- "00220-00225 – Emulsified Asphalt Surface Treatment" (or, "chip seal" projects)

For long preservation projects with low volumes, primarily "chip seal" projects, see the Unique Special Provision, "00225 – Combined No Passing Zones", used to minimize the number of "DO NOT PASS" signs. This Unique Special Provision is most applicable on projects meeting the following criteria:

- ADT < 1000
- Project Length is > 10 miles
- Unless engineering judgment determines the need for additional signs

'No Passing' zones less than 1/4 mile apart can be combined into a single, continuous 'No Passing' zone. See the above Unique Special Provision for sign placement details.

3.3.13 – FLAGGING

Flaggers are used to control the flow of traffic in and around the work zone. Flaggers are used on a wide variety of roadway classifications including local, low-volume highways to high-volume, urban arterials. Flaggers should not be used on freeway projects. A flagger is useful for the following activities:

- Controlling traffic flow on two-way, one-lane sections of roadway
- Stopping traffic to allow construction vehicles to enter or exit the roadway
- Slowing traffic immediately adjacent to workers and active construction equipment
- Directing traffic through an intersection under construction (If signalized, signal must be off while flagging)

PAY ITEM QUANTITIES

Flaggers are included in the contract as the pay item, "Flagger Hours". "Flagger Hours" can be calculated based on the scope of work, and by discussing needed quantities with a Project Manager, ODOT Region Design staff, or the ODOT Cost Estimating Unit in Salem.

To determine flagger hours, first examine the construction schedule. Determine the activities that normally require flaggers. Approximate how long it will take to complete each of those activities – typically in terms of weeks, days or work shifts. Convert those durations all to 'hours'. Next, determine the number of flaggers required for each of those activities.

Multiplying out each activity with the number of flaggers needed:

$$(D_1 \text{ x } F_1) + (D_2 \text{ x } F_2) + (D_3 \text{ x } F_3) + (D_n \text{ x } F_n) = \text{Total Flagger Hours}$$

Where: D = Duration of the Activity (hours); F = Number of Flaggers needed for the Activity

It is important to have a reasonable construction schedule and to know production rates for differing activities. Standard Construction Production Rates can be found on the Office of Project Letting Publications website. Flagging Hours should be as accurate as practical. Avoid over-estimating Flagger Hours, or adding arbitrary 'margins of error'.

FLAGGING PRINCIPLES

While Flaggers are certified and their day-to-day performance is not the responsibility of the TCP Designer, several basic Flagging principles can have a significant impact on the development of the Traffic Control Plan and Designers should be aware of them.

FLAGGING on MULTI-LANE ROADWAYS

Flaggers are allowed to **control only <u>one</u> lane of traffic at a time**. A single flagger should not be controlling two approaching lanes in the same direction simultaneously. In multilane sections, one approach lane must be closed before reaching the Flagging sign sequence.

> **Example:** See the ODOT Temporary Traffic Control Standard Drawing for Blasting Zones, TM871. The "4-LANE, 2-WAY ROADWAY" detail in this drawing shows a lane closure in advance of the Flagging sign sequence. This technique should be applied to any multilane facility approaching a flagging operation.

If a project requires flagging on a multi-lane roadway, include additional temporary signing and channelizing device quantities for the lane closure(s).

FLAGGING at INTERSECTIONS

When flagging intersections, one flagger should be used for each leg of the intersection where total approach volumes exceed 400 ADT for the intersection.

> **Example:** Four-leg intersection with ADT of 750 vehicles requires four flaggers.

See the "*2-LANE, 2-WAY, ONE LANE CLOSURE*" detail on ODOT Temporary Traffic Control Standard Drawing TM841 for an example of a flagging operation in an intersection.

In the case of flagging a multilane approach, place the lane closure well in advance of the flagging operation to allow traffic to safely merge and then refocus their attention on the approaching flagging operation.

FLAGGING at SIGNALIZED INTERSECTIONS

When flagging a signalized intersection, the signal ***must be turned <u>off</u>***, unless flagged by uniformed police officer(s). Refer to the ODOT Temporary Traffic Control Standard Drawings for details regarding work in signalized intersections.

When flagging in signalized intersections, lane shifts, closures and all appropriate traffic control devices and signing should be moved away from the intersection as far as practical to allow for the placement of required Flagger signing and the Flagger station.

FLAGGING at UNSIGNALIZED INTERSECTIONS

When flagging a stop-controlled intersection, the existing "*STOP*" signs must be covered according to ***ORS 811.260*** and ***811.265***. Refer to the ODOT Temporary Traffic Control Standard Drawings for details regarding work in an un-signalized intersection.

FLAGGING on FREEWAYS

ODOT Highway Construction contracts should not include or show Flaggers being used to control traffic on a freeway. It is not recommended to use Flaggers to slow traffic on a freeway due to the potential to create adverse differences in approach speeds into the work area, potentially increasing the risk of rear-end crashes.

For small, isolated work activities (e.g. PCC pavement or bridge joint repairs), an effective alternative is to include a Truck Mounted Attenuator (TMA) in the TCP that the contractor may place (as per manufacturer specifications) in advance of the work area.

Contractors may want to use a Flagger to "SLOW" approaching traffic during material delivery or hauling operations. This is at the discretion of the contractor, but ODOT no longer considers this a safe practice. In addition to the reasons mentioned above, a Flagger can be substituted with a PCMS on a work vehicle displaying more informative messages, such as:

SLOWED	RIGHT (LEFT)	WORKERS	WORK
TRAFFIC	LANE	IN RIGHT (LEFT)	VEHICLES
1/2 MILE	SLOWED	LANE	AHEAD

SIDE ROADS WITHIN the WORK ZONE

For lengthy preservation (paving) projects, where two-way, one-lane traffic is controlled by Flaggers and Pilot Cars, include a Flagger and appropriate signing for each intersecting side road within the limits of the ***active work area*** – ***not*** the project limits. Because of the mobile nature of preservation projects, as the work progresses, Flaggers (and some signing) can be moved along with the activity.

Again, it is important for the Designer to understand the productivity limits based on the scope of work. How far the contractor can pave in a day (or work shift) will determine how many side roads will be impacted by the work activity and how many Flaggers are needed in the TCP.

Additional Flaggers may be required at high-volume accesses (i.e. shopping or recreational centers, residential neighborhoods, campgrounds, or other high-volume generators). Advance Flaggers may also be needed depending on volumes, roadway geometries, etc.

Low-volume, dead-end roads or private accesses within the work area should be addressed on a project-by-project basis given the function of the road and services it feeds.

Individual private residences along the highway within the work area can be personally contacted and informed of the process for entering and exiting their property. Work closely with the Construction Project Manager's office to determine the extent of parties affected by construction and determine if additional mitigations in the TCP are needed.

3.3.14 – FLAGGING – ADVANCE FLAGGERS FOR EXTENDED TRAFFIC QUEUES

When traffic volumes increase unexpectedly and traffic queues cannot readily dissipate ("residual queues") while traffic is under a two-lane, one-way operation (i.e. flagging), extended traffic queues will likely develop.

Take into consideration the likelihood of residual queuing in developing the traffic control plan and determining other TCM to include. Depending on the approach volumes and the potential for residual queues, adjustments may be necessary in the 'Lane Restriction' portion of the project Special Provisions (Section 00220.40(e)) to further limit the hours the contractor can close lanes and avoid this condition.

In anticipation of extended queuing, refer to the "*EXTENDED TRAFFIC QUEUES FOR ADVANCE FLAGGING*" detail in the ODOT Temporary Traffic Control Standard Drawings to determine quantities for the additional devices. The detail describes:

- Placement details for additional signing and devices
- Conditions when additional devices and Advance Flagger are needed

During construction, field personnel should implement this measure under the following conditions:

- Traffic queues extending beyond the initial advance warning sign (e.g. "ROAD WORK AHEAD")
- Sight distance from the back of the stopped queue to the next approaching vehicle is less than 675 feet

In calculating quantities for, "Flagger Hours", consider including additional hours for Advance Flaggers. In the cost estimate, "Flagger" and "Advance Flagger" hours should be combined into the single "Flagger Hours" pay item.

3.3.15 – FLAGGING – FLAGGER / PILOT CAR OPERATIONS

Pilot Cars may be used in conjunction with flaggers in the TCP to guide platoons of vehicles through lengthy two-way, one-lane work areas. Pilot cars are an effective traffic control measure for a variety of work types – paving operations, longitudinal excavations, shoulder work, striping operations, night work, complex temporary alignments, etc.

Pilot Cars are typically included in the TCP when:

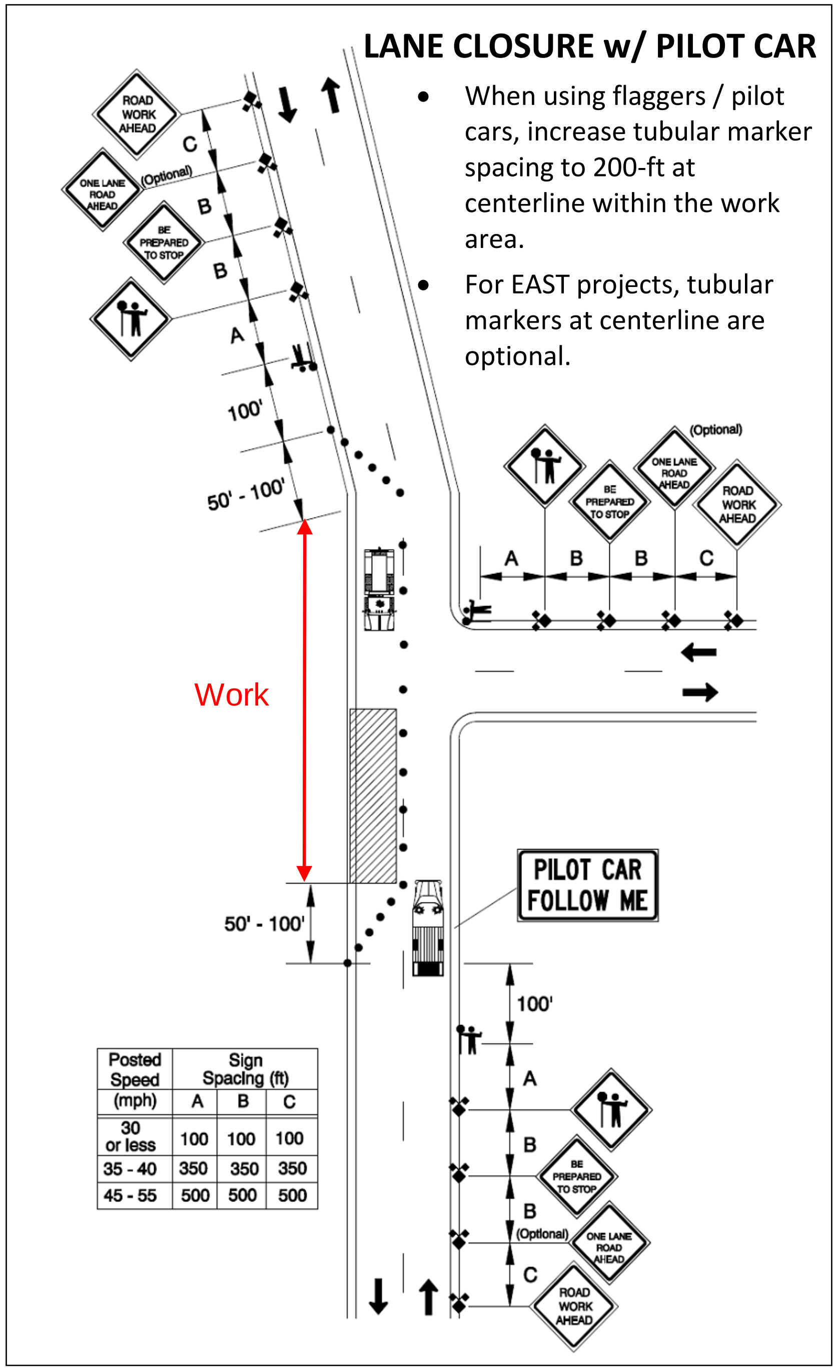
- Lane closures exceed 1/2 mi. and sight distance between Flagger Stations obscured by:
  - Roadway topography/ geometry – horizontal/ vertical curvature, foliage
  - Geography – terrain limiting communication (radios, cell coverage, etc.)
- Workers immediately adjacent to high-speed traffic, not separated by barrier system
- Multiple isolated activities occurring within a single, longer work area.

Pilot car operations often limited to a maximum length based on:

- Operating speed: 25 - 35 mph
- Holding traffic for 20 minutes, max. at each end of work area
- Number of intersections and accesses, which can affect pilot car efficiency

Pilot Cars are measured and paid for by the hour. Like Flagger hours, Pilot Car hours should be carefully calculated by the Designer.

The diagram demonstrates the set-up for a Flagger/Pilot car operation. The “ONE LANE ROAD AHEAD” sign may be used to provide additional work zone information, but is optional.



Posted Speed (mph)	Sign Spacing (ft) A	B	C
30 or less	100	100	100
35 - 40	350	350	350
45 - 55	500	500	500

Figure 3.4

WAIT FOR PILOT CAR Signing

The WAIT FOR PILOT CAR (CR4-20) sign was developed to be used on very low-volume, dead end side roads within an active work zone to replace the need for a Flagger. In addition to low volumes (< 100 ADT), the side road must meet the following additional criteria:

- Access or side road traffic is being stopped for no more than 20 minutes (per Section 00220 of the Oregon Standard Specifications for Construction, and Chapter 3 of the Oregon Temporary Traffic Control Handbook).
- Access or side road is a dead-end facility or has no immediate alternate access, and:
- Does not access public service facilities (e.g. parks, rest stops, waysides, ranger stations, landfills, utility hubs, treatment plants, etc.).

Per the “00225 – Wait For Pilot Car” Unique Special Provision, during construction, intersections using the WAIT FOR PILOT CAR sign are to be checked regularly each hour to ensure safe and effective traffic operations. If operational issues are observed at these or other locations using the WAIT FOR PILOT CAR sign, the sign shall be replaced by a Flagger.

For private residential driveways, a smaller 12”x 12” WAIT FOR PILOT CAR (CR4-20a) sign may be installed and face the residence (not visible to public traffic). The intent of this sign is to avoid the need for a Flagger at each individual private driveway within the active work area.

Complete details are included in *Chapter 6* of the *ODOT Sign Policy and Guidelines*.

3.3.16 – FREEWAY CLOSURES (SHORT TERM)

Occasionally, it may be necessary to temporarily close one or both directions of a freeway or access-controlled facility to complete work directly over the lanes of the highway. If a Rolling Slowdown (see *Rolling Slowdown Method (RSM),* below) cannot be used due to the 20-minute time limitation for that measure, a temporary, short-term closure may be necessary.

NOTE: Due to the significant impact this traffic control measure has on traffic capacity and mobility, a directional or full closure may only be limited to times when the lowest volumes occur – typically in the late evening or very early morning hours. Work Zone Traffic Analysis can be used to determine the acceptable hours for the closure. Include this information in the project Special Provisions under ***Section 0022.40(g) – Road Closure***.

The directional or full closure requires additional temporary signing and channelizing, as well as a detour plan. The detour plan can utilize either:

- The existing ramps of the interchange under construction, or a combination of adjacent interchanges to bypass the work site
- An alternate route if interchange configurations are not conducive as a detour route

In either case, an extensive combination of traffic control measures must accompany the detour plan. For multilane facilities incorporate the following measures:

1) Include one or more PCMS in advance of the initial advance warning signage.
   Suggested PCMS messages include:

FREEWAY	ALL	FREEWAY	TRAFFIC	FOLLOW
CLOSED	TRAFFIC	CLOSED	MUST USE	DETOUR
X MILES	EXIT FWY	1 MILE	EXIT XXX	EXIT XXX

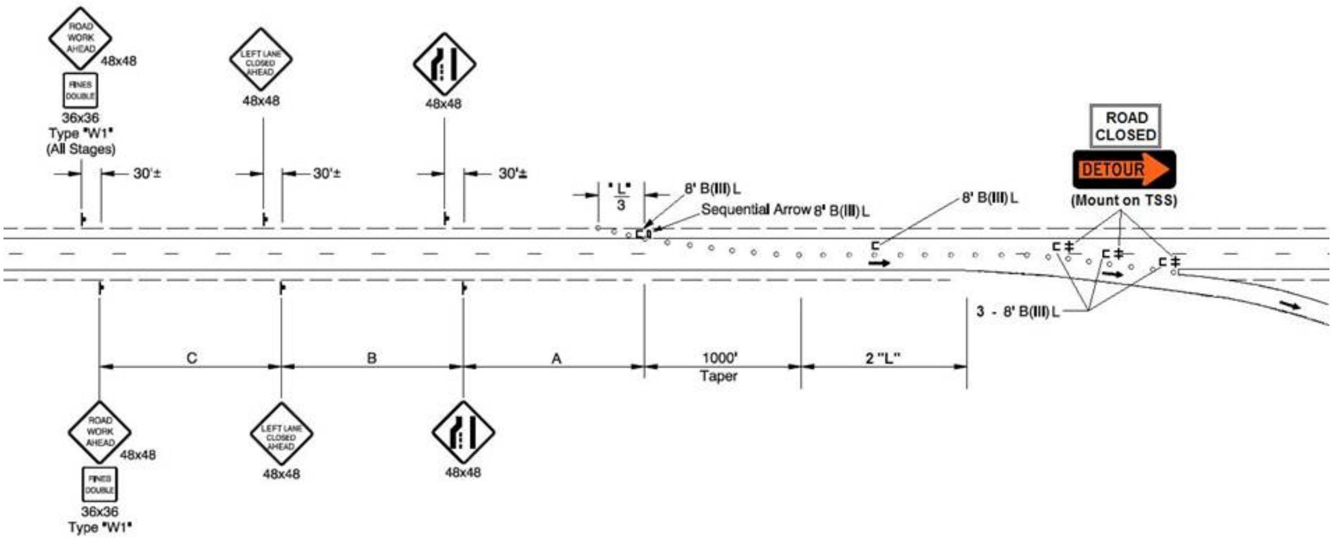
   Use PCMS to alert drivers of the approaching closure and to provide advance notification of what actions must be taken and where traffic must go.

2) Close all but one traffic lane. If possible, leave the right lane open to better facilitate exiting traffic off the freeway.

3) Include all necessary signing, channelizing and Sequential Arrows needed to direct drivers into the open lane. See the ODOT Traffic Control Plan Standard Drawings for additional information relating to a single-lane freeway closure.

   NOTE: If closing more than one lane, include one Sequential Arrow for each lane being closed. See the ODOT Traffic Control Plan Standard Drawings for additional information relating to a multi-lane closure.

4) Include an adequate number of devices and signing at the point of the closure to clearly indicate the roadway is closed and to direct traffic to the exit ramp or detour starting point (see *Figure 3.5*, below).



Freeway Closure – Figure 3.5

5) As shown in *Figure 3.5*, include a sufficient distance between one activity and the next for drivers. In this case, a distance of **2** "**L**" is shown between the end of the Lane Closure taper and the beginning of the exit ramp channelization.

6) If using interchange ramps for your detour, consider additional arrangements at ramp terminals to control traffic and give priority to exiting freeway traffic volumes - Traffic signals may need reprogramming, Flaggers may be needed, lanes on the crossroad may need to be closed for flagging operations, etc.

NOTES:

- Alternate routes must accommodate the Design Vehicle for the facility being closed – typically, a large, multiple-axle truck (e.g. WB-67).
- If a non-State facility is used for the detour, ensure that an inter-governmental agreement (IGA), or other official agreement, is in place prior to specifying the local facility in the TCP. Work with your Project Leader to coordinate these arrangements.

3.3.17 – HORIZONTAL AND VERTICAL DESIGN POLICY

Two key aspects in effective TCP design are providing sufficient horizontal roadway widths and adequate vertical clearances. As part of ODOT's focus on statewide mobility through highway work zones, freight industry needs - particularly oversized vehicles on the State highway system – must be considered and addressed.

Designers are responsible for indicating and mitigating all temporary widths and heights in the TCP, as well as including all relevant Special Provision language directing the contractor to implement these mitigations.

In the ODOT Mobility Procedures Manual, meeting the standards within *Chapter 4 – Temporary Conditions* and *Chapter 5 – Notification Requirements*, are required on all ODOT contracts. Current specifications require **35 days** of notification for any height, weight, width, or other restriction. Horizontal and vertical dimension deviations below the minimums given in the *Mobility Procedures*

Manual, or the *TCP Design Manual*, are subject to the approval of the applicable ODOT Region Mobility Liaison, and concurrence with the Motor Carrier Transportation Division (MCTD). If reductions in any of the above dimensions are necessary:

- Contact the ODOT Region Mobility Liaison; and,
- Communicate these changes to the MCTD. MCTD should especially be made aware of the construction staging plan and the approximate timing and anticipated duration for the reduced widths.

HORIZONTAL DESIGN

Use the Highway Mobility Procedures Manual and the following dimensions to develop the TCP:

The following dimensions assume **all** vehicle classifications are allowed on the roadway. Over-dimensional vehicles are not being diverted to an alternate route.

The total horizontal dimensions shown in *Table 3.6* below are ***minimums***. Designers should make efforts to increase these dimensions, where practical. For consistency with MCTD policies, dimensions shown are separated into Daylight and Nighttime hours. Daytime hours are defined as those times between, "1/2 hour before sunrise and 1/2 hour after sunset."

DAYLIGHT	**SINGLE LANE** (ft.)	**TWO LANES** (ft.)
Interstate/Multilane	19	28
Other 2 lane NHS Route	16	28

NIGHTTIME	**SINGLE LANE** (ft.)	**TWO LANES** (ft.)
Interstate/Multilane	16	28
Other 2 lane NHS Route	14	28

Minimum Horizontal Design Widths – Table 3.6

The majority of projects will use the Daylight horizontal widths listed in *Table 3.6*. As such, the following table can help in dividing horizontal widths into traffic lane and shoulder widths:

HORIZONTAL WIDTHS	**SINGLE LANE**		**TWO LANES**	
	LANE (ft.)	**SHOULDERS** (ft.)	**LANES** (ft.)	**SHOULDERS** (ft.)
Interstate/Multilane	12	3.5	12	2
Other 2 lane NHS Route	12	2	12	2

Lane & Shoulder Widths – Table 3.7

ADDITIONAL DESIGN CONSIDERATIONS: Consider the following in attempting to optimize safety, construction efficiency and traffic operations through the work zone:

- Depending on staging needs, but without falling below minimums shown in *Table 3.6*, lane and shoulder widths can be adjusted to favor construction requirements or traffic operations.
- If reduced horizontal widths are granted by MCTD/ODOT Region Mobility Liaison, lane widths should be reduced first, followed by shoulder width reductions, as follows:

- Interstate Recommended Min. Widths: Lanes = 11 ft.; Shoulders = 1 ft.
- Non-Interstate Recommended Min. Widths: Lanes = 10 ft.;Shoulders = 1 ft.
- Reduced widths should be analyzed for the off-tracking of the design vehicle. AutoTurn within MicroStation, or other comparable modeling software, may be used for the analysis.

- If a ***positive barrier*** (e.g. concrete barrier, guard rail, bridge rail, bridge abutments, or other rigid obstacle) exists on one side of the roadway only, the needed width for one or two lanes becomes dependent on pavement width availability, vehicle overhang and axle width. Discuss vehicle details with the MCTD and adjust your design accordingly.

SPECIFICATIONS: When a width restriction is anticipated as part of the TCP, Designers should ensure all applicable language from Sections 00220 and 00225 of the ODOT Standard Specifications and Special Provisions is included. The language must accurately address the contractor's responsibility for MCTD notification in the event a width constriction between positive barriers occurs anytime during the project.

VERTICAL DESIGN

For temporary vertical clearance, the following design standards apply:

- During TCP development, if any reduction in the existing vertical clearance is anticipated – installation of falsework, pavement overlays, etc. – MCTD must be notified of the change(s) in height.
- If any changes to vertical clearance are required in the TCP following the Preconstruction Conference, the TCP Designer should work with MCTD at least 35 days prior to the restriction.
- If 17 feet of clearance cannot be maintained during construction, include additional traffic control measures in the TCP to warn motorists of the restrictive condition. PCMS or additional signing can be used to display height restriction information and instructions.
- During TCP development, if the vertical clearance is expected to drop below 15 feet 6 inches, the Designer will need to include the language from Section 00225.02 in the Special Provision "boilerplate". Be sure to include sufficient quantities for the temporary Low Clearance signs as called for in the subsection.
- To further supplement our standard traffic control measures for low vertical clearances, an Overheight Vehicle Warning System (OVWS) from the QPL may be included in the TCP. If an OVWS is used, the Unique Special Provision language found on the Specifications web site needs to be included.

SPECIFICATIONS: If a height restriction is anticipated as part of the TCP, Designers should include all applicable language from Sections 00220 and 00225 of the ODOT Standard Specifications and Special Provisions in the contract. The language must accurately address the contractor's responsibility for MCTD notification in the event a vertical constriction occurs anytime during the project.

3.3.18 – RUMBLE STRIPS

LONGITUDINAL SHOULDER RUMBLE STRIPS

On many sections of Oregon freeways and highways, ODOT has installed longitudinal rumble strips along the shoulders and in the median. The rumble strips are a very effective measure in getting the attention of an errant or drowsy driver allowing them to return safely to their travel lane before leaving the roadway.

Unfortunately, staging or shifting traffic can send vehicles across the rumble strips creating an undesirable effect for drivers – even a potential safety concern.

Therefore, longitudinal rumble strips that conflict with the staging plan – forcing drivers to cross over the rumble strips - should be mitigated by calling for them to be ground (milled) out and paved back prior to shifting traffic.

TCP DESIGN NEEDS: Designers should include a reference to the ODOT Temporary Traffic Control Standard Drawing TM830 that includes the "Existing Rumble Strip Removal" detail. Designers should also include the language from the ODOT "Unique" Special Provision called, "00220 Longitudinal Rumble Strips" into the project Special Provisions.

Measurement and payment for grinding out and paving back longitudinal rumble strips should be covered under the "Cold Plane Pavement Removal" and "Asphalt Concrete Paving" pay items, respectively. These items are not currently measured or paid for under the TCP pay item list. If removal of shoulder rumble strips is necessary, communicate the quantity (feet) of rumble strips being removed to the appropriate member of the Project Development Team (e.g. Roadway Designer, etc.).

TEMPORARY TRANSVERSE RUMBLE STRIPS (TTRS)

Transverse rumble strips consist of a series of narrow, transverse bands of a raised material or depressed road surface extending across the travel lanes that provide a tactile and audible warning for drivers. Through noise and vibration, the rumble strips alert drivers of unexpected changes in alignment, surfaces, traffic control and other conditions that may require them to slow or stop. See the MUTCD, the ODOT Traffic Manual and ODOT Standard Detail DET4710 for additional information.

TCP DESIGN NEEDS: If a Designer wishes to include transverse rumble strips in the TCP, three key components are needed:

1) A completed "Temporary Transverse Rumble Strip Request" form must be completed and sent to the State Traffic Control Plans Engineer's office for review. A recommendation will be sent to the State Traffic Engineer. If approved, a signed approval letter will be returned to the original submitter.
2) The ODOT Standard Detail DET4710 must be included in the TCP
3) Language from the "00225 Temporary Transverse Rumble Strips" Unique specification must be incorporated into the project Special Provisions. When a specific type of transverse rumble strip is needed, adjustments to the Unique special provision language are needed to identify special restrictions or requirements.

There are three types of temporary transverse rumble strips used for different applications.

- **Raised Transverse Rumble Strips**: Made from pavement marking material (e.g. thermoplastics). Typically used for long durations on wearing courses only, as the removal of the rumble strips can damage the pavement. Raised rumble strips can also be made of temporary removable tape. The tape strips may be used on wearing surfaces as damage to the pavement is minimal for the removable tape.
- **Milled (Ground-in) Transverse Rumble Strips**: Made by grinding strips into the pavement. Typically used for long durations on base courses when a wearing course has not been paved yet (or on wearing courses that are to be paved as part of the project). Milled rumble strips should not be used on wearing courses as they damage the pavement and would require additional efforts to remove and repave.
- **Portable Transverse Rumble Strips**: Made of preformed plastic or rubber and simply placed on the road. Used on any pavement surface where the strips are needed for shorter durations. Not intended for extended stationary use, portable strips are intended for daily use and should be picked up at the end of each shift.

Temporary portable rumble strips are measured and paid for 'per foot'. The pay item should include all costs related to installation, maintenance, moving and removal.

3.3.19 – PORTABLE TRAFFIC MANAGEMENT SYSTEM (PTMS)

For complex projects on high-volume, high-speed facilities, where the safe, smooth operation of traffic can be critical, the use of a PTMS can help optimize safety and efficiency for both the contractor and public traffic. Also known as, "smart work zones", or "work zone ITS," these systems can help manage the flow of traffic, minimize congestion and ultimately reduce the number of crashes in a work zone.

PTMS can be used to measure and collect traffic volumes, speeds, headways, lane occupancies and monitor traffic flow conditions. The system processes the data and presents traffic with real-time travel information, or warns them of changing work zone traffic conditions. Drivers are alerted through the system's portable changeable message signs – warning then to slow or stop ahead; or, to follow a detour or use an alternate route.

A Unique Special Provision is available for the PTMS – "00225 – Portable Traffic Management System". Designer should be including this system in projects that would benefit from traffic flow information, queue detection, conflict monitoring alerts, or other safety and mobility benefits including:

- Traffic alerts of slowed or stopped traffic downstream – Displayed on PCMS for public traffic; Sent to email addresses/smart phones for PM and contractor staff.
- Travel time estimates to reach the end of the work zone, nearest crossroad or other highway landmark.
- Alert traffic of construction vehicles entering or crossing the traffic stream.
- Display pre-programmed legal speed reductions during peak work activity.
- On-site web-based (PTZ) cameras streaming images to the project-specific website for traffic and construction monitoring by PM staff.

- Collect traffic volumes, speeds in multiple lanes and in multiple directions for traffic analysis during and post-project.

PTMS can be modified to fit all types and sizes of projects and be adapted to a wide array of functions. Costs depend on the complexity of the system used and the duration the system is in place. For additional information, contact the ODOT Traffic Control Plans Unit in Salem.

3.3.20 – "ROAD WORK AHEAD" SIGNING

The "ROAD WORK AHEAD" (W20-1) sign is installed in advance of the transition and work areas to mark the beginning of the work zone. While there are other signs and devices that may precede the ROAD WORK AHEAD sign (e.g. PCMS, "ROAD WORK NEXT XX MILES", Project ID sign), the ROAD WORK AHEAD sign should be the predominant sign in advance of any lane shifts, lane closures or other changes to the original roadway environment. As such, the ROAD WORK AHEAD sign should be kept as close to the work area as practical and as dictated by other work zone signing needed within the work zone.

As a project progresses and as the new roadway is completed – including surfacing and pavement markings – specification language or plan sheet instructions should direct the contractor to move and reinstall the ROAD WORK AHEAD sign to a location that minimizes its distance from the active work area.

The "ROAD WORK NEXT XX MILES" (CG20-1) sign may be installed for projects longer than three miles where work is continuous along the highway, or where individual work areas are closely spaced (< 3 miles ± apart). The sign may be installed in advance of the initial "ROAD WORK AHEAD" sign at each end of the project facing incoming traffic.

MULTIPLE WORK AREAS

When a single project has multiple individual work areas along the same highway (e.g. concrete pavement repairs, bridge deck joint replacements), signing modifications may be needed.

When individual work areas are more than three miles(±) apart, Designers should include a separate "ROAD WORK AHEAD" sign in advance of each work area. Include a separate "END ROAD WORK" sign at the end of each work area. Law Enforcement agencies can then enforce the Double Fines law within those specific areas – where the conditions are most appropriate.

The "END ROAD WORK" (CG20-2A) sign is installed beyond the end of the work area to mark the end of the work zone. From the definition of a "highway work zone" under ORS 811.230, ODOT uses this configuration to define the limits of a "work zone" for the purposes of enforcing Oregon's double fines law.

3.3.21 – ROLLING SLOWDOWN METHOD (RSM)

If work takes place overhead, crossing live travel lanes in either or both directions of a highway, the "Rolling Slowdown Method" can be an effective traffic control measure for conducting the work safely, yet maintaining the movement of public traffic.

PURPOSE

Rolling Slowdowns are conducted for short-term work that requires working in or over live travel lanes on high-volume facilities (freeways, multi-lane arterials, etc.) for durations of less than 20 minutes. Rolling Slowdowns are used when a full highway closure and detour is impractical. Rolling slowdowns are useful for projects that might include:

- Installation of permanent, overhead Variable Message Signs (VMS)
- Replacement/repair of sign bridges and/or signs on them
- Installation of bridge girders, decking or other components
- Demolition and removal of structures
- Cable or other utility crossings

The Rolling Slowdown process creates a time gap (20 minute, max.) in live traffic to conduct overhead work while keeping the facility open and not stopping or diverting traffic. Rolling Slowdowns work best on access-controlled facilities.

CONSIDERATIONS

Rolling Slowdowns should be scheduled during off-peak traffic periods. Coordinate with State or local law enforcement agencies and the media prior to the scheduled Slowdown(s). Law enforcement agencies may be used to aid in the execution of the Rolling Slowdown as "pilot vehicles" (see below).

TCP Designers should discuss practical time gap lengths needed with their Project Manager. Longer time gaps can result in an increased number of accesses (ramps) affected by the Slowdown. The more access closures needed, the more signing and devices needed in the TCP quantity estimate.

The TCP Designer should be very familiar with the scope of work, and thus, should know if a Rolling Slowdown is likely to be included in the TCP. A Rolling Slowdown is a traffic control measure that is not implemented "at the last minute". A great deal of coordination with a broad range of stakeholders is necessary.

Rolling Slowdowns can involve a number of pay items, including:

- Pilot Car Hours (Unless using law enforcement resources)
- Flagger Hours (at on-ramp terminals and other closure points)
- Flagger Station Lighting
- Traffic Control Supervisor (TCS) - Recommended
- Temporary signs (closure and detour signing at on-ramp terminals and along detour routes)
- Barricades
- PCMS (one at each closure point, and at least one in each direction on mainline)
- Plastic Drums (at closure points)

Most devices may be reused for multiple Slowdowns, but quantities for Flaggers, TCS and Pilot Cars should be tabulated carefully. Variations in the number of Rolling Slowdowns and the number of closure points from one Slowdown to another can affect the quantities for Flagger and Pilot Car Hours.

PROCEDURE

1) Place a Portable Changeable Message Sign (PCMS), truck-mounted, on mainline in advance (upstream) of the planned starting point for the Rolling Slowdown – i.e. approximately ½ to 1-mile in advance of the first on-ramp closure.
    - Place one PCMS for each direction affected by the Slowdown. The PCMS should be mobile, preferably truck-mounted, and maintain approximately ½ to 1 mile advanced notice of the back of the traffic queue.
    - Suggested messages for the PCMS: SLOWED TRAFFIC AHEAD / PREPARE TO SLOW
2) Traffic Control vehicles (typically pilot cars, but may be marked police cars) will enter the highway and form a moving blockade by slowly decelerating traffic behind them to a predetermined fixed speed. One Traffic Control vehicle is needed for each lane of traffic. The queue should never stop completely.
3) A large gap will open between the free-flowing traffic in front of the Traffic Control vehicles and the slowed traffic behind. The gap in time between the slowly moving blockade and the work site (calculated beforehand – see Table 3-1) will give the contractor time to complete the planned overhead work. A maximum time gap of 20 minutes is allowed for any singular Rolling Slowdown.

    NOTE: The distance needed for 20 minutes of clear highway may not be practical, given the number of access points and traffic volumes (even at off-peak times). However, the ***need*** for a full 20-minute time gap is uncommon.
4) A separate Traffic Control vehicle - the "Chase Vehicle" - shall follow the last free-flowing vehicle ahead of the blockade. When the Chase Vehicle passes the work site, the overhead work operation can begin.
5) All on-ramps to the highway between the rolling blockade and the work operation must be temporarily closed, using flaggers, until the "All clear" signal is given by the crew doing the work, or until the front of the rolling blockade passes a particular on-ramp closure. Place advance signing at the approach to each entry ramp.

The location where the Traffic Control vehicles begin the Slowdown and the speed at which the rolling blockade is allowed to travel shall be based on the *Table 3.8*, below:

DESIRED GAP (mins.)	MINIMUM DISTANCE FROM WORK AREA (mi.)			
	* BLOCKADE SPEED (mph)			
	10	20	30	40
10	2.0	5.2	11.0	24.4
15	3.1	7.9	16.5	36.7
20	4.1	10.5	22.0	48.9

* Assumes a pre-slowdown speed of 55 mph.

ROLLING SLOWDOWN LENGTHS – Table 3.8

Table 3.8 assumes a pre-blockade speed of 55 mph (from truck speed limits of 55 mph). The table does not take into account horizontal or vertical alignments, lane widths, number of lanes, or other variables that may slow traffic moving through the project. Wherever practical, Rolling Slowdowns should combine the highest Blockade speed with the shortest Desired Gap to conduct the work.

At a minimum, Rolling Slowdowns should maintain a minimum speed of 30 mph on freeways and 20 mph on all other roadways. Slower blockade speeds should only be considered in cases where the number of accesses on the roadway segment are very high (> 1 access per mile) and the number of closures may be cost-prohibitive or create excessive delays or congestion on adjacent facilities.

A detail sheet should be developed and incorporated into the Traffic Control Plan sheets depicting all sign, PCMS and devices being used, and their placement for each closure point. Include Table 3.8 on the plan sheet, as well, in case adjustments are needed for the Slowdowns. See ODOT Standard Detail DET4740 for Rolling Slowdown Method details. DET4740 may be used as the basis for the added plan sheet in the TCP.

ADDITIONAL INFORMATION

From the 00220 Special Provision Boilerplate, Section 00220.40(g), the contractor is required to have contingencies prepared for the following circumstances:

- Work operations are not completed by the time the Blockade reaches the work area. All work, except that necessary to clear the roadway, will cease immediately and the roadway shall be cleared and reopened as soon as practical.
- The work site, the Blockade, and Flaggers shall communicate by radio to adjust the speed of the Blockade, as necessary, to accommodate the closure time needed.
- The initial PCMS on mainline should to be mobile and continuously move with the operation to provide pertinent data to the drivers approaching the back of the queue. Maintain the location of the PCMS about ½ to 1 mile behind the back of the queue. A PCMS located 10 miles behind the queue, trying to warn about the queue ahead, does not provide adequate warning.

ROLLING SLOWDOWN CALCULATION

$$\text{Min Blockade Distance}, D_{\text{blockade min}}\ (\text{miles}) = \frac{t_{\text{gap}} V_{\text{FreeFlow}} V_{\text{Blockade}}}{60\left(V_{\text{FreeFlow}} - V_{\text{blockade}}\right)}$$

$D_{\text{blockade min}}$ = the minimum distance upstream from the beginning of the work area where the blockade should begin (miles)

t_{Gap} = Desired Gap in Traffic (minutes)

V_{blockade} = Blockade Speed (mph)

V_{FreeFlow} = Free-Flow (pre-blockade) Speed (mph)

V_{FreeFlow} = 55 mph for Freeways & Non-Freeways

3.3.22 – SIGN PLACEMENT

Temporary sign placement is a critical component in the design of a TCP. Temporary signing is the primary method for conveying work zone warnings, guidance and regulatory messages to drivers. Signs must be designed properly, contain a clear, concise message, and be placed to maximize their visibility. Proper sign placement allows drivers to read, interpret and react to the sign messages.

A TCP Designer should be very familiar with the *TCD Spacing Table* shown on the ODOT Temporary Traffic Control Standard Drawings. MUTCD Section 6F provides additional information and guidance relating to the placement of temporary signs.

Address the following temporary signing items as you develop your TCP:

- First, conduct a field investigation and collect an inventory of existing signing – including specific sign locations – and any other roadside features that may conflict with temporary sign placement. See the ***Facility Features*** discussion earlier in Section 3.2.4.
- Use the inventory to place temporary signing within the TCP. Avoid locating temporary signing in the immediate vicinity of existing signing. Wherever practical, provide standard sign spacing between temporary and permanent signs.
- URBAN AREAS: Placement of temporary signing is more challenging with the presence of added roadside obstacles and facilities. Consider the following when specifying sign locations or showing them on TCP sheets:
  - Investigate the work site and collect data regarding available shoulder widths and the presence of sidewalks. Use this data to determine if widths will allow signs to be post-mounted or will require a Temporary Sign Support (TSS).
    - ***NOTE*:** 4-ft Type III Barricades (instead of 8-ft) may be specified (on plans or in Special Provisions) for use with a TSS if space is limited.
  - Collect additional data identifying designated bicycle lanes, multi-use paths, landscape strips between roadway and sidewalk, and other facilities that may affect temporary sign placement.
  - Be aware that the "shoulder" may also be a designated Bicycle Lane. Showing temporary signs in the "shoulder" (on the plans or in the Special Provisions) will force cyclists into live travel lanes, potentially creating an unsafe condition.
    - ***NOTE*:** If multiple TSS will be placed on a shoulder frequently used by bicycles for extended periods, add a "**Bicycles ON ROADWAY**" (CW11-1) sign in advance of the TSS-mounted sign sequence. Repeat the "Bicycles ON ROADWAY" sign approximately every mile, as needed.
  - Temporary signs may sometimes be installed on existing utility poles, but ONLY if prior arrangements have been made with the appropriate utility or local jurisdiction. Larger signs may exceed load limits for some utility structures. This should also be checked.

3.3.23 – SPEED ZONE REDUCTIONS

Under some circumstances, it may be necessary or advantageous to implement a temporary speed reduction through a work zone.

The duration of the temporary speed zone reduction will vary based on the type and complexity of the work being done and how quickly the constraint or hazardous condition can be relieved or eliminated.

To obtain a temporary speed reduction in a work zone on a State Highway, an official Speed Zone Reduction Order must be approved and signed by the State Traffic Engineer. County and City agencies must go through their proper channels in obtaining similar approval.

For ODOT projects, the Designer should download the "**Work Zone Speed Reduction Request Form**" - found in Appendix C or online under the Traffic-Roadway Section web site. Look for links to the Traffic-Roadway "*Publications*" page. The **Work Zone Speed Reduction Request Form** includes instructions for how to fill out the form and the process to follow. A process flowchart is also shown below – see *Figure 3.6*.

A variety of circumstances can justify the warrant for a speed zone reduction, including:

- Reducing the number of lanes for traffic
- Complex construction staging
- Temporary alignments, crossovers or on-site diversions
- Freeway nighttime paving operations or high-speed, multi-lane facility
- Workers present for extended periods within 2-ft of travel lanes and not behind barrier
- Lane widths (existing or due to construction) of less than 12 feet
- Horizontal curves with a safe speed 10 mph or more less than the posted speed
- Pavement edge drop-offs within two feet of the traveled way for more than ¼ mile

SPEED REDUCTION PROCESS INFORMATION

The State Traffic Engineer has the authority to set a reduced speed in a work zone or other temporary condition on State Highways. The request must be reviewed and concurred with by the Construction Project Manager, Traffic Control Plans Designer, and Region Traffic Manager before submitting to the Traffic Control Plans Unit for final review. For permit projects (e.g. Maintenance operations and Utility work), only the District Manager's review and signature is required before submittal to the TCP Unit. In submitting requests, include the completed Work Zone Speed Reduction Request Form and a copy of the traffic control plan (Advance Plans or "90% complete" recommended).

Requesting a Speed Zone Reduction is typically a 2-stage process:

1. During project development, request a, "Letter of Support" from the State Traffic Engineer
2. After Contract award, request a Temporary Speed Zone Order

If a speed reduction is being considered, the following guidance can optimize the approval process:

- Include a copy of the current TCP in the submittal. Provide as much detail as practical.
- Add a quantity of Temporary Signs in the estimate to cover signs used for the Speed Zone reduction – Typically, two signs per direction being slowed. Multi-lane facilities would need four signs per direction.
- ***DO NOT*** draw the specific **Speed Zone signs** on your plan sheets! ‘Sign Outlines’ or ‘placeholders’ may be included and labeled as, “Hold for Temp. Speed Zone Signing,” or other notation.
- Following the Plans-in-Hand meeting, issuance of Final Plans, or after Award, a Speed Zone Order can be requested. The signed Order will establish the final placement and duration of the temporary speed zone signs.

Use *Figure 3.6* to determine what needs to be submitted for Traffic-Roadway Section for review.

WORK ZONE SPEED REDUCTION PROCESS

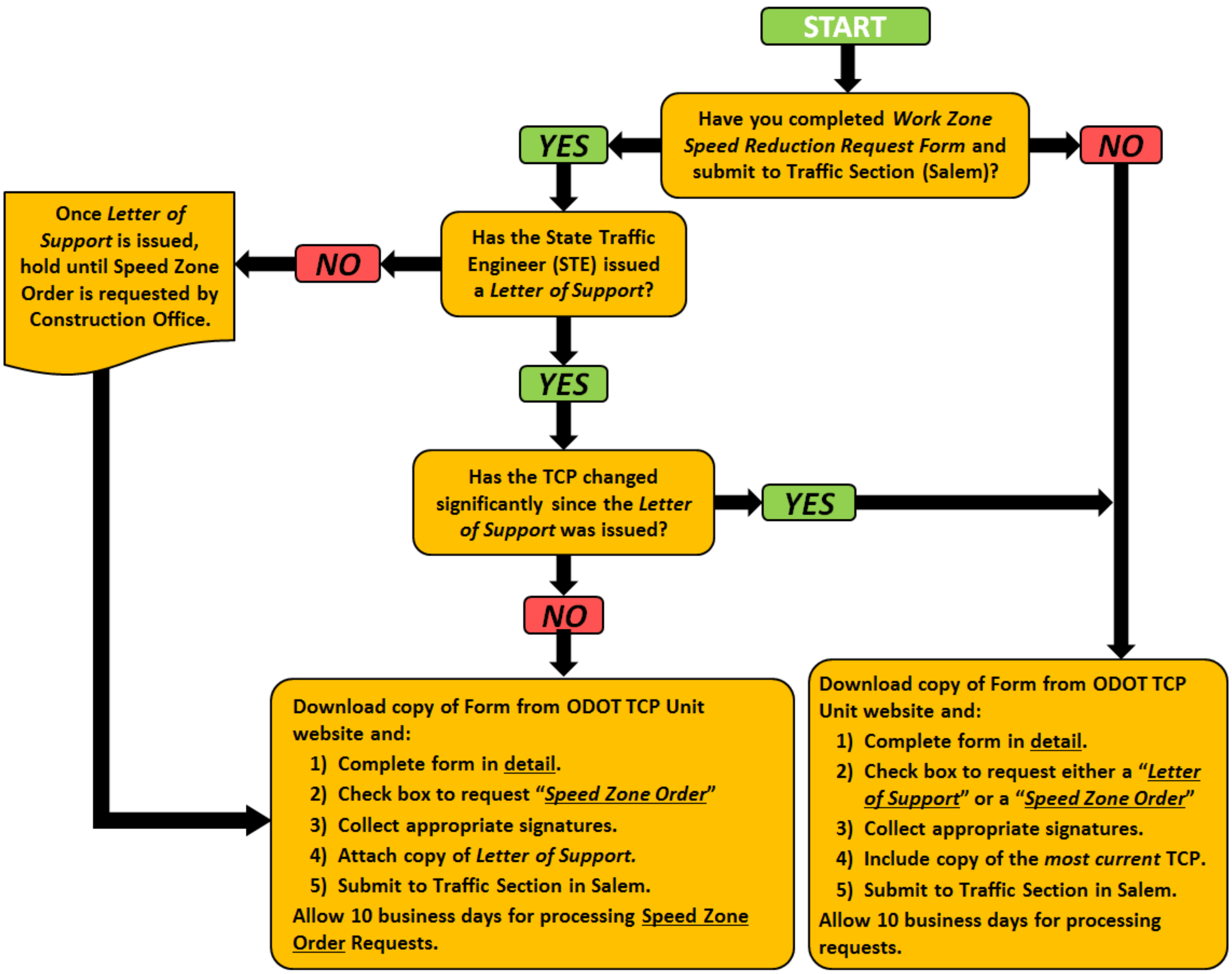


Figure 3.6

"LETTER OF SUPPORT"

Requesting a *Letter of Support* is typically done no sooner than after the completion of the Preliminary Plans for a project. Issuance of a *Letter of Support* depends largely on the amount of detail shown in the traffic control plan. The *Letter of Support* is ***not*** a Speed Zone Order and ***cannot*** be used to include specific speed zone signs in the TCP or place signs on a project.

The purpose of the *Letter of Support* is to:

- Inform the Traffic-Roadway Section, Project Manager, and Region Traffic Manager that a regulatory, work zone speed reduction is being considered for the project
- Open a dialog between Designers and Traffic-Roadway Section on the use of a regulatory speed reduction, and related temporary traffic control measures
- Enhance the consistency and quality of the design of work zone speed reductions
- Provide a means to capture temporary speed zone signing quantities in the TCP estimate
- Accelerate the processing of the Speed Zone Order request

PLAN AHEAD: Allow ***10 business days*** for Work Zone Speed Reduction requests to be processed and a *Letter of Support* to be issued.

Once a TCP Designer has received the *Letter of Support*, include the language from the Unique Special Provision, "***00225 – Temporary Speed Zone Reduction***" in the project Special Provisions.

TEMPORARY SPEED ZONE ORDER

A Temporary Speed Zone Order is typically requested after the contract is awarded and both the contractor and Project Manager (or District Manager for permit projects) have agreed on the project staging and traffic control. Allow **10 business days** for the Speed Zone Order request to be processed and the Order to be issued.

If a *Letter of Support* has been issued by the State Traffic Engineer, and no (significant) changes have been made to the traffic control plan since the *Letter of Support* was issued, the Project Manager (or District Manager for permit projects) can submit a signed Order request to the Traffic-Roadway Section. No additional information is required for processing the Order request.

TCP Unit staff will determine if a speed zone reduction is warranted based on the contents of the submitted Order request and current traffic control plans. Speed Zone Orders for a work zone are written specifically for the conditions present in the work zone. The presence of one or more conditions or factors from Section 6 of the Speed Reduction Request Form may not necessarily result in the support of a speed reduction. Some conditions may be better mitigated with temporary traffic control measures other than a speed reduction.

A Speed Zone Order can be issued without a *Letter of Support* for projects already under contract. Similar materials and information should be submitted as part of the Speed Zone Order request if a *Letter of Support* has not previously been issued (see Figure 3.6, above).

SPEED ZONE REDUCTION SIGNING

The standard sign sequence for a temporary speed zone reduction should include the following signs in the following order:

1) A fluorescent orange (ODOT: *Type "O8"*) version of the Speed Reduction (W3-5) sign
2) A SPEED XX (OR2-1) sign [or SPEED LIMIT XX (R2-1)* sign]

   *Use the "SPEED XX" or "SPEED LIMIT XX" sign in accordance with Oregon Law.

1) Speed Reduction (W3-5)

2) "SPEED XX" (R2-1)

OR

"SPEED LIMIT XX" (R2-1)

SIGN PLACEMENT

In most cases, sign placement for temporary speed zone signing is no different than for any other temporary signing. Nonetheless, the following guidelines can be used for locating temporary speed zone signing within a TCP:

- Two-lane, two-way roadways: Located on right side of roadway.
- Four-lane Divided or Access-controlled (freeway) roadways: Matching sequence located on right and left (median) side of the roadway, where practical. Supplemental (left-side) signs should not be placed in a center continuous two-way left turn lane.
- Roadways with three or more lanes per direction: Matching sequence located on right and left (median) side of the roadway, where practical.

A PCMS can be used to provide supplemental, advance notification of an approaching reduced speed zone. However, specific regulatory messages should be avoided on the PCMS to avoid confusing public traffic and law enforcement as to where the reduced speed zone begins.

MESSAGES to AVOID

SPEED	SLOW	SPEED
LIMIT	SPEED	XX
XX	XX	CAUTION

SUGGESTED MESSAGES

SPEED XX	SLOW TO	REDUCED	SLOW TO
AHEAD	XX MPH	SPEED	XX FOR
X MILES	AHEAD	X MILES	WORKERS

Speed Zone Reductions are written for a segment or length of roadway affected by some condition that warrants a reduction in speed to enhance safety for road users and workers. Speed Zone signing can placed in ***one*** or ***both*** directions of a roadway segment – depending on whether construction is making an impact on the original roadway environment and/or workers are present and adjacent to live traffic without the aid of positive protection.

The Speed Zone Order will include specific details regarding sign placement. Contact the Traffic Control Plans Unit for additional guidance.

FREEWAY SPEED ZONE REDUCTIONS

In an effort to help control speeds and optimize safety for high-speed work zones, new traffic control measures for select project types on Oregon freeways and divided highways have been developed. Projects on these facilities involving moving operations, where workers are immediately adjacent to live traffic, would qualify for a temporary speed zone reduction. The speed zone reductions are typically approved for 10 – 15 mph below the pre-construction posted speed limit.

In developing the TCP, include a Work Zone Speed Reduction Request for projects that include ***all*** of the following:

- Moving operations on Interstate freeways or multilane divided highways (e.g. paving, concrete rubblization, barrier replacement/installation)
- Pre-construction posted speed ≥ 45mph
- Workers will be adjacent to live traffic and not behind concrete barrier, guardrail or other positive protection barrier system
- Work is done at night. Consider requesting a speed zone reduction for daytime operations where the facility ADT > 10,000.

If the project meets all of the criteria listed above, include the Unique Special Provision, “00225 – Speed Reduction Measures (Paving Operations)”, identify Standard Drawing **TM880 - Freeway or Divided Highway Speed Reduction (Paving Operations)** on the list of applicable drawings in Section 00225 of the Special Provisions, and include language and quantities for all of the associated bid items. The freeway/divided highway speed zone reduction request process is the same as the process used to request a temporary speed zone reduction for other project types and scopes of work:

- A “Letter of Support” may be obtained from the State Traffic-Roadway Engineer (STRE) by completing and submitting a “Work Zone Speed Reduction Request” and a copy of the TCP. Having the “Letter of Support” will help expedite the processing of the Speed Zone Order Request once the project has been awarded.*
- To obtain a Speed Zone Order, a “Work Zone Speed Reduction Request” MUST be completed and submitted with a copy of the TCP to the STRE for approval.

SPEED ZONE REDUCTION ALTERNATIVES

As an alternative to a formal Speed Zone Reduction Order, other signs may be added to the TCP to warn of conditions that warrant reduced speeds.

Example signs include:

- Reverse Curve (W1-4), or Two Lane Reverse Curve (W1-4b) – (*right*)
- Advisory Speed (W13-1) riders below advance warning signs – (*right*)
- “LANE NARROWS” (CW23-5)
- Curve (W1-2a) with an advisory speed included on sign face – (*right*)

Advisory Speed plaques shall only be used where an engineering study determines the need to advise drivers of an advisory speed for a condition. Advisory Speed plaques shall be Type “O4” and in 5 mph increments.

The “ROAD WORK XX MPH” (CW20-1a) sign (*right*) may be used as a general warning for a reduced speed condition. The speed displayed on the sign should be determined through engineering judgment and have ODOT approval.

Avoid creating a temporary situation that would require an Advisory Speed of more than 20 mph below the pre-construction posted speed for non-freeways, and more than 15 mph below the posted speed for freeways.

IMPORTANT NOTES

- The “CONSTRUCTION SPEED XX” sign (*right*) has been deleted from the ODOT Sign Policy. ***Do not*** use this sign in a Traffic Control Plan.
- Reducing the posted speed of a facility through a Temporary Speed Zone reduction ***DOES NOT*** constitute a reduction in the DESIGN SPEED for traffic control measures or the traffic control plan.

3.3.24 – TEMPORARY ALIGNMENTS

Temporary roadways used by traffic during construction staging should be engineered alignments. Crossovers, on-site diversions, temporary ramps or other roadway elements should be designed and constructed based on an engineered alignment.

Designers should consider the following design elements in developing a temporary roadway:

- Spirals are not mandatory, but are recommended. It may be necessary to include a spiral, spiral segment or partial spiral in the design if the alignment departs from or returns to a curvilinear segment of roadway. Spiral elements will aide in proper superelevation and transitions.
- Minimum superelevation rates may be obtained from **Table 3-5 – Comfort Speed** of the HDM.
- See Section 3.3.3 for freeway crossover design details.
- Radii for all non-freeway projects shall not be less than that needed to meet a design speed equivalent to the pre-construction posted speed.
- Match mainline shoulder widths, where practical. For freeway crossover shoulder widths, 4 feet is recommended. Use a minimum of 2 feet for temporary freeway alignments.
- Include appropriate pavement markings and channelizing devices.

Pavement design and materials needed to construct temporary alignments are not normally included in the Traffic Control Plan. Embankment, aggregate, and pavement material quantities should be included in the Roadway pay item schedule.

3.3.25 – TEMPORARY CONCRETE BARRIER

Temporary concrete barrier is a commonly used traffic control measure and provides one of the most effective means for separating workers from public traffic within work zone. Several factors should be considered when determining the need for temporary concrete barrier.

BARRIER WARRANTS

The need for temporary concrete barrier is not always obvious. Engineering judgement and experience can help a Designer decide when to use barrier. As for guidance from a technical reference, the AASHTO Roadside Design Guide suggests the following as warrants for placing temporary concrete barrier:

- If setting and removing the concrete barrier to protect a hazard takes less time than the hazard is expected to be exposed to traffic.
- If the presence of the concrete barrier presents a lesser risk to safety than the hazard being protected.

Use the following as additional warrants for the inclusion of concrete barrier in your TCP:

- For freeway applications, if the existing means of separating opposing directions of traffic is altered or reduced through construction staging, temporary concrete barrier is warranted.

  For example:
  - Staging decreases a 30-ft wide landscaped median to a 20-ft median
  - Southbound traffic is moved into the median on a temporary crossover
  - Existing concrete median barrier is being replaced
- Protecting structure falsework, a bridge column or abutment, or other structure work
- Separating traffic from deep excavations adjacent to the travelled way. Examples of factors that emphasize this warrant include:
  - Providing a 3:1 aggregate wedge is impractical due to the depth of the excavation
  - Exposure to lengthy longitudinal excavations. (For lower speeds, shorter lengths; or for higher speeds, longer lengths.)
  - If a minimum 4-ft shoulder cannot be provided with the 3:1 aggregate wedge; or, the pavement surface replaced by the end of the shift
- Other work activities where severe damage or injury may result if left unprotected by a physical barrier

While not all inclusive, this list of warrants or conditions presents the Designer with an appropriate amount of lattitude and an opportunity to use their engineering judgement in the final decision to use concrete barrier or not.

BARRIER PLACEMENT

Due to the physical properties and nature of temporary concrete barrier, it needs to remain crashworthy when placed in a work zone. Therefore, there are strict requirements for the placement of concrete barrier. To remain crashworthy, temporary concrete barrier must be:

- Set on a level asphalt concrete (AC) or portland cement concrete (PCC) surface

- Installed with 3-ft of clearance behind it – measured from the back face of the barrier to the nearest obstacle. The 3-ft clearance shall be free of all permanent and temporary obstructions, including construction materials, parked vehicles, etc.
- Secured to a PCC or AC pavement surface when a 3-ft clearance cannot be provided. Refer to the ODOT Temporary Traffic Control Plan Standard Drawings for securing details.
  - Even when secured, a 1-ft minimum clearance must be provided behind the barrier.
  - Designers should identify barrier that requires securing on plan sheets as:

    "Temp. Conc. Barrier, Secured – XXX.XX ft."; *or*

    "Temp. Conc. Barrier, Reflectorized, Secured – XXX.XX ft."
- Anchored to a PCC bridge deck. See the ODOT Bridge Section's Bridge Design & Drafting Manual , Section 1.1.21.4, for specific barrier designs and installation details.

When installing temporary concrete barrier:

- Protect all blunt ends exposed to live traffic with a temporary impact attenuator from the ODOT QPL.
- Do not install on a gravel or dirt surface.
- Do not install concrete barrier at an angle greater than 25^0 from parallel with the approaching traffic flow.
- Do not use concrete barrier to close a roadway unless placed in a crashworthy manner with appropriate, crashworthy end treatments (see *End Treatments*, below).
- Do not install without pinning individual barrier sections together.
- Channelizing devices should close a lane/shoulder when preceding a lane/shoulder closure utilizing concrete barrier. Errant vehicles will be alerted to the closure by the channelizing devices, and will hopefully avoid striking the concrete barrier.

Temporary concrete barrier may be moved into place and used as "Permanent" barrier at the completion of the project, as long as the barrier meets all of the requirements of Standard Specifications Section 820.

REFLECTIVE BARRIER PANELS

Reflective barrier panels are a very effective device, when used properly, in improving the delineation and visibility of temporary concrete barrier. Panels are installed on the face of the barrier and provide drivers with a highly reflective series of markers.

Because of their reflectivity, Barrier Panels are most effective on barrier in curved sections of a road where, by itself, barrier may otherwise be difficult to see at night or in inclement weather.

For calculating relective barrier panel quantities, two panels are attached to each piece of barrier. Include a percentage of the total quantity for replacement (typically, 10-20%). Make small adjustments to the replacement percentage depending on factors such as the number of times barrier is moved, the width of the shoulders, traffic speeds and volumes, radius of curvature, and project duration.

Additional Reflective Barrier Panel information is included in Section 00225 of the ODOT/APWA Standard Specifications for Construction.

HIGHWAY MEDIAN BARRIER REPLACEMENT PROJECTS

An occassional component in freeway construction projects is the removal and replacement of obsolete permanent median barrier. In developing a traffic control plan for this type of activity, ODOT has found most contractors use the following procedure to replace the barrier:

- Place an equal length of temporary concrete barrier along side the existing barrier to be removed.
- Close the adjacent lane to provide sufficient room to work. Occassionally, the adjacent lane on both sides of the highway are closed.
- The contractor is given a quantity for the, "Temp. Concrete Barrier, Move" pay item equal to the length of the temporary barrier placed.
- If multiple lifts of pavement are needed to repair the pavement under the existing barrier, include enough quantities for the "Temp. Concrete Barrier, Move" pay item for ***each*** lift of paving. Appropriate barrier connections or blunt end protection are required. Designers should include barrier connection details in the TCP, as needed (see *End Treatments*).
- Including at least two Truck-Mounted Impact Attenuators (TMA) is recommended.

NOTE: Providing a perceived "*clear zone*" between opposing directions of travel by closing inside traffic lanes, in lieu of installing temporary concrete barrier, is not a standard practice.

TEMPORARY GLARE SCREEN

To minimize the potential for distracted drivers in the work zone, a new pay item has been developed and added to the ODOT QPL. The Temporary Barrier Screen is a visual and protective system installed on top of temporary concrete barrier. The Glare Screen is made of low-density polyethylene (LDPE) plastic, is lightweight and extends approximately 24 inches above the top of the barrier. While purposefully designed as an anti-"gawk" screen, the screens can also be used to control some dust and debris from passing over the barrier and into live traffic lanes.

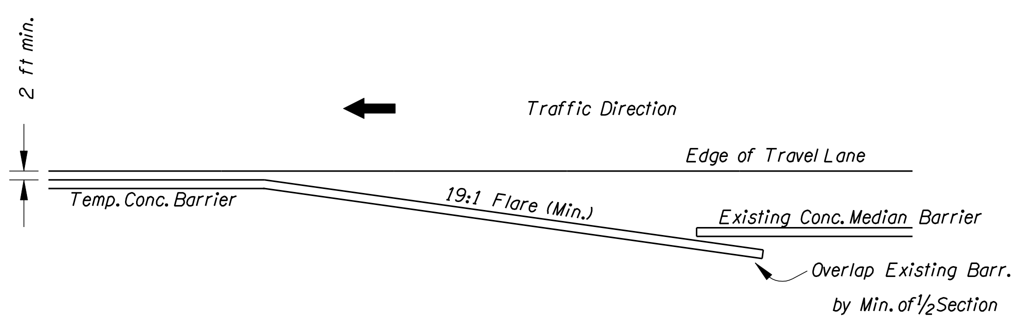
Systems made of plywood sheets and steel piping, or of chainlink fencing materials are no longer allowed on ODOT construction projects. Glare screen products must come from the ODOT QPL or be otherwise approved by the Construction Project Manager.

The ODOT TCP Unit continues to investigate additional barrier screen products for approval and addition to the ODOT QPL. Contact the ODOT Traffic Control Plans Unit office for additional information.

END TREATMENTS

The blunt end of a temporary concrete barrier run presents a serious hazard when exposed to traffic. When concrete barrier is placed on the project site, a number of methods are available for protecting the blunt ends:

1) ***Temporary Impact Attenuators*** – The most common device used for protecting blunt ends. Availalble in a wide variety of styles for various applications:
    - Barrel or Drum Array – A sand-filled array of plastic barrels. See the ODOT Temporary Traffic Control Plan Standard Drawings for additional details.
    - Narrow Site system – Approx. 2-ft in width. Used where space does not allow for the placement of the drum arrays. See the ODOT QPL for additional details.
    - Truck-Mounted Attenuator (TMA) – Installed on a truck. A TMA is intended as a short-term, mobile protection device. Portability gives the TMA greater flexibility in placement. Use of a TMA to protect blunt ends should be limited to three consecutive days.
2) ***Temporary Connections*** – Several devices are available to connect runs of temporary concrete barrier with other barrier systems including existing barrier, bridge rail and guard rail sections. For examples, please see ODOT Standard Drawings RD530, DET110 and others depending on the needed connection.
3) ***Overlapped Ends*** – If sections of barrier are being moved, installed or reinstalled frequently such that matching up the ends of the runs is impractical, blunt ends may be overlapped so as to "hide" the exposed end from approaching traffic. See the following diagram for additional details:



TYPICAL OVERLAP OF TEMPORARY CONCRETE BARRIER

4) ***Buried Ends in Fill/Back Slopes*** – When the work zone presents itself and other protection techniques listed here are impractical, the blunt end of the barrier may be buried in the roadside backfill or a cut slope. For examples of this type of application, see ODOT Standard Drawing RD526.
5) ***Sloped End Terminals*** – This device is limited to facilities with a posted speed of **30 mph or less**. Sloped end terminals are primarily used in urban, low-speed settings or in a ramp terminal or other intersection where traffic is coming to a stop. See ODOT Drawing RD510 for additional details.

NON-RECOMMENDED* and *DISCONTINUED PROTECTION METHODS

ODOT ***does not recommend*** the following measure for "protecting" blunt ends:

- ***Flaring the end of the barrier beyond the "clear zone."*** – Often, there is inadequate space available to provide the proper clear zone. In addition, the entire barrier flare must be installed on an AC or PCC surface to maintain the crashworthy properties of the barrier. Furthermore, the length of barrier needed (and any temporary surfacing) to provide the necessary clear zone can end up costing as much as a temporary impact attenutor.

The following measure for "protecting" blunt ends has been ***discontinued***:

- ***Barrier Mounds:*** Following a letter issued by the Federal Highway Administration (FHWA) in February, 2003, the use of barrier mounds as a means of protecting the blunt end of a concrete barrier run is ***no longer allowed***. ***Do not use*** mounded fill material at the end of a concrete barrier run to protect the blunt end – for either temporary or permanent applications. ***Do not include*** ODOT Standard Drawings RD525, RD565 or DET152 in your Traffic Control Plans.

TALL CONCRETE BARRIER ("F" SHAPE)

Tall "F" (42-inch) barrier was originally designed to replace the "single slope" concrete barrier. The Tall "F" barrier provides effective protection against median crossover crashes – particularly from large trucks. During Test Level 3 (TL-3) and 4 (TL-4) testing, the Tall "F" barrier performed very well, seeing deflections of approximately 32 inches.

The primary use for Tall "F" barrier is in the median of ODOT Interstate and Highway freight routes. As a secondary use, Tall "F" barrier may be used as shoulder barrier for these same routes.

In the TCP, Tall "F" barrier may be used as temporary barrier. Typically, however, the Tall "F" barrier is then moved into a final location and used as permanent barrier. Due to the limited availability and greater difficulty with moving this type of barrier, it is impractical for a TCP Designer to specify Tall "F" barrier to be used ***exclusively*** as temporary barrier.

Do not specify the use of Tall "F" barrier in your TCP as temporary bridge rail or in a situation where the Tall "F" barrier would need to be restrained on a PCC surface. The current *Barrier Restraint* Detail shown in the ODOT Traffic Control Plan Standard Drawings has not been approved for use with Tall "F" barrier.

For pinning "Tall F" barrier to the roadway, see ODOT Drawing RD516.

3.3.26 – WORK ZONE TRAFFIC ANALYSIS (WZTA)

All construction projects affecting traffic flow on State Highways require a Traffic Analysis to determine when the existing lanes will exceed their capacity. The Traffic Analysis is used to identify how many lanes are needed to support projected construction year volumes during specific times of day or night, days of the week, or months of the year, while accounting for multiple work zone factors that can create delays or congestion.

For ODOT projects, the project-specific traffic analysis should be conducted by someone trained to use ODOT's proprietary Work Zone Traffic Analysis (WZTA) web-based software, or other comparable traffic analysis software. ODOT provides a *Work Zone Traffic Analysis Theory and Application Workshop* that focuses on the use application of the WZTA software. The *"Work Zone Traffic Analysis Manual"* is specific to the new web-based work zone analysis tool (see Work Zone Traffic Analysis Tool @ http://wpdotappl21/WZTA/). The manual is available on the ODOT Traffic-Roadway Section's *Publications* website. The Work Zone Traffic Analysis Tool methodology is designed for highway segment analysis only. Intersection or Network analyses that demand greater levels of detail and accuracy – including refined delay calculations, require different modelling and analysis software applications (e.g. HCS, QuickZone, SYNCHRO, CORSIM, etc.) for work zone lane closures, but still requires using the principles, thresholds and guidance discussed in the Work Zone Traffic Analysis Manual. Contact the ODOT Region Traffic Analysts to determine the appropriate traffic analysis method.

Travel Delay Estimates are also generated from Work Zone Traffic Analysis. ODOT's Statewide Traffic Mobility Program was created to manage delays on the state highway system. In 2005, the Mobility Program created 'delay thresholds' for Oregon's major highway corridor segments. The thresholds correspond with the maximum acceptable *additional* delay generated by construction and maintenance projects for each highway segment. Segment lengths vary, but are typically between 1-2 miles in most parts of the state, with longer segments in the more rural areas.

When Travel Delay Estimates are generated by the Traffic Analyst, discuss the results with the Project Leader and ODOT's Region Mobility Liaison (responsible for coordinating regional travel delay estimates). ODOT's current Region Mobility Liaisons are listed below:

ODOT REGIONAL MOBILITY LIAISONS				
Tony Coleman	Region 1 Mobility Liaison	123 NW Flanders St Portland, OR 97209	503.731.8531	anthony.t.coleman@odot.state.or.us
Angela Kargel	Region 2 Mobility Liaison	455 Airport Rd SE Bldg A Salem, OR 97301	503.986.2656	angela.j.kargel@state.or.us
Matt Malone	Region 3 Mobility Liaison	3500 NW Stewart Parkway Roseburg, OR 97470	541.957.3503	richard.malone@state.or.us
Joel McCarroll	Region 4 Mobility Liaison	63055 N. Hwy 97 Bend, OR 97708	541.388.6189	joel.r.mccarroll@odot.state.or.us
Jeff Wise	Region 5 Mobility Liaison	3012 Island Ave La Grande, OR 97850-1902	541.963.1902	jeff.wise@odot.state.or.us

Within ODOT, the Region Traffic Analysts will complete the analysis and return a report to the TCP Designer identifying the number of lanes needed to accommodate the anticipated traffic volumes through the work zone, and the times of day when the lanes are needed. The TCP Designer can then use this information to make edits to the Special Provisions subsection ***00220.40(e) – Lane Restrictions***. The language in Section 00220.40 should be modified based on each project's unique set of circumstances, with the TCP Designer carefully editing the language to ensure the intent of the traffic analyst is accurately conveyed. See Chapter 4 for further discussion on Section 00220.40.

If ***all*** of the following criteria are met, the only remaining Lane Restrictions to be enforced are the standard Weekend and Holiday lane restrictions:

- ADT < 3000;
- Simple roadway geometry, including two-way, two-lane configurations; and,
- The TCP Designer determines there are no complicating factors and construction does not affect the normal flow of traffic.

Current Lane Restriction specification language can be found in Section 00220.40 of the ODOT/APWA Standard Specifications and the Section 00220 Special Provision "boilerplate". Both references are available on the Specifications Unit website. Follow the link to, "*Specifications*" from the *ODOT Traffic-Roadway Section* main page.

SPECIAL EVENTS

The TCP Designer and the Work Zone Traffic Analyst should work together to determine if there are local events which could seriously affect traffic flows through the work zone, and if special lane restrictions need to be imposed during the event.

The TCP Designer should contact the local Chamber of Commerce to collect a list of special events that may affect traffic flow through the work zone. Conversations with the Chamber of Commerce will provide additional information including; anticipated number of participants, start and end times for the activities and the general location for the event(s). Following discussions with the Region Traffic Analyst, additional Lane Restrictions for any relevant special events may need to be included in the Special Provisions under Section 00220.40(e).

After award of the contract, Lane Restrictions may be modified if it is determined the original restrictions were excessive. This determination can be made through conversations with Region staff and by making field observations. Any requests to modify Lane Restrictions should be forwarded to the TCP Engineer of Record and the Region Traffic Engineer for review and concurrence.

3.4 – DESIGN-RELATED SPECIFICATIONS

Special Provision language is a key component in every TCP. The specifications in this Section can present additional challenges for a TCP Designer – resulting in inconsistent applications – thus, additional clarification has been included here.

As is evident in several locations throughout this Design Manual, it is strongly recommended the TCP Designer be very familiar with the contents of the current ODOT/APWA Standard Specifications for Construction, Special Provision "boilerplates", and the "Unique" Special Provisions from Sections 00220 and 00225. Being familiar with other related and cross-referenced Sections is also encouraged. See Chapter 4 for additional Specification information.

3.4.1 - 20-MINUTE STOP OR HOLD

In keeping with ODOT's commitment to mobility and minimizing delay to the traveling public, the following bulleted item is included in *Section 00220.02 – Public Safety and Mobility* in the ODOT/APWA Standard Specifications for Construction:

- Do not stop or hold vehicles on a highway within the project site for more than 20 minutes.

Because of this strong commitment, this bulleted item should never be deleted through the project-specific Special Provisions.

It is rare, and often unnecessary, but changes to the amount of time ("20 minutes") made through the Special Provisions must be concurred with by the ODOT Traffic Control Plans Engineer.

> ***NOTE***: Requests to lengthen the amount of delay will not be granted as this creates undue delays in the work zone – leading to driver frustration and potential road rage situations.

IMPORTANT NOTES:

- Carefully take into account the scope of work, project schedule and cumulative, long-term effects on traffic traveling through this project before considering any modifications to this Standard Specification.
- This language is primarily aimed at two-way, one-lane operations – typically, during flagging operations – but can also apply to flagging of side roads or private accesses within a work zone.
- This language ***does not apply to freeway operations***, as stopping or holding traffic on Oregon freeways is not allowed for planned construction or maintenance activities.
- The *2008 Standard Specifications for Construction*, rewrote the original 2002 language and split it into two separate bulleted items for clarity. The second bullet addresses temporary driveway closures:
    - Do not block driveways for more than two hours, unless otherwise authorized in writing.

In addition, Liquidated Damages (see Section 00180.85) may not be applied to this portion of the Special Provisions. Under this situation, ODOT notifies the contractor that they are in 'Breach of Contract,' and they must modify work practices to relieve the excess delay or they will be issued a "Suspend Work" order.

3.4.2 – ALTERNATIVE CONTRACTING METHODS

Alternative contracting methods can be used to accelerate the completion of a project. By reducing the overall project duration, traffic delays and inconveniences to public traffic can be minimized. Examples of effective Alternative Contracting methods include:

- Incentive/Disincentive (I/C) bonuses
- "A+B" Contract – where, "A" = Material costs; "B" = Time needed for construction
- "A+C" Contract – where, "A" = Material costs; "C" = Value of Contractor's pre-qualifications
- "Design-Build" Contract – Where early project segments are built, while subsequent segments are designed and prepared for construction. Method allows for flexibility in construction sequencing and design modifications to fit unanticipated site needs
- "Lane Rentals" – Where contractors can pay a premium to extend lane closures to complete time consuming, costly work that would otherwise require extensive staging

Project Development Teams may choose to use an alternative contracting method if the following conditions exist:

- High traffic volumes – generally in large, urban areas
- Work which completes a critical gap in the highway system
- Major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic (i.e. high-volume bridges, Interstate routes, commuter routes)
- Projects requiring lengthy detours, creating large amounts of out-of-direction travel
- A highway element with a significant crash history, or other operational deficiency

When project teams decide an alternative contracting method will be use to deliver the contract, TCP Designers can assist by identifying any additional traffic control measures or special needs for the contract, and by:

- Conducting work zone traffic analysts for a number of staging scenarios
- Determining the Lane Restrictions in Section 00220.40(e) for each staging scenario
- Attempting to determine user delay costs and impacts to traffic (used to compare one scenario against another, not necessarily to find the "lowest cost")
- Examining staging plan scenarios and soliciting potential construction schedules
- Assembling draft special provision language – particularly looking at lane restrictions and other work limitations – e.g. times, locations, activities, seasons, etc.

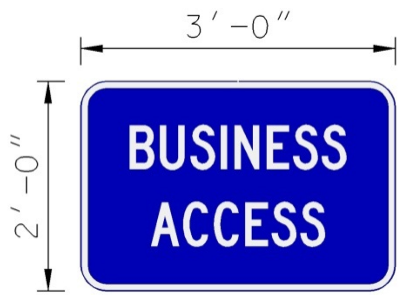
Alternative contracting methods should be discussed and agreed upon at the Project Team level, including issues of sufficient funding incentives, seasonal or other time constraints, stakeholder agreements, etc. Alternative contracting methods, and their feasibility, can also be discussed with members of the ODOT Office of Project Letting in Salem.

3.4.3 – BUSINESS ACCESSES

This traffic control measure is used to help delineate business accesses disrupted by construction. Driveway approaches for private businesses are occasionally disturbed making them less visible to passing traffic, and particularly difficult to find at night or during inclement weather.

In an effort to partner with local businesses affected by construction, ODOT uses additional signing and special channelizing devices to clearly identify temporary business accesses.

Signing and Blue Tubular Markers in place



(CG20-11)

ODOT uses the "BUSINESS ACCESS" (CG20-11) sign (*above*) to identify the affected accesses. Refer to the ODOT Sign Policy & Guidelines, Chapter 6, for additional guidance on sign designs and placement.

The sign is to be installed on a single-post Temporary Sign Support (TSS), but will not require the placement of a Type II or III barricade (see ODOT Standard Drawing TM821). On plan sheets, Designers should add, "(Mount on Single-Post TSS)" under each sign. ***Do not*** indicate the sign is to be mounted on a Type II barricade. Current ODOT temporary signs include the cost of the sign support. A Type II barricade is a separate pay item. A conflict arises when the sign is installed on the Type II barricade. ODOT expects the barricade cost to be included in the cost of the sign, while the contractor expects to be paid for the barricade. Therefore, indicate the sign is to be installed on a single-post TSS.

When included in the TCP, also include the current Unique Special Provision, "***00220-00225 – Business Access***" in the project-specific Special Provisions. Due to the specific purpose of the signing, this measure should limited to business accesses and not applied to private residential driveways or public streets.

3.4.4 – PAVEMENT PRESERVATION PROJECTS

INTRODUCTION

Pavement preservation projects make up a largest part of the highway construction projects completed each year. While larger, complex modernization or bridge replacement projects get most of the attention, pavement preservation projects demand a surprising amount of attention to detail regarding the temporary traffic control. Preservation projects have the potential of creating much more delay to the traveling public due to the nature of the work and the traffic control measures used – e.g. flagging one-lane two-way traffic.

PAVEMENT PRESERVATION PROJECT TYPES

ODOT includes Uniques Special Provisions for three distinct types of pavement preservation projects. Each Unique Special Provision includes a list of specific usage criteria described in the "Instructional Notes":

- For ***Minor Hot Mix Asphalt Concrete (MHMAC) and HMAC*** preservation projects:

  *"**Unique 00225 - MHMAC and HMAC Preservation Projects**"*

  Use this Unique Specification on Level 1, 2, or 3 MHMAC and HMAC Overlay (00744 or 00745) Preservation projects, provided the following criteria are met:

  - *Obtain Region Technical Center Manager's approval*
  - *Perform and/or document enough traffic analysis to confirm traffic volumes meet the following criteria:*
    - *ADT < 5,000 for roadways with posted speed > 45 mph*
    - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*

- For ***Emulsified Asphalt Surface Treatment (EAST)*** preservation project (a.k.a. "Chip Seals"):

  "Unique 00220/00225 - Emulsified Asphalt Surface Treatment"

  Use this Unique Specification on Chip Seal "Emulsified Asphalt Surface Treatment" (00710 or 00715) projects, provided the following criteria are met:

  - *Obtain State Traffic Engineer's approval*
  - *Compile Field Data Summary*
  - *ADT < 5,000 for roadways with posted speed > 45 mph*
  - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*
  - *Federally funded projects require* FHWA *approval*

- For ***Cold In-place Recycle (CIR) or Emulsified Asphalt Concrete (EAC)*** preservation projects:

  "Unique 00220/00225 - CIR and EAC"

  Use this Unique Specification on "Cold in Place Recycle" (00720) or "Emulsified Asphalt Concrete" (00735) projects, provided the following criteria are met:

  - *Obtain State Traffic Engineer's approval*
  - *Compile Field Data Summary*
  - *ADT < 5,000 for roadways with posted speed > 45 mph*
  - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*
  - *Federally funded projects require* FHWA *approval*

SPECIAL PROVISION "BOILERPLATES"

In the context of this manual, "Boilerplates" are prepared documents that can be used in the same way a form letter or a document "template" might be used. Boilerplates can be thought of as generic 'fill-in-the-blanks' documents where the TCP Designer inserts additional project-specific information, and deletes superfluous language.

Due to the dynamic nature of the temporary traffic control discipline, Boilerplates can also be used to make corrections or additions to the ODOT/APWA *Standard Specifications for Construction* after the book is published.

When beginning any new ODOT/APWA highway construction project, the TCP Designer must download a ***new copy*** of the Special Provision boilerplates for Sections 00220 and 00225 from the ODOT Specifications Unit web site.

For some projects, such as preservation projects, the Designer must also download copies of applicable "Unique" Special Provisions depending on the scope of work and other features of the project – "Unique" examples include: "00225 - MHMAC and HMAC", "00225 - Bicycles on Roadway", "00220 - Pipe Excavation", "00220-00225 Flagging 24 Hours", etc.

Boilerplates are updated frequently, so the TCP Designer should ***always*** download the current edition available on the ODOT Specifications web site before ***every*** project.

> ***NOTE***: If several months pass between the first time the boilerplates were downloaded and the completion of a project, the TCP Designer should consider downloading another new copy of the boilerplates and updating the Special Provisions for the project.

SIGNS AND STRIPING

Because preservation projects frequently obliterate existing striping, No Passing and Passing Zones need to be identified using, "DO NOT PASS" (R4-1) and "PASS WITH CARE" (R4-2) signs. In addition, the "NO CENTER STRIPE" (W8-12) signs with "NEXT XX MILES" (W7-3a) riders must be used to alert drivers and supplement temporary pavement markings.

From Section 00225.02 of the three preservation project Unique Special Provisions, contractors are given instructions to install these signs to replace the missing centerline pavement markings.

While the Unique Special Provision language for preservation projects also describes temporary pavement marking requirements, the markings are not sufficient enough to solely convey regulatory Passing and No Passing Zone restrictions. Therefore, the signs described above must be installed and remain posted until permanent markings are in place.

Other project-specific requirements for striping, signing and traffic control are included in each of the Unique Special Provision for the preservation projects.

3.4.5 - STEEL PLATING

On State Highways with a posted speed greater than 35 mph, contractors are not allowed to use steel plating to temporarily cover open trenching across the roadway or adjacent to the edge of the traveled way. Details of this specification language have been incorporated into the 2008 Standard Specifications for Construction under Section 00220.

The language is intended to address the placement of steel plating anywhere in the travel lane and on the shoulder.

For higher-speed roadways (40 mph and greater), it has been determined unsafe to have traffic, especially large trucks, traverse the steel plating. Despite efforts to secure the plating to the roadway, the high impact loads to the plates eventually loosen the plate and create extremely severe hazards for drivers.

If steel plating is used on lower-speed roadways, the current Section 00220 Special Provision boilerplate describe methods and materials to be used by the contractor to safely use steel plating under live traffic.

A separate Unique Special Provision, "*00220 – Pipe Excavation*", is available to address various scenarios involving trenching or the installation of piping or conduit transversely under the roadway. Conversations with the Construction Project Manager will help determine the appropriate language to include in your Special Provision.

3.4.6 – TRAFFIC CONTROL SUPERVISOR (TCS)

The Traffic Control Supervisor (TCS) is a specially trained and certified employee working for the prime contractor, or as a subcontractor. The TCS is responsible for coordinating the administration, proper installation, maintenance, layout and overall quality of the Traffic Control Plan, and the necessary temporary traffic control devices used on the project.

The TCS must carry a valid TCS Certificate. According to the specifications, the Project Superintendent shall not be assigned as the TCS on a construction project. For every day a TCS is to be on the project, the Engineer must be notified 24-hours in advance.

TCS are currently measured and paid for on a per "construction work shift" basis. The payment of one TCS "work shift" will be made regardless of length of the work shift. Payment will not be made until a Traffic Control Inspection Report (No. 734-2474) is completed for each day the TCS has finished a work shift.

Below are examples of some of the duties of the TCS from the current Specifications:

- Overseeing the installation, maintenance and removal of traffic control devices and markings
- Coordinating personnel, mobile equipment and supplies used in traffic markings, sign installations and roadway channelization
- Scheduling and insuring that all field assignments are satisfactorily completed according to prescribed traffic engineering plans.
- Supervising traffic control and maintenance crews

See Section 00225 of the Standard Specifications for additional information regarding TCS duties, measurement and payment details.

WHEN SHOULD A TCS BE INCLUDED IN A CONTRACT?

Technically, a TCS can be included on any project. However, it is recommended that a TCS be used when a project meets two or more of the following criteria:

- Multiple Stages involving repeated lane closures, traffic shifts or other significant disruptions to normal traffic operations
- The placement and/or repeated relocation of multiple TCD, including significant signing changes – i.e. detours or alternate route signing
- Projects with complex construction staging or complicated temporary alignments
- Night paving operations – particularly on freeways
- High ADT highways (> 10,000)
- Freeway work
- High profile projects with substantial community or stakeholder involvement
- When a formal TMP is required

TCS QUANTITIES

The current unit of measure for the TCS is the “construction work shift”. Quantities for the TCS will depend on a variety of conditions and factors, including:

- Scope and complexity of the work
- Duration of the contract (1 month? 1 year? Longer?)
- Physical length of the project
- Number of changes (Stages or Phases) to the traffic control layout
    - Lane closures or shifts
    - Work areas that progress along mainline on a regular basis
    - Opening/closing detour routes
- Facility type (freeways and high-speed, multilane roadways warrant additional TCS)
- The amount of work done at night (traffic control quality more critical at night)
- Site location and roadway geometry
- Seasonal weather conditions

However, the general practice is to provide one TCS construction work shift for each anticipated day of active work. A Designer should do their best in determining the construction schedule for the project, and determine a reasonable number of active work days. Winter shutdowns and other periods of work suspension should not be included in the TCS quantity estimate.

Additional TCS information is available in Section 00225 of the Standard Specifications and Boilerplate Special Provisions. See Subsections 00225.32, 225.88 and 225.98 for additional TCS details.

<u>QUANTITY CALCULATIONS – EXAMPLES</u>

- Freeway paving project expected to last 4 weeks. Paving approximately 2 miles per night. Shifting traffic three times per shift. Long, straight, flat section of freeway.
  - <u>TCS Quantity</u>: 4 weeks @ 5 nights per week = 20 shifts

    Consider adding small quantity for weather/mechanicals = 0 – 5 shifts

    TOTAL = 20-25 Work Shifts
- Bridge Replacement on two-lane, rural highway. ADT = 4500. Bridge replaced in three Stages. Two-way, one-lane traffic moved three times over 6-month-long project. Project starts in April. July and April likely to run two 8-hour shifts to meet completion date.
  - <u>TCS Quantity</u>: Three stages over 6 months = 6 x 23 days per month = 138 shifts

    <u>July – Second shift</u> = 23 shifts

    <u>August – Second shift</u> = 23 shifts

    <u>Two weekends</u> (1 shift each Sat & Sun) <u>July</u> & <u>August</u> = 2 x 2 x 2 = 8 shifts

    Contingency shifts = 5 shifts

    TOTAL = 197 Work Shifts

The TCP Designer should have regular discussions with the Construction Project Manager's office to confirm appropriate TCS quantities. Consider small adjustments (3%–10%) to TCS quantities as a contingency for changes in the staging plan or construction schedule.

However, like Flagger Hours, Designers should be prepared to justify their quantities for this pay item. Arbitrary or over-inflated quantities for this pay item should be avoided.

<u>TCS PAYMENT</u>

Within Section 00225.88, the TCS item is ***measured*** per "construction work shift". Under Section 00225.98, the TCS is ***paid*** for at the contract unit price, <u>per each</u> for the item "Traffic Control Supervisor" – meaning <u>each</u> unit is a, "construction work shift."

Payment is made for each Construction Work Shift that a TCS has been authorized to work on the project. Current language limits payment of a maximum of two TCS per single work shift. This is done to allow a TCS to be at each end of a very long project with active work areas many miles apart. It is also used to keep contractors from abusing the pay item quantity.

Traffic Control Plans Design Manual

11th Edition

Chapter 4
Specifications & Standard Drawings

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SPECIFICATIONS & STANDARD DRAWINGS

Chapter 4

4.0 – KEY POINTS OF THIS CHAPTER

- Purpose of Specifications and Standard Drawings
- Structure and Components of Specifications and Standard Drawings.
- Information on Selected Specifications and Standard Drawings.

4.1 – STANDARD SPECIFICATIONS

Highway construction specifications are a standard set of instructions, procedures and requirements directed at contractors and used to execute and manage a legal binding construction contract. The Specifications include descriptions for the scope of work, types of materials, equipment requirements, construction methods; and, measurement and payment methods for each work-related pay item.

4.1.1 – GENERAL OVERVIEW

The ***Oregon Standard Specifications for Construction*** are applicable to all highway construction projects within the State. The **2015** edition of the Oregon Standard Specifications **for Construction has been published and distributed. The 2015 Standard Specifications are in effect for all projects with a bid let date after January 31, 2015.**

Unlike the 2008 edition, the 2015 edition was published as a single volume – including Part 00100.. The 2008 Standard Specifications book is still available and is still valid for current construction projects that bid before February 1, 2015.

Visit the ODOT Specifications Unit website for current information on the 2008 and 2015 Standard Specifications.

STRUCTURE AND COMPONENTS - DIVISION FORMAT

The Standard Specifications are divided into 13 Parts according to function – e.g. Roadwork, Bridges, Water Supply Systems. Each Part is divided into Sections and Subsections. Sections are divided into ten different Subsections. Sections include only those Subsections applicable to the subject matter within the Section.

The Standard Specifications applicable to Temporary Traffic Control Plans are found in Part 00200, under Sections 00220 (Accommodations for Public Traffic) and Section 00225 (Work Zone Traffic Control).

The following table describes the ten different Subsections within each Section. Names and descriptions of the Subsection names remain consistent throughout the Standard Specifications, Special Provisions, and "Unique" Special Provisions. Subsections are identified as follows:

SUBSECTION NAME	***NUMBER***	***DESCRIPTION***
Description	**.01 - .09**	Includes the intended function (Scope) of the Subsection, Definitions, and other General Requirements
Materials	**.10 - .19**	Provides details for materials used on the project site – type, sources, physical properties, functions, etc.
Equipment	**.20 - .29**	Details for equipment, labor or additional items needed to accomplish the work
Labor	**.30 - .39**	Unique labor or qualification requirements
Construction	**.40 - .49**	Sequence of construction operations, needed processes, pay item project site limitations, and end product requirements
Temporary	**.50 - .59**	Unique temporary measures needed to accomplish the work. Not meant to supplement work zone traffic control measures
Maintenance	**.60 - .69**	Any required maintenance, repair or avoidance measures
Finishing & Cleaning Up	**.70 - .79**	Other related work required before the overall work and completion of the project is accepted
Measurement	**.80 - .89**	Units of measure and means by which pay items and work are calculated, totaled and recorded for payment
Payment	**.90 - .99**	Details, limitations, exclusions regarding payment for work or individual pay items based on the units of measure from the Measurement subsection

4.1.2 – STANDARD SPECIFICATIONS – SECTION 00220

SECTION 00220 – ACCOMMODATIONS FOR PUBLIC TRAFFIC – Focuses primarily on instructions and requirements for contractors to maintain facilities for all road users for the life of the project. TCP Designers should be familiar with this Section – paying particular attention to the following subsections:

00220.02 – Public Safety and Mobility

- *"Allow emergency vehicles immediate passage at all times"* – The TCP should consider and include measures and mitigations available to the Contractor for allowing for the passage of emergency vehicles at all times. The "at all times" clause may be accomplished, for example, through the use of a detour. However, Designers should work with Emergency Response and law enforcement agencies to ensure the detour route is viable, and does not compromise adequate response time or preclude access to sites cut off by the detour.
- *"Do not stop or hold vehicles…for more than 20 minutes"* – TCP and traffic control measures should avoid conditions where the contractor could create delays to stopped traffic for periods greater than 20 minutes. Despite current Mobility policies, during specific work operations (e.g. flagging two-way one-lane traffic), this allowance is still given to contractors. In rare cases, to more-aggressively limit traffic delays, the 20-minute duration has been reduced to as little as 10 minutes. Modification to this Standard Specification language should be carefully considered and discussed with Region Traffic Engineers, the Region Construction Project Manager and the Traffic Control Plans Engineer.

- *"Do not block driveways for more than two hours…"* – In developing TCP staging plans, Designers should anticipate potential disruptions of traffic flow across "driveways" due to construction activities – particularly business accesses. If necessary, additional measures may be needed (e.g. "Business Access" unique spec) to mitigate the affected accesses; or, changes to the TCP may be needed to minimize adverse impacts to the accesses.
- *"Do not perform work that restricts…both sides of the travelled way at the same time"* – The intent of this language is to allow vehicles travelling in one direction along a roadway segment to have the ability to exit the roadway in at least one direction (e.g. left or right). In addition, it provides drivers with an "escape route" in one direction – away from the work area – in the case of sudden traffic incident. In rare cases, there may be exceptions to this language. For example, if work is taking place on a one-lane elevated roadway or bridge where the work type might require activity to be done on both sides simultaneously (e.g. painting).
- *"Do not use steel plating…greater than 35 mph"* – Carefully consider construction staging that may result in the need to use steel plating on a high-speed road (≥ 45 mph). If unavoidable, Designers should explore what other options or strategies could be used to avoid steel plating:
    - Can the hazard be placed behind or protected with concrete barrier?
    - Could traffic be detoured?
    - Could the work be accelerated or incentivized to be completed in a single shift?
    - Could flagging be used to control traffic speeds over the plating?

  Ultimately, public traffic should not be left to control their speed under this situation.

00220.03 – Work Zone Notifications

- *"Over-Dimensional Vehicle Restrictions"* – If, during the development of the TCP, there is concern over impacts, or over any restrictions to over-dimensional vehicles (including within a detour), TCP Designers should discuss the specific TCP details with ODOT's Motor Carrier Transportation Division (MCTD). Times and dates for these impacts are difficult to determine during project development, however, notifying MCTD *early*, and updating them *often*, allows MCTD more time to communicate with the trucking industry and make adjustments to their schedules.
- *"Notify the MCTD…at least 35 calendar days before…"* – Primarily a specification intended for contractors. But, TCP Designers can use this language to refine staging plans – particularly with on-going conversations with Construction Project Managers to assist with reasonable construction schedules and other factors that may influence the TCP.
- *Closures – Lanes, Roads, Interchange Ramps, and Bicycle and Pedestrian Facilities* – Intended for contractors, Designers can refer to this language to more closely examine the staging plans and TCP for details and measures the contractor will need to mitigate any of the closures applicable under this subsection.

4.1.3 – STANDARD SPECIFICATIONS – SECTION 00225

SECTION 00225 – WORK ZONE TRAFFIC CONTROL – Focuses on providing traffic control measures necessary for conducting the work, as well as describing necessary traffic control devices, their expected function, placement, maintenance, measurement and payment. Designers should be familiar with this subsection, paying particular attention to the following subsections:

00225.02 – General Requirements

- Note all paragraphs included in this subsection regarding the standard signs installed on each project. Designers should use these paragraphs to develop their TCP – in placing the signs with respect to other signs, and the quantity for temporary signing.
- *"Do not allow construction vehicles to accelerate or decelerate in a travel lane open to traffic on a freeway or multi-lane facility"* – Designers should review their staging plan and determine if this situation can be avoided. If not, Designers should be looking for alternatives including temporary accesses, or allowable lane closure times for contractor vehicle acceleration/deceleration.
- *"Do not use a flagger to allow construction vehicles to access an open traffic lane on a freeway or a multilane facility"* – ODOT does not encourage or support the placement of a Flagger on a freeway or multi-lane facility acting in this capacity. During operations where multiple material delivery trucks are tasked with decelerating enough to safely enter into a closed lane to deliver construction materials (aggregate, asphalt, etc.), former practice would place a Flagger upstream of the access point to slow approaching traffic. Past experiences identified a number of issues:
    - Flagger locations were far enough upstream that inbound traffic speeds were at or above the posted speed. When displayed, interpretation of the Flagger's "SLOW" paddle message by approaching traffic widely varied. Dramatic speed differentials resulted in an increase of near-misses and likely rear-end crashes.
    - Placing the Flagger in a location that may not meet driver expectancy, and is usually of limited visibility (especially for nighttime operations), seemed to endanger the safety for the Flagger.
    - Other effective mitigations have been developed and employed since this practice has been discontinued:
        - "CONSTRUCTION VEHICLE DO NOT FOLLOW" (CW23-14) signs on the back of each material hauling vehicle.
        - Temporary Speed Zone Reductions reducing the legal posted speed prior to the work area.
        - Speed Radar Trailers to reinforce the reduced posted speed.
        - Increased spacing between temporary channelizing devices (from 40' to 80') to allow material delivery vehicles to navigate into the closed lane at slightly higher speeds.

  ODOT continues to discourage TCP Designers from including Flaggers on freeways or on high-speed multi-lane roads – either in the Specifications or shown on the plans – as a traffic control measure.

- *"When paving operations create an abrupt edge…"* – TCP Designers can use this language to identify and determine the Standard Drawings, the TCD (e.g. temporary signing), and TCD quantities needed for the TCP.
- *"…When extended traffic queues develop…"* – TCP Designers should work closely with the Traffic Analyst to determine the effectiveness of the staging plan and traffic control measure(s) proposed for the TCP – paying particular attention to analysis results for potential traffic queuing.

  If regular queuing can be anticipated, Designers should include a reasonable quantity of Flagger Hours based on the duration of the flagging operations and the amount of time during the shift (or 24-hour day) where extended queues will occur and need to be mitigated.

  NOTE: Extended queues can also develop in situations where driver expectancy is threatened or challenged – e.g. unfamiliar temporary alignments, dramatic changes in roadway width or roadside activities, limited sight distances, inclement weather, etc. Independent of the measures used to control traffic, these factors effectively reduce roadway capacities, affect free-flow speeds, and alter driver behaviors – all leading to excessive traffic queuing.

  For extreme or long-duration instances of these factors and conditions, Designers should consider including additional Flagger Hours to account for Extended Queue flagging, as well.

00225.10 – 00225.17 – TEMPORARY TRAFFIC CONTROL MATERIALS

TCP Designers should be very familiar with the traffic control measures and devices described in the following subsections. For consistency in safety, application, inspection, measurement and payment of these devices, agencies should refer to and enforce the language in these subsections when using these devices in their work zones.

- **00225.10 General** – "*Evaluate the condition of TCD using the…ATSSA…'Quality Guidelines for Work Zone Traffic Control Devices'*" – Designers should familiarize themselves with this handbook as it provides a field-level guide regarding agency expectations for device quality, maintenance and replacement during a construction project.
- **00225.11 Temporary Signing** – Includes important information regarding signs, supports and other accessories. Designers should also be aware of the cross reference to *Sections 00940* (Signs) and *02910* (Sign Materials) as they contain valuable information regarding temporary sign design and fabrication that is frequently referred to in a TCP.
- **Traffic Control Supervisor (TCS)** – *Section 00225.32 (Labor)* – A challenging TCP pay item due to its intended application and the development of pay item quantities for it. TCS duties are listed in this Section. Expectations for how and when a TCS is to report to the job site during non-working on-call hours is also explained.

  Consider the role of the TCS as that of the temporary traffic control "quarterback" – whose key responsibilities are centered on actions beginning as, "Notify…", "oversee…", "coordinate…", "review…", "inspect…", "prepare…", "provide…", "attend…", etc. The TCS can be considered the TCP supervisor for the project – but often hired by the prime contractor and included in the TCP as a pay item.

NOTE: If the TCS pay item quantity is *zero*, Special Provision language is added to the contract to identify a modified list of traffic control oversight "duties" the contractor is responsible for replaces the list identified under Section 00225.32 in the Standard Specifications. The modified list of duties is paid for under the Temporary Protection and Direction of Traffic (TP&DT) pay item identified in Section 00225.90(a-2).

TCS Measurement (00225.88) and Payment (00225.98)

Chapter 3 discusses details for determining TCS quantities. The Designer should work closely with Construction Project Managers to confirm TCS quantities.

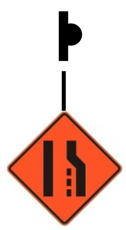
- **Inconsistent Temporary Signs** – *Section 00225.41(e)* – The Section attempts to get contractors to obscure temporary signs that are not applicable to the current work zone conditions, or otherwise provide erroneous information to public traffic. TCP Designers should be familiar with their staging plan and the need for all temporary signs in each Stage of the project.

  Designers may consider identifying specific signs in the TCP that should be covered or removed during a given Stage when the sign is not needed. This gives the agency more power to enforce this Section and makes the need/inappropriateness of the sign clearer.

  NOTE: If a temporary sign is needed for only one Stage of the project, ensure all other plan sheets do not display that sign. Contractually, contractors are paid for signs "shown in the plans". If a sign is repeated on a subsequent Stage, yet not actually needed during that Stage, contractors may still claim payment for the sign, as they may have bid the project in that manner. If a sign is needed for the duration of the project, under the first incident of the sign in the plans, "(All Stages)" may be included as a note beneath the sign (see Example below). On subsequent plan sheets, only a *reference* back to the initial sign is used (see Example below).

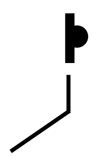
  EXAMPLE:

  From Stage I on Sheet 2C-5:

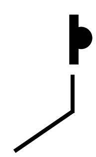
  (All Stages)

  Stage II, same sign needed on Sheet 2C-21:

  See Sheet 2C-5

  Stage III, same sign needed on Sheet 2C-34

  See Sheet 2C-5

- **Flagger Station Lighting** - *00225.47 (b)* – For projects that include nighttime flagging, include an appropriate number of Flagger Station Lights in the TCP. Remember to include additional units if flagging is anticipated for extended queuing.

4.2 – SPECIAL PROVISIONS

***NOTE*: ALL ODOT HIGHWAY CONSTRUCTION PROJECTS REQUIRE *SPECIAL PROVISIONS*.**

SPECIAL PROVISIONS – Commonly referred to as, "Boilerplates", and labelled as such on the ODOT Specifications Unit website. Special Provisions supplement the Standard Specifications, and serve to correct, add language to, or delete language from them. The "Boilerplate" Special Provisions also include more project-specific instructions and requirements that are used regularly in a project – but not on *every* project.

As the *Standard Specifications for Construction* book is updated, much of the corrective language in the boilerplates is incorporated into the new edition. The project-specific and conditional Special Provision language remains in the boilerplates.

Special Provisions can be found on the ODOT Specifications Unit web site, under the Highway Section, Engineering Services pages.

The Specifications Unit website also includes a link to the, "Specification and Writing Style Manual." This manual is critical in understanding the proper writing techniques used in writing specifications for ODOT highway construction contracts. Three key principles to remember in writing specifications for ODOT construction contracts are:

- Write specifications as instructions to the contractor
- It is implied instructions are to the contractor. Thus, "…the contractor…" can be omitted from most specifications
- Write using the imperative mood, whenever practical

The following provides an example of the imperative mood and preferred writing style. Instead of:

> *The contractor shall install temporary markers 10' feet apart along both sides of driveways within the work area.*

The specification would use the imperative mood, remove "the contractor" as the subject, and be written as:

> *Install temporary markers 10' apart both sides of driveways within the work area.*

4.2.1 – SPECIFICATION AND SPECIAL PROVISION WRITING

Before adding, deleting, or otherwise modifying Standard Specifications or Special Provisions, Designers should know the current requirements for making these edits. From the ODOT Specifications Unit website, see the Technical Services Bulletin 12-01(B). In general, if project-specific changes are made to Special Provision "Boilerplates" for *Sections 00220 – Accommodations for Public Traffic*, or *00225 – Work Zone Traffic Control*, they should be forwarded electronically to the Traffic Control Plans Engineer in Salem, for concurrence. In addition, if changes are made to the 00225.80's (Measurement) or 00225.90's (Payment) subsections, these changes must also be sent to the Specifications Engineer for concurrence.

Any edits to the 00100 Section of the Standard Specifications regarding legal or contractual requirements must be reviewed by the Department of Justice (DOJ). The ODOT Specifications Engineer will coordinate with DOJ the review of any changes.

When a change to a published Standard Specification or Special Provision is needed or proposed, the ODOT Specifications Unit asks that a Specification Change Request Form (see their website) be completed and submitted to them for processing.

PROJECT-SPECIFIC SPECIAL PROVISIONS

TCP Designers typically only modify the Special Provision "Boilerplates" when developing the project-specific Special Provisions for the traffic control plan. The Designer will edit the "Boilerplate" documents to meet the needs of their individual project.

In starting a new project, TCP Designers first need to download a current copy of the "boilerplates" for both Sections 00220 and 00225 from the Specifications Unit website.

NOTE: ***Always*** download a new version of the Section 00220 and 00225 boilerplates before starting a new project. Special Provisions are updated and changed often. As a rule of thumb, if several (2-3) months lapse between the initial development of your project specifications and before the Special Provisions are to be sent out for final approval/concurrence, download a new version of the boilerplates to ensure no updates have been made that might conflict with other portions of the TCP.

While editing your project-specific Special Provisions, ensure "Track Changes" is ***on*** in Microsoft Word to record the changes made. In editing the Special Provisions, do the following:

- Delete portions that do not directly apply to the project – particularly to portions referring to pay items that have a *zero* quantity.
- Carefully read the, "Instructional Notes" in ***(parentheses and in colored, bold, italicized font)***. Follow applicable instructions, then delete Instructional Notes before providing the final draft.
- Cut/paste language from all applicable, "Unique" Special Provisions (see Section 4.2.4, below) into the project-specific Special Provisions.
- Fill-in all blanks with the appropriate information

Before submitting the final hard copy version, Designers should "Accept All Changes in Document".

4.2.2 – SECTION 00220 "BOILERPLATE" SPECIAL PROVISION

From the 2015 Section 00220 boilerplate, TCP Designers should note the following subsections:

SECTION 00220.02 – Public Safety and Mobility

The bullet that begins, "When performing trench excavation…", complements the Standard Specification addressing the use of steel plating on roadways with a posted speed greater than 35 mph. This special provision language provides additional instructions and expectations to contractors in the case where the posted speed is over 35 mph. The measures included in the language can aid the TCP Designer in developing their TCP – including considering necessary pay items, pay item quantities, and modifications to staging plans to potentially avoid the situation.

Work Zone Traffic Analysis and 00220.40(e) – Lane Restrictions

In most highway construction projects, traffic lanes may need to be closed for various lengths of time to complete the work. Within ODOT, conducting site-specific Work Zone Traffic Analysis (WZTA) will result in times and days when one or more traffic lanes can be closed. WZTA and the proper determination of when lanes can and cannot be closed is critical in preserving safety within the influence area of the work zone, managing congestion and worker exposure, minimizing travel delay;

and, maintaining driver expectancy for a given facility type. WZTA can also be used to optimize construction costs and scheduling efficiencies through effective staging strategies.

Subsection ***00220.40(e-1) Closed Lanes***, if modified as a result of WZTA, will include project-specific times when the contractor may close one or more traffic lanes.

SECTION 00220.40(f) – Limited Duration Road Closure

Used for a wide variety of road or facility closures, Designers may edit the language to use the subsection for interchange ramp closures, intersecting side streets, accesses, etc. In editing this subsection, Designers should include sufficient detail to clearly indicate the facility being closed, the allowable length of the closure, any additional TCM needed to safely conduct the closure, additional TCD needed to properly sign the detour, etc.

SECTIONS 00220.41 through 00220.45

The subsections include additional language focusing specifically on Bridge Work. Designers can use this language to provide additional details in the TCP that will aid contractors in conducting the work safely, efficiently and cost-effectively. Useful language includes:

- Instructions to begin bridge work only after all equipment, labor and materials are on hand to complete work efficiently and quickly.
- References to the TCP – indicating the need for adequate TCD and signing for proper road closures and detours
- Load restrictions for existing bridges under construction or being used for staging.

4.2.3 – SECTION 00225 "BOILERPLATE" SPECIAL PROVISION

From the 2015 Section 00225 boilerplate, TCD Designers should note the following Subsections:

SECTION 00225.02 – General Requirements

A considerable amount of project-specific language in contained in this subsection that a TCP Designer can use to generate TCP pay items and quantities, including:

- Standard project signs – e.g. "ROAD WORK NEXT XX MILES", "ROAD WORK AHEAD", "FINES DOUBLE", Project Identification signing, and "END ROAD WORK" signs.
- Horizontal and vertical clearance signs.
- Detour and Road Closure signing.

SECTION 00225.12(h) – Pedestrian Channelizing Devices (PCD)

The PCD is used to separate, guide and protect pedestrians through or around work areas that have disrupted existing pedestrian facilities. In cooperation with Section 00220.02, PCD from the ODOT Qualified Product List are ADA-compatible and, when used properly, provide safe channelization for all pedestrians – particularly visually-impaired pedestrians and those requiring wheelchairs for mobility. Designers should include PCD quantities for projects where existing pedestrian facilities have been altered or disturbed by construction activities and a temporary alternate facility or route is necessary. See *Chapter 3* for additional details regarding PCD application.

4.2.4 – “UNIQUE” SPECIAL PROVISIONS

Unique Special Provisions modify Standard Specifications and/or Special Provisions. Unique Special Provisions are narrower in scope – addressing a highly specialized TCM, device or condition – and included in projects on an, "as needed" basis. While most “Uniques” add new language, they may also replace Standard Specifications and/or Special Provisions. Designers should read through Instructional Notes carefully for each “Unique”.

Examples of “Unique” Special Provisions include language aimed at addressing “Business Accesses”, “Rumble Strips”, “Abrupt Edges (for Excavation)”, and “Bicycle Accommodation”, among others. If custom Special Provision language is needed, contact the Technical Expert and the Specifications Unit for help.

By their nature, Unique Special Provisions are not included in the majority of projects, but TCP Designers are responsible for carefully and regularly through the list of Unique Special Provisions available on the ODOT Specifications Unit website as they develop their TCPs and begin assembling their project-specific Special Provisions.

4.4 – HIERARCHY OF DOCUMENTS

A wide variety of documents are used to assemble a TCP and develop a construction contract. Designers should make every effort to avoid contradictions and conflicts within those contract documents. The Oregon Standard Specifications for Construction lists a hierarchy for the documents included in a construction contract. This list is identified as the, “Order of Precedence” under ***Subsection 00150.10 (a)***. Review this subsection and become familiar with the hierarchy for the contract documents within your project.

4.5 – STANDARD DRAWINGS

General information, typical applications, and common layouts for temporary traffic control devices are shown in the ODOT Temporary Traffic Control Standard Drawings – currently under the ***TM800 Series***. The TM800 series drawings show traffic control layouts for many common work zones, including 2-Lane, 2-Way Roadways, Freeway Sections, Bridge Constructions, and Signalized Intersections.

The Standard Drawings can be found on the ODOT website by using the following link sequence:

- ➔ “Technical Services”
    - ➔ “Sections”
        - ➔ “Traffic-Roadway Section”
            - ➔ “Roadway Engineering”
                - ➔ “Visit the Standard Drawings Page”

Or, by searching the internet for, “***ODOT Standard Drawings***”. The first link should be for the *Oregon* DOT Standard Drawings homepage.

IMPORTANT: The drawings show general information and common practices. They can be used to convey, instruct, or provide layout information for a variety of common, non-site specific work zone activities. Standard Drawings should ***not*** be used to:

- Substitute for complex, multi-stage traffic control plans. Project-specific plan sheets should be developed for more elaborate staging plans.
- Create excerpts by cutting small details from the drawings and copied into other documents or portions of a TCP. Standard Drawings are an engineered product sealed by the Traffic Control Plans Engineer. Changes or deviations from Standard Drawings should be developed as separate details within a TCP and sealed by the responsible engineer (e.g. "Engineer of Record").

Designers should select the Standard Drawing(s) most applicable to project activities and that contain other details that will be needed at some time during the project.

NOTE: Standard Drawings selected for the project must coincide with language included in the Special Provisions written for the project. Designers should also ensure that if Special Provisions refer to a specific detail on a Standard Drawing, the temporary traffic control measures and devices shown in that detail have an associated pay item quantity (unless otherwise addressed in the special provisions).

If a construction project is not complicated and does not require extensive construction staging, it may be possible to adequately convey construction information to the contractor using only the appropriate Standard Drawings, Standard Specifications and project-specific Special Provisions. Project-specific staging plan sheets may not be needed.

Each of the current TCP Standard Drawings has been organized to include similar details making it easier to locate specific information. The set of TCP drawings have been divided into subsets, with each subset being reserved for the following categories:

- TM800 – Standard TCP Details
- TM810s – Category I Devices (*using FHWA Crashworthy designations*)
- TM820s – Category II Devices
- TM830s – Category III Devices
- TM840s – Urban settings (Speeds < 45 mph)
- TM850s – High-speed roadways (Speeds 45 mph or higher)
- TM860s – Freeways applications (Speeds 55 mph or higher)
- TM870s – Special applications
- TM880 – Freeway speed control measures for paving operations

A brief description of the contents and function for each Drawing is included below:

TM800 – Tables, Abrupt Edge, and PCMS Details

The tables on this drawing are referred to often on other TCP Standard Drawings. The most commonly used tables include:

- Concrete Barrier Flare Rate
- Taper Rates & Buffer Lengths
- Traffic Control Device Spacing Table

This drawing also includes details for the application of:

- Abrupt Edge treatments and Signing
- Portable Changeable Message Sign (PCMS) Installations
- Flagger Station Lighting delineation
- General Notes for All TCP Temporary Traffic Control drawings

TM810 – Temporary Reflective Pavement Markers

Includes details for a variety of patterns using temporary reflective pavement markers to either simulate or supplement other pavement markings.

TM820 – Temporary Barricades

Includes fabrication and notation details for Type I, II and III temporary barricades

TM821 – Temporary Sign Supports

Includes a detail describing proper temporary sign placement, as well as details for the construction of the three primary types of temporary sign supports:

- Double Post TSS
- Single Post TSS – Including specific instructions for “Business Access” signing
- Concrete Barrier sign support

TM830 – Temporary Concrete Barrier and Longitudinal Shoulder Rumble Strip Details

Includes details for pinning temporary concrete barrier to asphalt concrete (AC) and Portland cement concrete (PCC) pavement surfaces. Also includes a detail for the removal of existing longitudinal shoulder rumble strips.

TM831 – Temporary Impact Attenuators

Displays configurations for temporary (sand barrel array) impact attenuators based on the pre-construction posted (design) speed. Includes installation details for a standard installation as well as a “zero-offset” installation.

TM832 – Temporary Impact Attenuators

Displays configurations for temporary (sand barrel array) impact attenuators used to protect the blunt end of a double run of concrete barrier. Configurations are based on the pre-construction posted (design) speed.

TM840 – Closure Details

Includes details for establishing a variety of closures including highway, street and sidewalk closures. Also includes a detail for the fabrication of a "trailblazer" detour sign cluster.

TM841 – Intersection Work Zone Details

Includes details for conducting a variety of lane closures under various work area locations and roadway configurations:

- 2-lane, 2-way streets for one-lane closures and shoulder closures
- 4-lane, 2-way streets for right-side, near-side and far-side closures
- 2-lane, 1-way streets for right-lane closures

TM842 – Signalized Intersection Details

Includes details for establishing and protecting work areas in the vicinity of signalized intersections on two or three-lane roadways.

TM843 – Multi-lane Signalized Intersection Details

Includes details for establishing and protecting work areas in the vicinity of signalized intersections on four or five-lane roadways.

TM844 – Temporary Pedestrian Access Routing

Includes details for routing pedestrians through and around work areas.

TM850 – 2 Lane, 2-Way Roadways

Includes details for sign placement, lane closures and flagging operations on two-lane, two-way roadways.

TM851 – Non-Freeway Multi-lane Sections

Includes details for lane closures and establishing work zones on multi-lane, non-freeway roadways.

TM852 – Non-Freeway Multi-lane Sections

Includes additional details for lane closures, shifts and establishing work zones on multi-lane, non-freeway roadways.

TM860 – Freeway Sections

Includes details for conducting basic lane and partial ramp closures on a freeway section.

TM861 – Freeway Sections

Includes details for establishing a single-lane closure for pavement preservation work on a freeway section.

TM862 – Freeway Section

Includes details for establishing a two-lane closure for pavement preservation work on a multi-lane freeway section.

TM870 – Bridge Construction

Includes details for establishing a two-way, one-lane operation using either flaggers or a temporary traffic signal during the construction of a new bridge.

TM871 - Blasting Zones

Includes details for protecting traffic from a blasting zone on either two-lane or divided highways.

TM880 – Freeway or Divided Highway Speed Reduction (Paving Operations)

Includes details for speed reductions related to paving work on a freeway/divided highway.

OTHER RELEVANT DRAWINGS

Other Standard Drawings that could be included in the contract based on the scope of work and contents of the TCP include:

RD410..............................Guardrail Parts (Thrie Beam)
RD420..............................Energy Absorbing Terminal
RD425..............................Non Energy-Absorbing Terminal 3’ or 4’ Flare
RD500..............................Precast Concrete Barrier Pin and Loop Assembly
RD510..............................Concrete Barrier Terminal
RD530..............................Guardrail Transition to Concrete Barrier
RD535..............................Concrete Barrier (Modified) Around Median Obstacle
RD545..............................Precast Tall (42”) Concrete Barrier
RD560..............................Cast-in-Place Tall Barrier Transition to Standard Concrete Barrier
BR233..............................Thrie-Beam Rail and Transition
BR236..............................Trailing End Bridge Connection Concrete Bridge Rail to Guardrail
TM204.............................Flag Board Mounting Detail
TM211.............................Signing Details US and Interstate Route Shields
TM212.............................Signing Details Oregon Route Signs
TM570.............................Traffic Delineators
TM575.............................Traffic Delineator Installation for Freeways
TM576.............................Traffic Delineator Installation for Non-Freeways
TM670.............................Wood Post Sign Supports
TM671.............................3 Second Gust Wind Speed Map
TM677.............................Sign Mounts
TM681, TM687, TM688 ...Perforated Steel Square Tube Sign Support Installation and Foundation

4.6 – STANDARD DETAILS

Standard Details may be used to provide additional information for a specific task, material or construction procedure not already described for the contractor in either the Special Provisions or on a Standard Drawing. Standard Details are intended to be copied into the Traffic Control Plan sheets at the beginning of the plan set (see the ODOT Contract Plans Development Guide (CPDG) for details). Standard Details may also, in some circumstances, be used to supplement Special Provision language and traffic control plan sheets.

In the Special Provisions, include the reference to the specific Standard Detail by calling out the traffic control plan sheet number where the detail has been inserted – e.g. "See Rumble Strip Detail on Sheet 2C-2." This helps ensure the contractor sees the Detail and uses it to complete the specific work activity.

A number of Traffic Control Plan Standard Details are available on the ODOT "Standard Drawings" link under the "Roadway Engineering" web site described in Section 4.5, above. For example:

- DET 4700 – Automated Flagger Assistance Device (AFAD) for Red/Yellow Lens AFADs
- DET 4705 – Automated Flagger Assistance Device (AFAD) for Stop/Slow AFADs
- DET 4710 – Temporary Transverse Rumble Strips
- DET 4720 – Diversions and Cross Overs
- DET 4740 – Rolling Slowdown Method
- DET 4750 – 3 Lane 2-way Roadways
- DET 4760 – Temporary Glare Screen

Standard Drawings for TCP Design	
Dwg. Number	**Drawing Titles**
TM800	Tables, Abrupt Edge, and PCMS Details
TM810	Temporary Reflective Pavement Markers
TM820	Temporary Barricades
TM821	Temporary Sign Supports
TM830	Temporary Concrete Barrier and Rumble Strip Details
TM831	Temporary Impact Attenuators (Single Barrier Run)
TM832	Temporary Impact Attenuators (Double Barrier Run)
TM840	Closure Details
TM841	Intersection Work Zone Details
TM842	Signalized Intersection Details
TM843	Multi-Lane Signalized Intersection Details
TM844	Temporary Pedestrian Access Routing
TM850	2-Lane, 2-Way Roadways
TM851	Non-Freeway Multi-Lane Sections (Shoulder, 2-Lane, Int./Ext. Lane Closures)
TM852	Non-Freeway Multi-Lane Sections (Crossover & Median Closures)
TM860	Freeway Sections (Shoulder, 1 Lane Closure, On & Off Ramp)
TM861	Freeway Sections (Overlay Work - 1 Lane Closure)
TM862	Freeway Sections (Overlay Work - 2 Lane Closure)
TM870	Bridge Construction
TM871	Blasting Zones
TM880	Freeway or Divided Highway Seed Reduction (Moving Operations)

Traffic Control Plans Design Manual

11th Edition

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Chapter
5

CHAPTER 5 - TRAFFIC CONTROL PLANS DESIGN

5.1 – TRAFFIC CONTROL PLANS

NOTE: While this chapter is primarily written with the ODOT project development and plans production processes in mind, there is information in the following Sections that may be of value to members of other agencies responsible for the design and implementation of temporary traffic control plans.

A Traffic Control Plan (TCP) consists of written instructions, and often engineered drawings, that a contractor uses to construct a highway project, while guiding and protecting traffic passing through or around a work zone.

The primary function of a TCP is to provide for the safe and efficient movement of road users through or around work zones while protecting on-site workers, incident responders, and equipment, while providing for the efficient construction and maintenance of the highway. The needs and control of all road users (i.e. public traffic, bicyclists, and pedestrians) through a work zone are an essential part of highway construction.

Therefore, the four primary functions of a TCP are to provide:

1) **Efficient Traffic Flow**
2) **Enhanced Safety**
3) **Minimized Inconvenience**
4) **Adequate Mobility for All Road Users**

Planning for the TCP should be started as **early** in the Project Development process as possible – especially for larger, “significant” and more complex projects. Consider a variety of staging options for the TCP – including those options where separation between workers and public traffic can be maximized. Regularly communicate with Project Team members and utilize all available resources when optimizing the TCP – particularly Construction Management staff to address constructability issues.

5.2 – PLAN SHEET FUNCTION & SEQUENCE

TCP plan sheets are customized for each project based on the scope of work and the complexity of the project. If the project can be built without the need for involved stages, detours or other complexities, plan sheets may not be needed. Designers are responsible for determining if the development of project-specific plan sheets will help clarify the intentions of the TCP and construction staging sequence, however, Construction Office staff should be brought into this decision-making process. They may have a unique perspective on past experiences with a particular project type or the benefits associated with having additional details for a give activity.

Plan sheets are typically added when additional information would significantly aid in bidding on and building the project. Plan sheets are used when communicating detailed information solely through Standard Drawings and Special Provision language is inadequate.

TCP Designers are strongly encouraged to consider developing project-specific plan sheets for those situations that are obvious and for those that are less-obvious. Plans sheets for pedestrian accommodation portions of a project are particularly encouraged.

WRITTEN TCP

A "**Written**" TCP, as the name would imply, does not typically include plan sheets. A "written" TCP will include project-specific specification language and cross-reference Standard Drawings for the basic traffic control device layouts to be used for construction. Any additional project-specific details are typically included in the project special provisions and within the itemized cost estimate.

PLAN SHEETS

For more complex projects, plan sheets are necessary to develop a safe, efficient and comprehensive staging plan. The staging plan is valuable for showing one interpretation for the construction sequence and how the roadway is divided amongst road users and the construction work space.

Plan Sheets are needed when the following components are included as part of the project TCP:

- Detours
- Staging – Where locations for traffic and the work area are shifted around within the project limits more than once over the life of the project. For example:
    - Bridge replacements using one or two-lane on-site diversions
    - Full-depth pavement reconstruction
    - Construction of temporary roadways to support live traffic
    - Modifying existing traffic flow patterns to accommodate temporary traffic flows (e.g. one-way street converted to a two-way street)
- Interchange modifications, upgrades or construction of new elements
- Significant horizontal or vertical roadway alignment changes
- Complex activities at intersections or other locations with multiple accesses or conflicts

When developing a TCP, Designers should evaluate the following key design elements:

- ***Strengths and Opportunities*** – Chances available to the Designer to accelerate or simplify construction, to separate workers from public traffic; and, to minimize traffic delays. Taking advantage of the staging plan, local transportation services and infrastructure; and, other features of the existing project site and surrounding environment.
- ***Weaknesses and Threats*** – Significant hurdles – even "fatal flaws" – within the existing site or proposed project. Issues or constraints that will have a notable impact on the TCP design and constructability of the project. Site restrictions that might create additional challenges for the TCP Designer, Project Team, Construction Management staff and contractor as the project is developed and eventually constructed.

Designers will be confronted by a broad range of factors and considerations as they develop their TCP. Understanding the scope of work and having multiple technical resources available will aid in developing a safe and effective TCP.

The following are some specific factors that can influence the development of a Traffic Control Plan:

- ***Traffic Data*** – Existing volumes, facility capacity, 85^{th} percentile speeds, truck percentages, crash history and problem areas within the project limits
- ***Roadway Characteristics*** – Horizontal and vertical alignments, number of lanes, lane and shoulder widths, pavement types and condition, sight distances, surrounding terrain, and local environs (e.g. urban, rural, commercial, residential, etc.)
- ***Traffic Control & Safety Appurtenances*** – Signs, structures, traffic signals, roadside barriers, pavement markings, lighting, and other traffic control devices
- ***Construction Details*** – Materials used for finish product, excavation quantities and locations, project durations, available right of way and work area separation from traffic, and number of accesses adjacent to work areas

Traffic control plans are developed in response to and in cooperation with the contents of the Roadway plan sheets. The staging of the project coincides with the finished products being built – with the exception of temporary work that may be needed prior to permanent features or subsequent Stages to allow for the accommodation of traffic and presence of construction activities in close proximity with one another. For ODOT projects, TCP sheets are typically arranged as follows:

1) **Detail Sheets** – Include additional information for specialized construction activities, customized temporary signs, or other unique devices or products.
2) **Detour Sheets** – Display designated route(s) for traffic to circumvent the work zone using existing alternate routes. Includes details for points of closure, detour-specific signing, devices and other detour route conditions, restrictions or information.
3) **Plan Sheets** – Construction staging drawings identifying the portions of the work area used by live traffic and those available to the contractor for construction. Includes details for the location, type and quantity of traffic control devices required to guide and protect traffic through the work zone.

See *Figure 5.1* through *Figure 5.4*, below, for examples different kinds of TCP plan sheets. Visit the ODOT E-Plans website for examples of actual project TCP plans.

NOTE: The use of a certain traffic control measure in one project does not constitute a TCP "standard", nor does it warrant its use in subsequent projects.

STAGE vs. PHASE

A Stage includes the construction required to complete the work on one portion of the roadway while traffic uses the remaining portion. Subsequent Stages moves traffic to the newly constructed portion, and allows work to take place on the portion vacated by traffic. Multiple Stages and Phases are developed, as needed, for more complex projects. Plan sheets should be developed and labeled for each Stage. Stages will show the traffic control needed to protect the work area and guide, regulate, and warn traffic moving through the project.

A Phase is a smaller, more distinct portion of a Stage. Typically, during Phase construction, mainline traffic alignments do not change, rather traffic is shifted within the space for traffic, while work on associated segments is completed. Plan sheets should be developed and labeled for each Phase within each Stage.

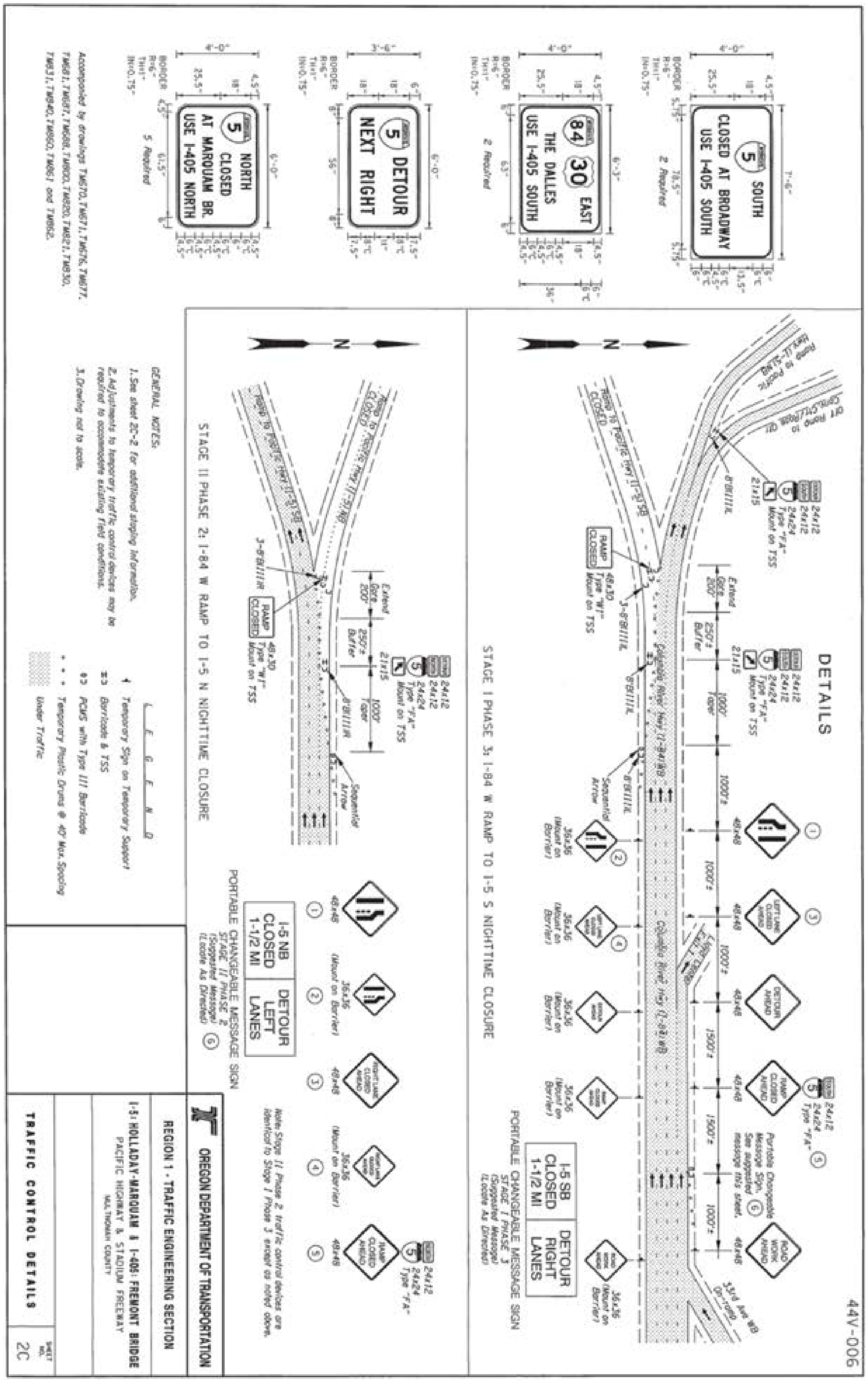
PLAN SHEET NUMBERING

TCP sheet numbering should follow the guidance shown in the Contract Plans Development Guide (CPDG). Sheet numbering within the TCP series shall be accomplished using number extensions beginning with number 2 (i.e., 2, 2A, 2A-2, 2A-3...).

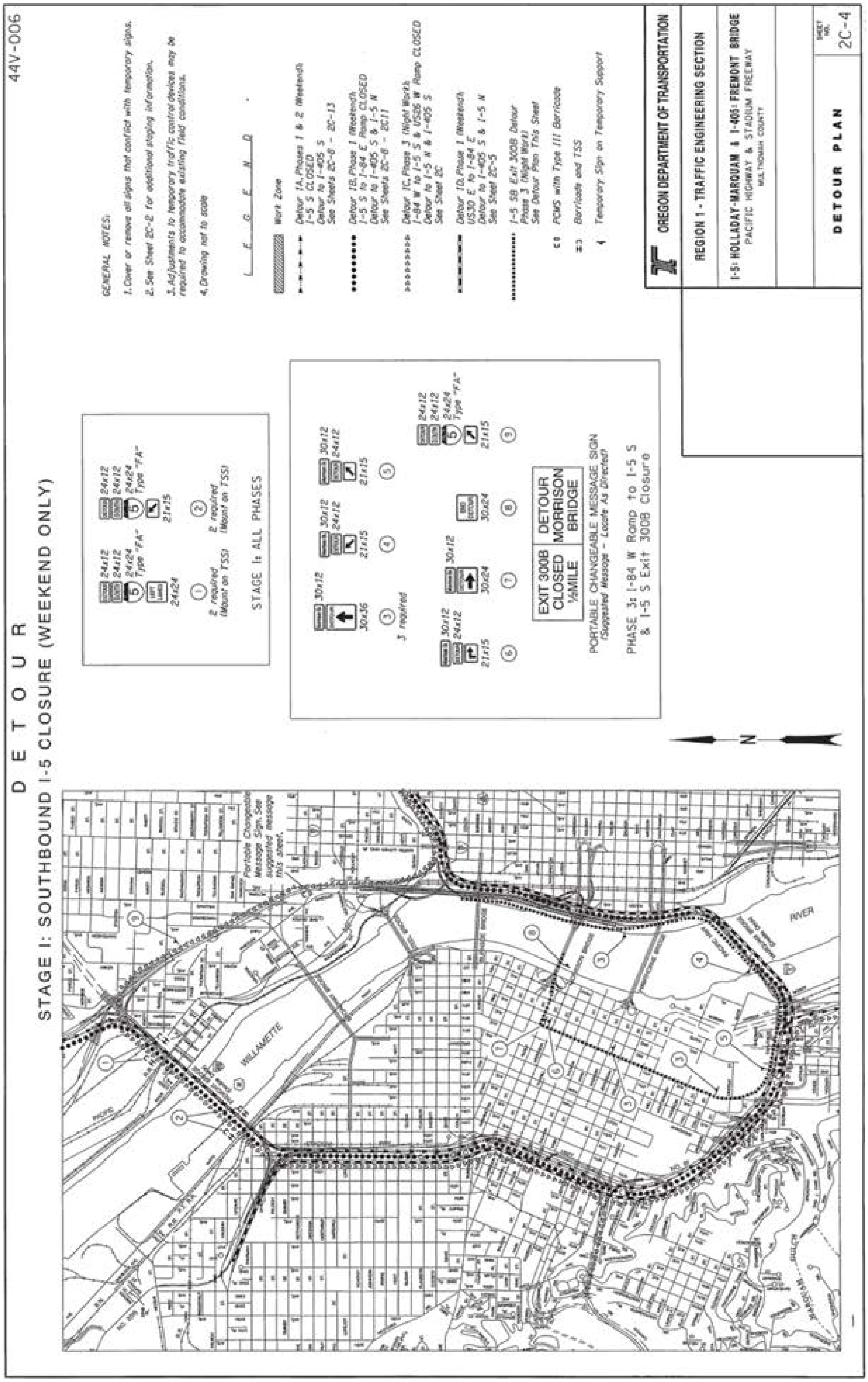
When *Typical Sections* and *Details* are included in the contract plan set, the Traffic Control plan sheets become "2C", "2C-2", "2C-3", etc. If either the *Typical Sections* or *Details* are dropped from the project, the TCP plan sheets would become, "2B", "2B-2", "2B-3", etc. If both *Typical Sections* and *Details* are dropped from the project, the TCP sheets would end up as, "2", "2A", "2A-2", etc.

Further, when the first Section in a plan sheet Series only includes one sheet, the next Section would begin with the letter A. For example, if the *Typical Sections* have only one sheet, the *Typical Section* sheet would be numbered as, "2". *Details* would become the "2A" Series, and the TCP sheets would become the "2B" Series.

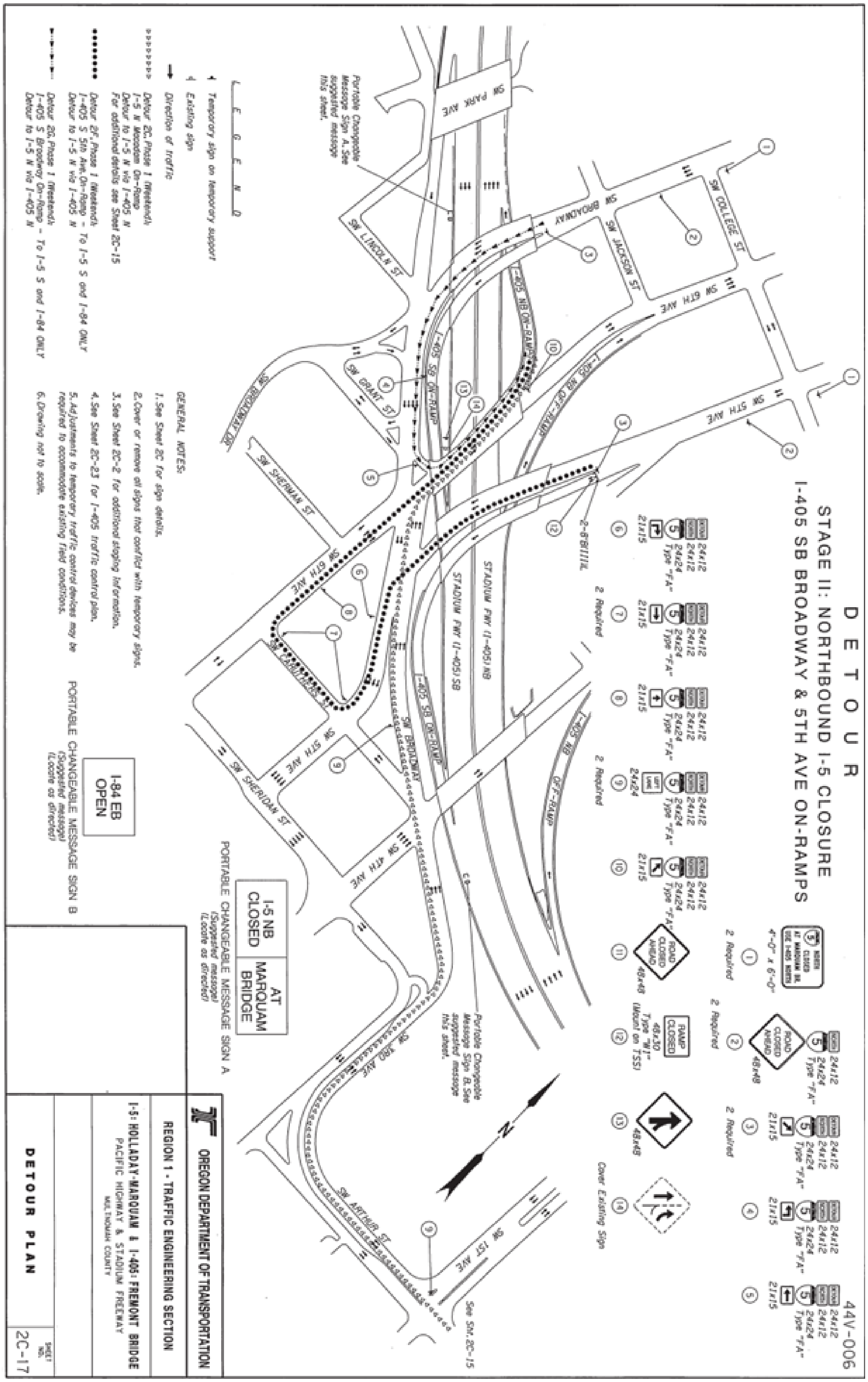
Details Sheet – Figure 5.1



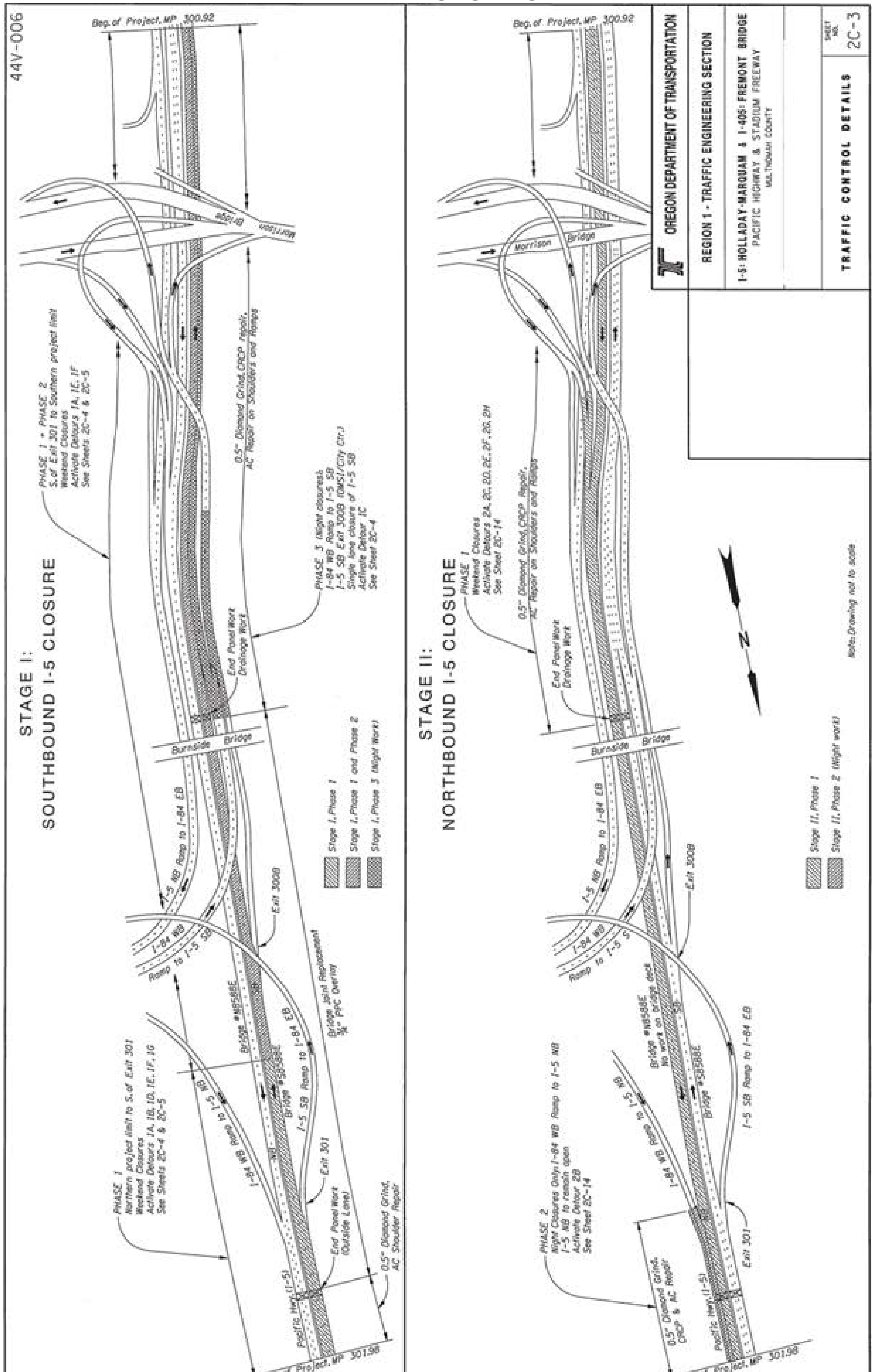
Detour Sheet – Figure 5.2



Detour Sheet – Figure 5.3



Plans Sheet – Staging – Figure 5.4



5.3 – PLAN SHEET DEVELOPMENT

In its contract plan development process, ODOT uses the following terminology for the differing layers of design that make up a complete project design.

BASE SHEETS

The Base Sheets (or Base Map) act as the starting point for the development of the TCP – helping to provide early suggestions as to the number of Stages and Phases needed for the project. The base map is derived from the existing Roadway plan sheets.

The following features are represented on the Base Sheets:

- Engineered alignments and centerlines
- Existing edges of pavement
- Engineering Station labels
- Existing roadway appurtenances

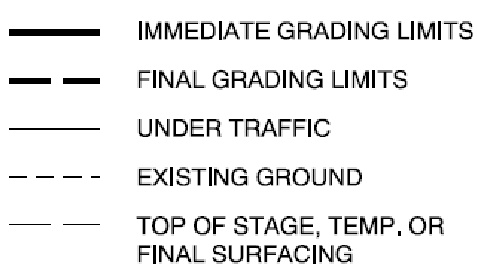
For ODOT contract plans development, the typical scale for the traffic control plans is 1”=200’ – half the scale of the Roadway plans (1”=100’).

CROSS SECTIONS

Cross sections are a representation of the typical sections associated to a particular stage at a given station, but with the distinction of showing multiple phases of construction on a single diagram (e.g. Final grade, Existing ground, Top of Stage, etc.). Typical Sections, developed by the Roadway designer, are a graphical representation of the work within the project limits at a specific Engineering Station. Typical Sections provide a detailed illustration of the construction components being built, removed, moved or otherwise incorporated into the project at a specific location during a particular time in the contract and should be used by the TCP designer to aid in the TCP design.

Once the location for a representative Section has been selected, the Section should be shown for every Stage throughout the plans. The Cross Section will illustrate how the entire roadway will be constructed by showing each Stage at that location.

To differentiate the various Stages in time on each Cross Section, a unique line style is used for each of the following surfacing components:

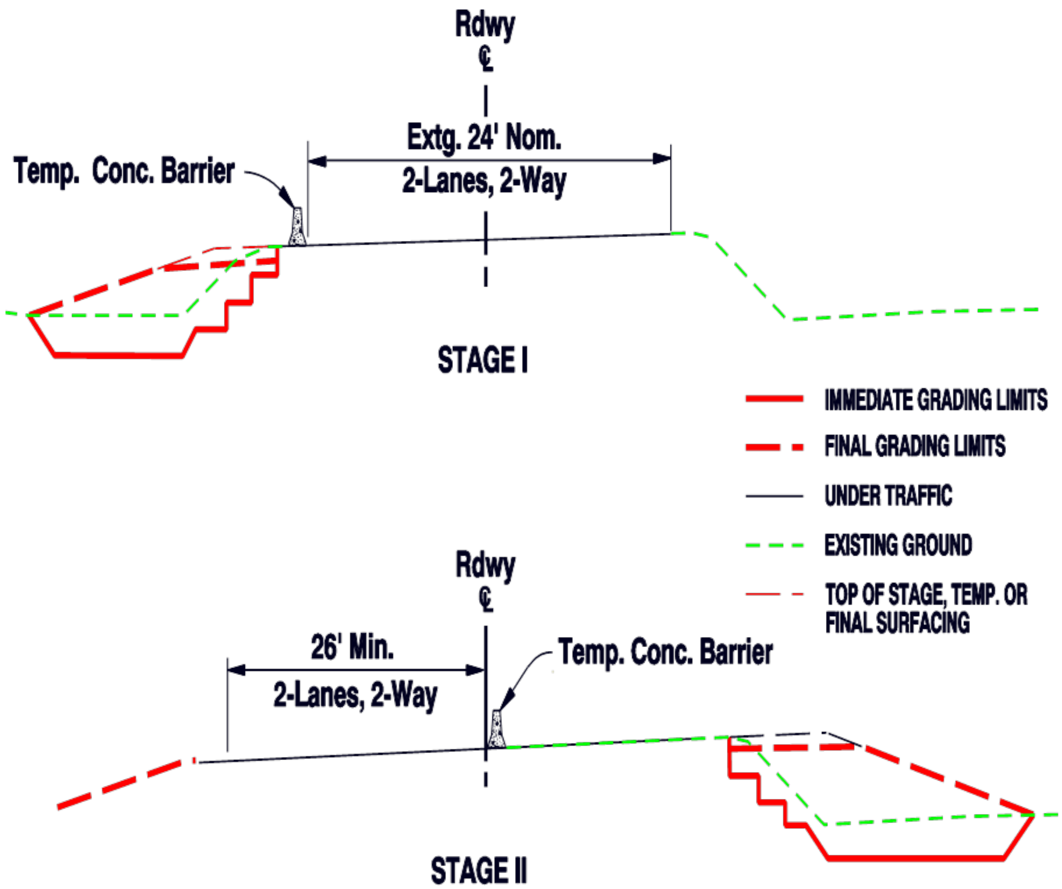


Dimensions on the Cross Section will show the width available for traffic. The TCD separating the work area from the ”Under Traffic” area, should also be shown. The “Under Traffic” area is determined by evaluating the scope of construction, TCD, and staging requirements during each stage.

The cross section should be scaled at 4 to 5 times the size of the plan scale to provide adequate detail – preferably between 1”=40’ and 1”=50’. The cross section can be placed on the same plan sheet where the Station exists, or on a separate sheet, where space allows. A separate plan sheet may be preferred when multiple sections are taken from a single plan sheet.

Through comprehensive evaluation, it can be determined if the available lane width during a Stage/Phase is adequate. When the available lane width is less than adequate, staging or construction alternatives are considered – including constructing temporary roadway widening. In some cases, it may be advantageous to build temporary surfacing – despite the fact that the surfacing may be “throw away”. Other alternatives include compensating for the narrower width by limiting the duration of the work, utilizing different traffic control measures, rearranging Stages, or developing a broader mitigation strategy.

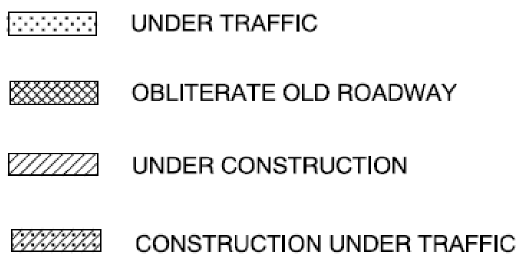
See *Figure 5.5* below for example Cross Sections for “Stage I” and “Stage II”. Note the multiple line styles shown – representing existing and future surfaces – simultaneously on a single diagram.



Cross Sections for Stages I and II – Figure 5.5

PLAN SHEETS

Using the earlier base sheet and cross section information, the TCP incorporates the desired staging and phasing into the design. Designers should graphically identify the work area – typically accomplished by filling in the area with a stippling hatching pattern. Areas “under traffic” can be left unchanged. Other areas, such as “Construct Under Traffic” should use a distinct alternate hatching pattern. Example patters are shown below:



Complete the plan by including the required TCD within each Stage and Phase.

5.4 – TYPICAL APPLICATIONS

Include the appropriate Standard Drawings to provide additional guidance and details for the more straight-forward or common work activities. To determine which Standard Drawings to include, Designers should carefully evaluate the following:

- Scope of work
- Duration of the project
- Existing roadway characteristics – Type, widths, location, features, geometry
- Proximity of work to live traffic
- Traffic volumes
- Pre-construction posted speed

Refer to ***Chapter 4 – Specifications*** for detailed discussions regarding Standard Drawings and Standard Details.

Chapter 6 of the MUTCD also contains a number of common traffic control layouts for standard work zone operations. Refer to **Section 6H – Typical Applications** for a variety of more common layouts for activities ranging from mobile operations to long-term stationary work on freeways. Designers can use the Typical Applications to develop more detailed, project-specific TCPs, as needed.

5.5 – TEMPORARY SIGNS AND GUIDSIGN™

TEMPORARY SIGNS – Use the following resources when determining the text, configuration, sizing, color, usage and placement for Temporary Signs:

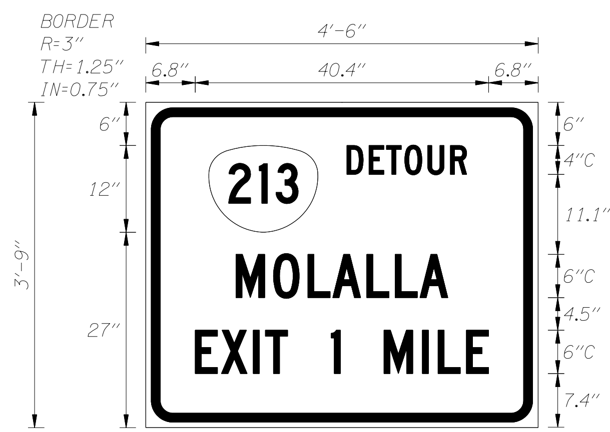
- ODOT "Sign Policy & Guidelines for State Highway Signs"
- FHWA "Standard Highway Signs"
- Manual on Uniform Traffic Control Devices (MUTCD)

GUIDSIGN™ **-** For the design of highway signs, ODOT utilizes a software program called GuidSign™. The program runs within the MicroStation™ drafting software environment. It is also available in AutoCAD™ and there is a Windows® version.

The program includes a variety of features for creating many panel styles derived from MUTCD sign standards. Designers should become familiar with the features of the software by completing an on-line tutorial or taking a training class. GuidSign™ can be a powerful tool in designing permanent and temporary signs for your project. However, its complexity may warrant a grief amount of training before beginning your designs.

Once in the software, Designers can manipulate a variety of sign panel categories to create needed signs. Example categories include:

- Panel (Regulatory, Guide, Service, Exits)
- Borders (Thickness, radius, offset)
- Margins (Border, Text, Symbols, etc.)
- Spacing (Letters, Words, Symbols, Shields, etc.)
- Text (Font style, Height, Orientation)
- Symbols (Arrows, Logos, Shields, etc.)



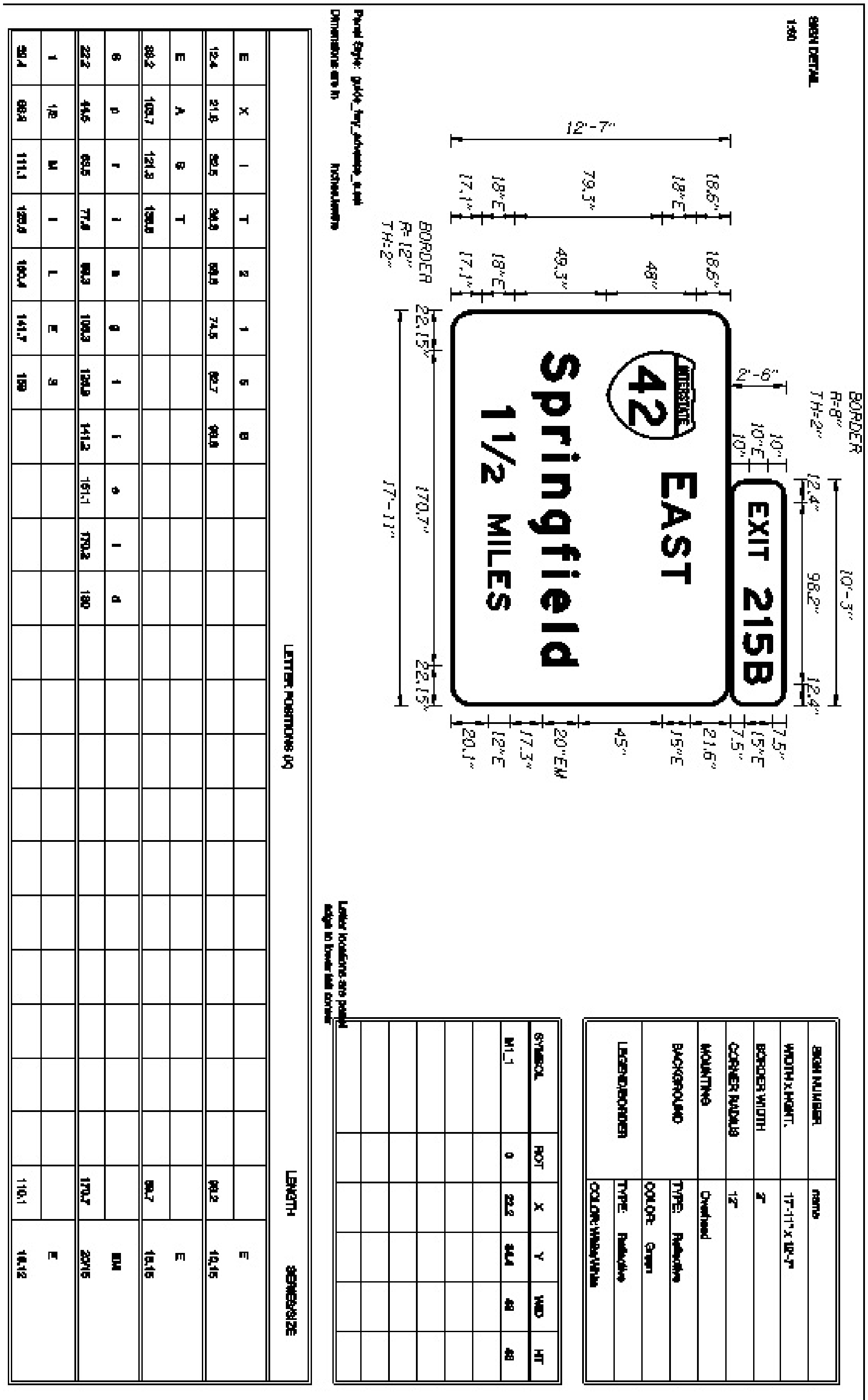
SIGN DESIGN – When using GuidSign™ (or other applicable software) to design temporary signs, details shown in Table 5.1, below, should be used:

SIGN SIZE (in x in)	BORDER RADIUS (in)	BORDER THICKNESS (in)	BORDER INSET (in)
≤ 24 x 24	1-1/2	5/8	3/8
30 x 30	1-7/8	3/4	1/2
36 x 36	2-1/4	7/8	5/8
48 x 48	3	1-1/4	3/4
60 x 72	3	1-1/4	3/4
72 x 120	1/8 x Min. Dimension	1-3/4	1-1/4
> 72 x 120	1/8 x Min. Dimension	2-1/2	2

Sign Design Attributes – Table 5.1

In GuidSign™, various text fonts, height, and spacing are selected for letters, numbers, and fractions. Others objects – arrows and symbols – can be selected from the menus. GuidSign™ also includes a feature for placing Exit Panels within a sign design. There are editing functions for modifying the sign and moving and aligning objects and text. Once the sign is prepared, panel dimensions can be added.

A reporting function can be used to prepare a detailed report – *Figure 5.6*. Sign contractors can then use the report to manufacture the sign.



Sign Panel Report – Figure 5.6

5.6 – DRAFTING STANDARDS

ODOT provides a number of resources for the development of highway construction contract plans. The tools are available on the ODOT website under the Roadway Engineering page. Users can search the internet for "*ODOT CPDG*" to find the Roadway Engineering home page. The two most commonly used resources are the Contract Plans Development Guide (CPDG) and the ODOT CAD Workspace.

CONTRACT PLANS DEVELOPMENT GUIDE (CPDG)

The Contract Plans Development Guide (CPDG) presents the policies, procedures, methods, and standards for developing and preparing final Contract Plans. It also provides the standards used in the preparation of these plans using Computer Aided Design (CAD) in MicroStation™. Department staff, consultants, and outside agency personnel should use the CPDG to prepare contract plans.

ODOT staff and consulting engineer staff working on ODOT projects must perform road design services and contract plan production using MicroStation™ and InRoads™ and provide all deliverables in a form suitable to these programs.

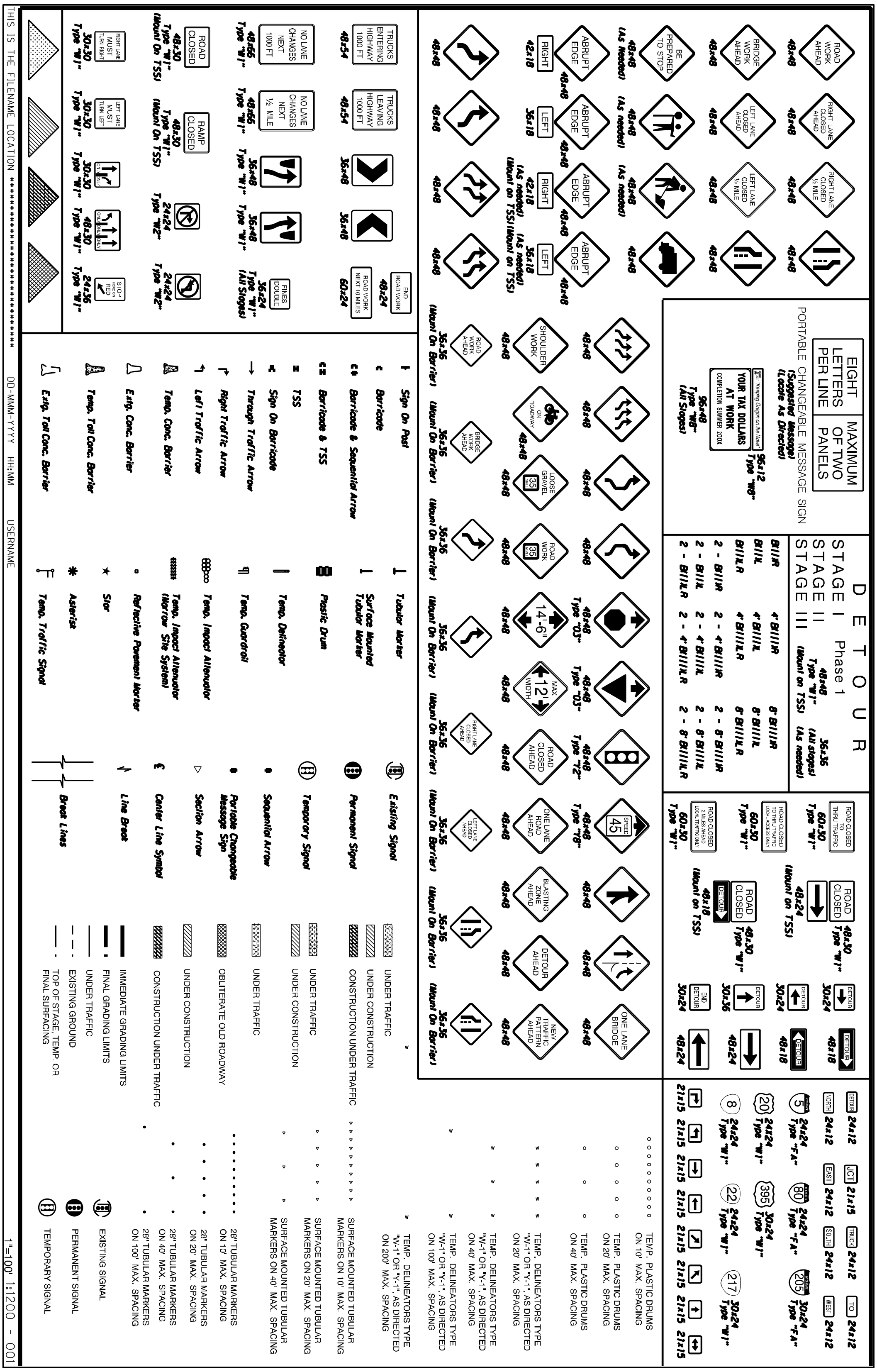
Consultant engineering staff working on federal aid projects for local governments is encouraged to follow the direction in this guide as closely as possible. Other CAD formats may be required as a part of a contract with a local government.

ODOT CAD WORKSPACE

The CAD Workspace is a FTP (File Transfer Protocol) website that maintains several files useful for developing ODOT construction contract plans. Under the ODOT Workspace, Designers can download, install and update the following tools:

Cell Libraries – The TCP cell library – "**TCPE.cel**" – can be used to quickly place TCP related signs, devices, and symbols on traffic control plan sheets.

TCP Cache – The TCP Cache is another useful resource in developing traffic control plan. Once the MicroStation™-compatible cache file is attached – "**<year>TCP.cache.dgn**" – the elements within the file can easily be copied into the plans. Although not listed under the ODOT Workspace, contact the Traffic Control Plans Unit for a copy of the TCP cache file. An example of the cache file is shown below in *Figure 5.7*.



ODOT TCP Cache – Figure 5.7

Traffic Control Plans Design Manual

11th Edition

Chapter 6
Traffic Control Cost Estimating

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CHAPTER 6 -

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TRAFFIC CONTROL COST ESTIMATING

Chapter 6

6.0 – KEY POINTS OF THIS CHAPTER

How to complete a Cost Estimate, including:

- Identifying Pay Items
- Managing Pay Items During Staging
- Calculating Quantities
- Assembling TP&DT Lump Sum Pay Item
- Calculation Methods

6.1 – TCP COST ESTIMATOR

ODOT has developed an Excel-based spreadsheet to help organize and manage traffic control devices, quantities, and costs. The use of the spreadsheet is *not* mandatory and should be considered as yet another tool available to Designers in developing their temporary traffic control plans.

The "TCP Cost Estimator" is available on the ODOT Traffic Control Plans Unit website. The file is updated on a regular basis, so download a new copy from the TCP Unit website before beginning your estimate.

Designers should be aware that the Cost Estimator does have some limitations. For ***very*** complex staging plans, it may be necessary to run through the process more than once to calculate quantities for a particular pay item.

In generating quantities, many of the calculations are rounded up to the nearest whole unit or the nearest factor of five. Some quantities include a percentage for the anticipated replacement of damaged devices. Some devices, however, require the TCP Designer to manually enter a percentage for replacement devices.

Read all Notes and Comments ('mouse-over') within the Cost Estimator before completing an estimate. All of the adjustments mentioned above are based on historical observations and the dynamic and widely variable nature of this discipline.

NOTE: The first worksheet of the Cost Estimator is titled, "*INSTRUCTIONS – Read First*". Read this before using the Cost Estimator for the first time. If you have any questions or find errors within the Cost Estimator, please contact the Traffic Control Plans Unit.

6.2 – TRAFFIC CONTROL PLAN PAY ITEMS

A number of traffic control devices are used to assemble a traffic control plan. TCP Designers will quickly become familiar with the more frequently-used devices. This chapter hopes to introduce the extensive list of TCD, as well as information and practices available in calculating quantities for these devices.

The TCP Cost Estimator includes the temporary traffic control devices currently being used by ODOT (and most city and county agencies) within its highway construction contracts. Designers should become familiar with the technical ***pay item name*** for each item and their unit of measure.

Temporary Protection & Direction of Traffic (TP&DT)
Temporary Signs
Temporary Barricades, Type II
Temporary Barricades, Type III
Temporary Guardrail, Type 2A, Reflectorized
Temporary Guardrail, Type 3, Reflectorized
Temporary Guardrail, Type 4 Reflectorized
Temporary Guardrail End Pieces, Type B
Temporary Guardrail Terminals, Flared
Temporary Guardrail Terminals, Non-Flared
Temporary Guardrail Transition
Temporary Bridge Connections
Temporary Concrete Barrier, Reflectorized
Temporary Concrete Barrier, Tall, Reflectorized
Moving Temp. Concrete Barrier
Securing Temp. Concrete Barrier
Temporary Impact Attenuator (Barrel arrays)
Moving Temporary Impact Attenuator (Barrel arrays)
Repair Temp. Impact Attenuator (per Sand Module)
Temporary Impact Attenuator, Narrow Site System
Moving Temp. Impact Attenuator, Narrow Site System
Repair Temp. Impact Attenuator, Narrow Site System
Truck Mounted Impact Attenuator (TMA)
Repair Temp. Impact Attenuator, TMA
Temporary Glare Shields
Moving Temporary Glare Shields
Temporary Reflective Barrier Panels
Surface Mounted Tubular Markers
Replace Surface-Mount Tubular Markers
Temporary Plastic Drums
Temporary Delineators
Pedestrian Channelization Devices
Temporary Reflective Pavement Markers
Temporary Flexible Pavement Marker
Temporary Removable Tape
Temporary Non-Removable Tape
Temporary Non-Reflective Tape
Temporary Striping
Temporary Pavement Legends
Temporary Pavement Bars
Pavement Legends and Bar Removal
Temporary Stripe Removal
Temporary Traffic Signal Installation
Portable Temporary Traffic Signal
Sequential Arrow Sign
Portable Changeable Message Sign (PCMS)
Radar Speed Trailer
Flaggers
Flagger Station Lighting
Automated Flagger Assistance Device (AFAD)
Traffic Control Supervisor (TCS)
Portable Traffic Management System (PTMS)
Pilot Cars

6.3 – QUANTITY CALCULATIONS

In developing the cost estimate for a Traffic Control Plan, there are two important tasks to focus on:

- A complete list of TCP pay items (and accompanying Special Provisions)
- Adequate quantities for those pay items

Having both the right type of TCD and sufficient quantities, helps avoid the need for inconvenient and often costly Contract Change Orders (CCO). Therefore, carefully compare the contents of their Special Provisions and plan sheets (if applicable), as well as the list of appropriate Standard Drawings, to the list of pay items in the TCP Cost Estimator. And, in confirming the complete list of devices, ensure that an adequate quantity has been provided in the TCP – including a small percentage as a contingency or to account for damage by traffic, vandalism, etc.

TEMPORARY SIGNS

One of the more important pay items is the quantity for Temporary Signs. Since every project will include some amount of temporary work zone signing, forgetting the pay item is not likely. However, not generating a proper quantity is very easy to do. Below is an excerpt from the list of Temporary Signs that are included on the "SIGNS" workbook within the Estimator.

SIGN NAME / LEGEND	**SIGN NUMBER**	**Width in.**	**Height in.**	**Size ft^2**	**Quantity**
KEEPING OREGON ON THE MOVE (Rider) 	**With CG20-8 or CG20-8s**	96	12	8	
YOUR TAX DOLLARS AT WORK (Project Identification sign) 	**CG20-8**	96	48	32	
YOUR TAX DOLLARS AT WORK (Urban ID sign w/ "ODOT" Rider) 	**CG20-8**	48	66	22	
ROAD WORK AHEAD	**W20-1**	48	48	16	
ROAD WORK AHEAD - *(Smaller)*	**W20-1**	36	36	9	
BRIDGE WORK AHEAD	**CW21-10**	48	48	16	
BRIDGE WORK AHEAD - *(Smaller)*	**CW21-10**	36	36	9	
SHOULDER WORK	**W21-5**	48	48	16	
SHOULDER WORK *(Smaller)*	**W21-5**	36	36	9	
ON RAMP (Rider)	**W13-4**	36	36	9	
NEXT XX MILES (Rider)	**W7-3a**	24	18	3	
ROAD WORK NEXT XX MILES	**CG20-1**	60	24	10	
ROAD WORK XX MPH ***(New sign!)***	**CW20-1a**	48	48	16	
INTERMITTENT ROAD WORK NEXT XX MILES	**CG20-13**	60	36	15	

It is important to remember the following when calculating Temporary Sign quantities:

- In multi-lane sections, a ***pair*** of signs – one on each side of the roadway – are needed for each direction
- Sign supports and sign covers, installation, moving, reinstalling and removing are all included in the square-ft cost of the signs
- Route Shields are measured separately – even if installed on the face of another temporary sign
- Examine Stages and Phases of the TCP carefully. Signs may be reusable from one Stage to the next and thus, a new sign is not needed – it can simply be moved to the new location needed for the next Stage. Make references on subsequent plan sheets back to earlier sheets where the same sign is used in the same location. For example:
    - Sheet 2C-5: Shows a "ROAD WORK AHEAD" sign at Sta. 125+00
    - Sheet 2C-10: A leader pointing to a post-mounted sign symbol at Sta. 125+00 says, *"See Sheet 2C-5"*
- The "SIGNS" worksheet includes blank lines for project-specific "custom" signs (e.g. "BAKER RD. DETOUR NEXT RIGHT")
- An additional 5% is automatically added to Temporary Sign quantities at the end bottom

By providing a thorough list of temporary work zone signs from the MUTCD , the FHWA Standard Highway Signs (SHS) manual, and the ODOT Sign Policy & Guidelines, the Designer can use the Estimator like a checklist to capture a quantity for each individual sign needed for the project. The Estimator generates the total square footage quantity of temporary signs and adds a small percentage to account for damage, vandalism, oversights, etc.

ACCOMPANYING TCD

When a given TCD is normally accompanied by an additional device(s), the Cost Estimator automatically includes those devices. For example, per Standard Drawing TM800, for each Portable Changeable Message Sign (PCMS) placed on the roadway, six Plastic Drums and one Type III Barricade are installed in advance of it. Thus, for each PCMS entered into the "PCMS-ARROWS-RADAR" worksheet (*Figure 6.1*), the Estimator automatically adds six Plastic Drums and one Type III Barricade and inserts them into the "ESTIMATE SUMMARY worksheet (*Figure 6.2*).

PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)			
Each PCMS adds: 1 Type III Barricade and 6 Plastic Drums to the "Estimate Summary"			
Stage/Phase or Operation	**NEW PCMS**	**MOVE PCMS**	**Comments**
EX: North end of Project (for duration)			
For Duration of Project	2		
TOTAL:	2		

"PCMS-ARROWS-RADAR" worksheet – Figure 6.1

TRAFFIC CONTROL PLANS - PAY ITEM ESTIMATE SUMMARY					
Project:			**County:**		
Preparer:		**Date:**		**KEY #**	
Phone:		**Email:**			
Pay Item #	**PAY ITEM**	**Unit**	**Quantity**	**Unit Cost**	**TOTAL**
0225-0100000A	*Temporary Protection & Direction of Traffic*	LS	All	---	$ -
0225-0102000J	*Temporary Signs*	ft^2	*0*	$ 14.50	$ -
0225-0104000E	*Temporary Barricades, Type II*	Each	*0*	$ 47.00	$ -
02	*Temporary Barricades, Type III*	Each	*2*	$ 108.00	$ 216.00
0225-0140000F	*Temporary Glare Shields*	ft	*0*	$ 10.00	$ -
0225-0141000F	*Moving Temporary Glare Shields*	ft	*0*	$ 3.50	$ -
0225-0141100E	*Temporary Reflective Barrier Panels*	Each	*0*	$ 12.50	$ -
0225-0142000E	*Surface Mounted Tubular Markers*	Each	*0*	$ 34.00	$ -
0225-0143000E	*Replace Surface-Mount Tubular Markers*	Each	*0*	$ 34.00	$ -
0	*Temporary Plastic Drums*	Each	*12*	$ 40.00	$ 480.00
0225-0147000E	*Temporary Delineators*	Each	*0*	$ 30.00	$ -
0225-0141150F	*Pedestrian Channelization Devices*	ft	*0*	$ 26.00	$ -
0225-0158000A	*Temporary Traffic Signal Installation* **	Lump Sum	*0*	$ -	$ -
0225-0158000E	*Portable Temporary Traffic Signal* **	Each		$ -	$ -
0225-0162000E	*Sequential Arrow Sign (project duration)*	Each	*0*	$ 2,400.00	$ -
0225-0164000E	*Portable Changeable Message Sign (PCMS)*	Each	*2*	$ 5,500.00	$ 11,000.00
0225-0172000T	*Pilot Cars*	Hour		$ 60.00	$ -
			GRAND TOTAL:		**$11,696.00**

"ESTIMATE SUMMARY" worksheet – Figure 6.2

Additional devices are also added for Portable Traffic Signals, AFADs, and for Portable Traffic Management Systems (PTMS).

6.4 – TEMPORARY PROTECTION & DIRECTION OF TRAFFIC (TP&DT), LUMP SUM ITEM

The TP&DT Lump Sum item – often misconstrued as being synonymous with the entire Traffic Control Plan (TCP) – is actually a single pay item comprised of several individual Traffic Control items that do not otherwise have their own pay item category, including monies that might be used by the contractor to pay for labor costs related to the installation, maintenance, cleaning and removal of various TCD as called for in the Specifications. It can be considered as a "miscellaneous" item.

On the following page is an excerpt from the Cost Estimator listing some of the items that would be accounted for under the Temporary Protection & Direction of Traffic lump sum item:

ITEM	Unit	Quantity	Unit Cost	TOTALS
Tubular & Conical Markers (Use Worksheet Below)	Each	0	[redacted]	$0.00
Tubular& Conical Marker MOVES (Use Worksheet Below)	Each	0	[redacted]	$0.00
Temp. Concrete Barrier To & From Stockpile (Includes Std. & Tall Barrier)	ft	0	[redacted]	$0.00
Remove Temp. Barrier from Project (Includes Std. & Tall Barrier)	ft	0	[redacted]	$0.00
Move Concrete ("Zipper") Barrier Laterally	Each	0	[redacted]	$0.00
Move "Zipper" Machine To/From Storage {Min}	Lump Sum	0	[redacted]	$0.00
Guard Rail, Anchor Type 1	Each	0	[redacted]	$0.00
Guard Rail, Anchor Type 1 Modify	Each	0	[redacted]	$0.00
Guard Rail, Transition 2-Sides	Each	0	[redacted]	$0.00
Pole Base Excavation Covers	Each	0	[redacted]	$0.00
Work Zone Delineation Fence (Orange, plastic)	ft	0	[redacted]	$0.00
Temporary Chain Link Fence	ft	0	[redacted]	$0.00
Falsework Illumination	ft	0	[redacted]	$0.00
Incidental Flagging Hours	Hour	0	[redacted]	$0.00
Blue Tubular Markers	Each	0	[redacted]	$0.00

Estimated TP& DT:	*Construction Budget:*	*x 1.0% =*	$0
	COMPARED TO ...		
Calculated TP&DT (from items above. Use $5000 Min.):			$0
		** **TP&DT =**	

** Typically, use the larger of the two amounts. However, staging complexity and project duration can affect TP&DT amounts. Therefore, If the difference is greater than 100%, consider using the average of the two amounts.

See Section 00225.90(a-2) for other items included in the TP&DT lump sum Pay Item.

In the Cost Estimator, the calculated TP&DT Lump Sum item will be compared to an historical percentage of the total Project Construction Cost. Have the Construction budget number available as it must be entered into the spreadsheet. The Percentage amount is compared to the calculated Lump Sum amount. The larger of the two amounts will be used and carried forward into the Total TCP Cost Estimate. ***However***, if there is a significant difference between the two values (> 100%), consider using the average of the two amounts.

6.5 – TCP COST ESTIMATE

Costs for temporary traffic control pay items fluctuate each year. Costs are adjusted annually following the release of the updated average annual pay item price report generated by the ODOT Highway Division's Estimating Unit. Designers working on ODOT construction projects should not make additional modifications to the pay item costs in the Cost Estimator – including regional adjustments. These and other cost adjustments are made during the final stages of project development before the project is released for advertisement.

The last worksheet in the TCP Cost Estimator is called the "ESTIMATE SUMMARY" and summarizes all of the quantities and costs generated for traffic control devices.

Once all preceding worksheets are complete, Designers should remember to complete the cells in yellow on the ESTIMATE SUMMARY, where applicable to your project.

Before completing the Cost Estimate, revisit the entire workbook looking for any errors, oversights or omissions. In addition, the following items are worth noting:

- "CHANNELIZATION" Worksheet: Check for an appropriate percentage of replacement for Plastic Drums and Surface-Mounted Tubular Markers, as appropriate.
- "BARRIER-GUARDRAIL" Worksheet: You may prefer to calculate quantities for Barrier and Barrier Moves by hand in lieu of using this worksheet.
- "BARRIER Accessories" Worksheet: Quantities for the three new "Repair Temporary Impact Attenuator" pay items should be discussed with Construction office staff.
- "ESTIMATE SUMMARY" Worksheet:
    - Temporary Traffic Signal Installation and Portable Temporary Traffic Signal: Based on the staging plan, designs for signal installations should come from a Traffic Signal Designer. Approval to add a signal, even a temporary one, must come from the State Traffic Engineer.
    - Flaggers and Pilot Cars: Quantities should be calculated very carefully. Flagger hours are likely to be dependent on the scope of work and construction schedule. Designers should communicate with Construction Management staff who, having reviewed the scope of work and the staging plans, should be able to recommend or confirm quantities for these pay items.
    - Flagger Station Lighting: Used to light each anticipated Flagger station. Seek guidance from Construction staff to refine quantities, as needed.
    - Traffic Control Supervisor (TCS): See *Chapter 3* for additional warrants and assistance in determining TCS quantities. Consult with Construction staff and the 2015 Standard Specifications to provide additional guidance regarding TCS quantities.
    - Tow Trucks: A rare pay item, but useful on projects with limited widths and where continuous flow of traffic in a single lane is critical. MUST include "Unique" Special Provision language. Consult with Construction offices for use.

When submitting a TCP estimate, the "ESTIMATE SUMMARY" worksheet is typically the only worksheet needed. If sending electronically, the whole Excel file may be sent. Keep a copy of the entire workbook in both electronic and hardcopy formats for your Project File.

APPENDIX A – ACRONYM LIST

3R / 3-R	Resurfacing, Restoration, and Rehabilitation
4R / 3-R	Resurfacing, Restoration, Rehabilitation, and Reconstruction
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AEE	Association of Engineering Employees
AGC	Association of General Contractors of America
ASAP	As Soon As Possible
ASCE	American Society of Civil Engineers
ATE	Associate Transportation Engineer
ATR	Automatic Traffic Recorders
ATS	Advanced Transportation Systems (subcommittee of AASHTO)
ATSSA	American Traffic Safety Service Association
BLM	Bureau of Land Management
BMP	Beginning Mile Point
BMP	Best Management Practice
BMS	Bridge Management System (ISTEA)
BNRR	Burlington Northern Railroad
CAC	Citizens Advisory Committee
CAD / CADD	Computer Aided Drafting and Design
CalTrans	California Department of Transportation
CAT	Countermeasure Analysis Tool
CBD	Commercial Business District
CCA(A)	Clean Air Act (Amendment)
CFS	Cubic Feet per Second
CMS	Changeable Message Sign(s) (see VMS – preferred)
CMS	Congestion Management System (ISTEA)
CP	Cathodic Protection
CPM	Critical Path Method (method of scheduling)
CTWLTL	Continuous Two-Way Left Turn Lane, “Twiddle”
DBA	Doing Business As
DEQ	Department of Environmental Quality
DHV	Design Hourly Volume
Dia.	Diameter
DLCD	Division of Land Conservation and Development
DM	District Manager
DMS	Dynamic Message Sign (see VMS)
DMV	Driver and Motor Vehicle Services
DUII	Driving Under the Influence of Intoxicants
E&C	Engineering and Contingencies
EA	Environmental Assessment
EA	Expenditure Account
EAC / HMAC	Emulsified Asphalt Concrete / Hot Mix Asphalt Concrete
EB	Eastbound
ECL	East City Limits
EIS	Environmental Impact Statement
EMP	Ending Mile Point
EMS	Emergency Medical Services

EP	Edge of Pavement
EPA	Environmental Protection Agency
ES	Edge of Shoulder
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
GPS	Global Positioning System
HCM	Highway Capacity Manual
HEP	Hazard Elimination Program
HOV	High Occupancy Vehicle
I/D	Incentives / Disincentives
ID	Inside Diameter
IGA	Inter-Governmental Agreement
ISTEA	Intermodal Surface Transportation and Efficiency Act
ITE	Institute of Transportation Engineers (formerly Traffic)
ITIS	Integrated Transportation Information System
ITS	Intelligent Transportation System
kg	Kilogram
km	Kilometer
km/h	Kilometers per Hour
LCDC	Land Conservation and Development Commission (Oregon)
LL	Live Load
LMC	Latex Modified Concrete
LOS	Level of Service
m	Meter
MCTD	Oregon Motor Carrier Transportation Division
MHz	MegaHertz (millions of cycles per second)
mm	Millimeter
MP	Milepoint, Milepost
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NB	Northbound
NCHRP	National Cooperative Highway Research Program
NCL	North City Limits
NEPA	National Environmental Protection Act
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NIMBY	Not in My Backyard
NTS	Not to Scale
OAR	Oregon Administrative Rules
OD	Outside Diameter
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHP	Oregon Highway Plan
ORS	Oregon Revised Statutes
OSHA	Occupational Safety and Health Administration (U.S.)
OSP	Oregon State Police

OSU	Oregon State University
OTC	Oregon Transportation Commission
OTIA	Oregon Transportation Investment Act
OTP	Oregon Transportation Plan
OVWS	Overheight Vehicle Warning System
Oxing	Overcrossing
PCC	Portland Cement Concrete
PCE	Passenger Car Equivalents
PCMS	Portable Changeable Message Sign
PDT	Project Development/Design Team (also PT for Project Team)
PE	Preliminary Engineering
PE	Professional Engineer (registered)
PIN	Personal Identification Number
PM	Project Manager
PMC	Polymer-modified Concrete
PS&E	Plans, Specs, and Estimates
PSF	Pounds per Square Foot
PSI	Pounds pre Square Inch
PT / PDT	Project Team / Project Development Team
PUC	Public Utility Commission
PVMS	Portable Variable Message Sign
QA	Quality Assurance
QPL	Qualified Products List
R&D	Research and Development
R/W	Right of Way
RAME	Region Access Management Engineer
RATS Team	Region and Technical Services Team
RDWY	Roadway
REA	Revised Environmental Assessment
Rev.	Revised, Revision Date
RFP	Request for Proposal
RIG	Resource Issues Group
RFQ	Request for Qualifications
ROD	Record of Decision
RR	Railroad
RTP	Regional Transportation Plan
RWIS	Roadside Weather Information Sign
SB	Southbound
SCL	South City Limits
SF	Square Feet, ft^2
SH, Shld	Shoulder
SHPO	State Historic Preservation Office
SI	Le Systeme International d'Unites (Metric System)
SOV	Single Occupant Vehicle
SPIS	Safety Priority Index System
SPRR	Southern Pacific Railroad
SRCM	Soils and Rock Classification Manual (ODOT)
SSD	Stopping Sight Distance
STA	Special Transportation Area
STE	State Traffic Engineer

STIP	Statewide Transportation Improvement Plan
STIP-SIP	Statewide Transportation Improvement Program – Safety Investment Program
STR	Section, Township, and Range (surveying)
SU	Single Unit Truck
T&E	Threatened and Endangered
TAC	Technical Advisory Committee
TAG	Technical Advisory Group
TCD	Traffic Control Devices
TCM	Traffic Control Measures
TCP	Traffic Control Plan
TCPE	Traffic Control Plans Engineer
TCS	Traffic Control Supervisor
TDB	Transportation Development Branch
TDM	Transportation Demand Management
TE	Transportation Engineer
TEA-21	Transportation Equity Act for the 21st Century
TEOS	Traffic Engineering and Operations Section
TGM	Transportation Growth Management
Thk	Thick, Thickness
TIP	Transportation Improvement Plan
TIS	Transportation Impact Study
TMA	Truck Mounted Impact Attenuator
TMP	Traffic Management Plan
TP & DT	Temporary Protection & Direction of Traffic
TPAU	Transportation Planning Analysis Unit
TRB	Transportation Research Board
TS&L	Type, Size, and Location
TSP	Transportation System Plan
TSRM	Technical Services Resource Manager
TSS	Temporary Sign Support
TSSU	Traffic Systems Services Unit
TTC	Temporary Traffic Control
TTI	Texas Transportation Institute
TVT	ODOT's Transportation Volume Tables
TWLTL	Two-Way Left-Turn Lane
U of O	University of Oregon
UBA	Urban Business Area
UGB	Urban Growth Boundary
UP	University of Portland
UPRR	Union Pacific Railroad
USDOT	United States Department of Transportation
V/C	Volume to Capacity Ratio
VE	Value Engineering
VMS	Variable Message Sign
VMT	Vehicle Miles of Travel (Vehicle Miles Traveled)
w/	With
w/o	Without
WB	Westbound
WCL	West City Limits

WIM	Weigh in Motion
WS	Wearing Surface
WSDOT	Washington State Department of Transportation
Wt.	Weight
WYSIWYG	What-You-See-Is-What-You-Get, “Wizzy Wig”
Xing	Crossing

APPENDIX B – GLOSSARY OF TERMS

TERM	DEFINITION
3-R Project	A project involving resurfacing, restoration, or rehabilitation of an existing highway.
4-R Project	A project involving reconstruction of an existing highway.
AASHTO	American Association of State Highway and Transportation Officials.
Abutment	Supports at the end of the bridge used to retain the approach embankment and carry the vertical and horizontal loads from the superstructure. Current terminology is bent or end bent.
Access Control	The condition where the legal right of owners or occupants of abutting land to access a highway is fully or partially controlled by the Department of Transportation.
Access Management	Measures regulating physical connections to streets, roads, and highways from public roads and private driveways.
ADT (Average Daily Traffic)	The average number of vehicles passing a certain point each day on a highway, road, or street.
Advance Plans	90% complete plans including special provisions normally sent at 15 weeks.
Advance Review	Complete review prior to final approval. All of PS&E must be provided and nearly complete.
Advertisement	The period of time between the written public announcement inviting proposals for projects and the opening of the proposals (bid or letting date).
Aggregate	Rock of specified quality and gradation.
Aggregate, Coarse	Aggregates predominantly retained on the No. 4 sieve for Portland cement concrete and those predominantly retained on the ¼" for asphalt concrete.
Aggregate, Dense Graded	A well-graded aggregate so proportioned as to contain a relatively small percentage of voids.
Aggregate, Fine	Those aggregates which entirely pass the 3/8" sieve.
Aggregate, Open Graded	A well-graded aggregate containing little or no fines, with a relatively large percentage of voids.
Aggregate, Well-Graded	An aggregate possessing proportionate distribution of successive particle sizes.
Air-Entraining Agent	A substance used in concrete to increase the amount of entrained air in the mixture. Entrained air is present in the form of minute bubbles and improves the workability and frost resistance.
Alignment	Geometric arrangement of a roadway (curvature, etc.).
Allowable Headwater	The maximum elevation to which water may be ponded upstream of a culvert or structure as specified by law or design.
Alternative Modes	Modes such as rail, transit, carpool, walking, and bicycle which provide transportation alternatives to the use of the single-occupancy automobiles.
Approach	[OAR 734-020-0420(1)] All lanes of traffic moving toward an intersection or mid-block location from one direction.
Approach Road	A roadway or driveway connection between the outside edge of the shoulder or curb line and the right-of-way line of the highway, intended to provide vehicular access to and from said highway and the adjoining property.
Apron	The paved area between wingwalls at the end of a culvert.
Asphalt	Asphalt cement.
At-Grade Crossing	A crossing of two highways or a highway and a railroad at the same level.
Asphalt Concrete	A mixture of asphalt cement, graded aggregate, mineral filler, and additives, as required.
Average Daily Traffic (ADT)	Average Daily Traffic (ADT) – The average 24-hour volume of traffic, being the total during a stated period divided by the number of days in that period. Unless otherwise stated, the period is a year.
Award	Written notification to the bidder that the bidder has been awarded a contract.
Axle Load	The load borne by one axle of a traffic vehicle.
Backfill	Material used to replace or the act of replacing material removed during construction; also may denote material placed or the act of placing material adjacent to structures.
Backwater	The water upstream from an obstruction in which the free surface is an elevation above the normal water surface profile.
Ball-bank Indicator	A curved level which is used to determine the safe speed around a curve, as indicated by trial speed runs. The indicator measures the centrifugal force on the vehicle. The ball-bank indicator is designed to show the combined effect of the vehicle body roll angle, the centrifugal force, and the superelevation angle of the roadway.
Base Course	The layer of specified material of designed thickness placed on a subbase or a subgrade to support a surface course.
Bedrock	The solid rock underlying soils or other superficial formation.
Bench Mark	A relatively permanent material object bearing a marked point whose elevation above or below an adopted datum is known.
Bench Repair	Repairs made to signal control equipment by the Traffic Systems Services Unit (TSSU).
Best Management Practices	Techniques which reflect current thinking on a specific subject.
Bid Schedule	The list of bid items, their units of measurement, and estimated quantities bound in the proposal booklet. (When a contract is awarded, the Bid Schedule becomes the Schedule of Contract Prices.)
Bidder	Any qualified individual or legal entity submitting a proposal in response to an advertisement.
Biennium	For the State of Oregon, a two-year period, always odd numbered years, starting July 1 and ending two years later on June 30.
Bleeding (Concrete)	The movement of mixing water to the surface of freshly placed concrete.
Borrow	Material lying outside of planned or required roadbed excavation used to complete project earthwork.
Box Culvert	A culvert of rectangular or square cross-section.

TERM	DEFINITION
Breakaway	A design feature that allows a device such as a sign support to yield or separate upon impact. The release mechanism may be a slip plane, plastic hinges, fracture elements, or a combination of these.
Bridge End Panel	A reinforced concrete slab placed on the approach embankment adjacent to, and usually resting upon, the abutment back wall; the function of the approach slab is to carry wheel loads on the approaches directly to the abutment, thereby eliminating any approach roadway misalignment due to approach embankment settlement.
Bridge Railing	A longitudinal barrier whose primary function is to prevent an errant vehicle from going over the side of the bridge structure.
Bushings	A lining used to reduce friction and/or insulate mating surfaces usually on steel hanger plate bearings.
Buttress	A rock fill placed at the toe of a landslide in order to resist further slide movement. The slide toe is excavated to below the zone of sliding before placing rock fill.
Capacity	The maximum number of vehicles (vehicle capacity) or passengers (person capacity) that can pass over a given section of roadway or transit line in one or both directions during a given period of time under prevailing roadway and traffic conditions.
Cast-in-Place	The act of placing and curing concrete within formwork to construct a concrete element in its final position.
Catch Basin	A receptacle, commonly box shaped and fitted with a grilled inlet and a pipe outlet drain, designed to collect the rain water and floating debris from the roadway surface and retain the solid material so that it may be periodically removed.
Cathodic Protection	A means of preventing metal from corroding; this is done by making the metal a cathode through the use of impressed direct current and by attaching a sacrificial anode.
Centerline	A defined alignment from which specific information is identified.
Change Order	A written order issued by the Engineer to the contractor modifying work required by the contract and establishing the basis of payment for the modified work.
City Street	A public road which is owned and operated by a city government intended for use of the general public for vehicles or vehicular traffic.
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 with clearances less than the minimum width should be removed and relocated outside the minimum clear zone or remodeled to make breakaway, shielded, or safely traversable.
Cobbles	Particles of rock, rounded or not, that will pass a 12" square opening and be retained on a 3" sieve.
Cofferdam	A barrier built in the water so as to form an enclosure from which the water is pumped to permit free access to the area within.
Cohesionless Soil	A soil that, when unconfined, has little or no strength when air-dried and that has little or no cohesion when submerged.
Cohesive Soil	A soil that, when unconfined, has considerable strength when air-dried and that has significant cohesion when submerged. Clay is a cohesive soil.
Commercial Vehicle	A vehicle that is used for the transportation of persons for compensation or profit, or designated or used primarily for the transportation of property.
Compaction	The process of densifying a layer of soil or rock material by using static or vibratory rollers made specifically for this purpose.
Concept Plans	Plans to determine the basic features of a project including alignments, typical sections, slopes, preliminary drainage, and TS&L bridge plans.
Concrete Overlay	1.5" to 2" of concrete placed on top of the deck, used to extend the life of the deck and provide a good riding surface.
Continuous Two-Way Left-Turn Lane	A traversable median that is designed to accommodate left-turn egress movements from opposite directions; Abbreviated as "TWLTL and often pronounced, "Twiddle"
Contract	The written agreement between the Division and the contractor describing the work to be done and defining the obligations of the Division and the contractor.
Contract Plans	Detailed drawings and diagrams usually made to scale showing the structure or arrangement, worked out beforehand, to accomplish the construction of a project and/or object(s).
Contract Time	The number of calendar days shown in the proposal which is allowed for completion of the work.
Contractor	The individual or legal entity that has entered into a contract with ODOT.
Coordinates	Linear or angular dimensions designating the position of a point in relation to a given reference frame. It normally refers to the State Plane Coordinate System.
Core	A cylindrical sample of concrete removed from a bridge component for the purpose of destructive testing.
County Road	A public road which is owned and operated by a county government intended for use by the general public for vehicles or vehicular traffic.
Course	A specified surfacing material placed in one or more lifts to a specified thickness.
Crash Cushion	An impact attenuator device that prevents an errant vehicle from impacting fixed object hazards by gradually decelerating the vehicle to a safe stop or by redirecting the vehicle away from the hazard.
Crash Tests	Vehicular impact tests by which the structural and safety performance of roadside barriers and other highway appurtenances may be determined. Three evaluation criteria are considered, namely (1) structural adequacy, (2) impact severity, and (3) vehicular post-impact trajectory.
Creep	Time dependent inelastic deformation under elastic loading of concrete or steel resulting solely from the presence of stress.
Cross Section	The exact image formed by a plane cutting through an object, usually at right angles to a central axis or alignment.
Crossover	A technique used to shift live traffic from one side of a divided roadway either into the median or onto the remaining half of the highway not under construction. Also called an "on-site diversion", it may also cross traffic out onto a temporary roadway running parallel to the work area.
Crosswalk	Any portion of a roadway at an intersection or elsewhere that is distinctly indicated for pedestrian crossing by lines or other markings on the surface of the roadway that conform in design to the standards established for crosswalks.
Crown Section	Roadway section with the height of the center of the roadway surface above its gutters.

TERM	DEFINITION
Culvert	A pipe, a reinforced concrete box, or a series of pipes or boxes that provide an opening under the ground for passage of water or other uses.
Curb	A vertical or sloping member along the edge of a pavement or shoulder forming part of a gutter, strengthening or protecting the edge, and clearly defining the edge of vehicle operators.
Curing	The preparation of a material by chemical or physical processing for keeping or use; treating concrete by covering its surface with some material to prevent the rapid evaporation of water.
Delamination	Subsurface separation of concrete into layers.
Deliverables	Engineering work to be submitted.
Demand	The number of users desiring service on the highway system.
Design Speed	A speed determined by traffic volumes, the geographic characteristics of the area, geometric layout of the existing facility, number of traffic lanes, and the posted speed for use in designing a project. Within the TCP discipline, Design Speed equates to the Pre-construction Posted Speed of the roadway facility.
Design Volume or Design Hourly Volume	A volume determined for use in design representing traffic expected to use the highway. Unless otherwise stated, it is an hourly volume. ODOT uses the 30th highest hour as its design hour.
Deviation	A departure from an access management standard.
DLCD	Department of Land Conservation and Development.
"Doghouse" (signal head)	A five indication, traffic control signal display used for control of P/P left turn lanes consisting of a single, circular red indication centered at the top with circular and arrow indications for yellow and for green in the middle and lower portion of the display, respectively.
E&C	*Engineering & Contingencies* are ODOT's costs to administer the construction contract. In addition, Contingencies are unforeseen costs due to design changes, construction, extra work price agreements or types of problems caused by weather, accidents, etc. by the contract pay item.
Environmental Classes	Class I Environmental Impact Statement: Projects that normally involve significant changes in traffic capacities and patterns. These projects generally involve major right-of-way acquisitions. Both draft and final Environmental Impact Statements are required. Class II Categorical Exclusions: Projects that normally involve the improvement of payment conditions on traffic safety but little, if any, change in traffic capacities or patterns. Right-of-way requirements must be minor. These projects are categorically excluded from further environmental documentation, unless permit requirements indicate otherwise. Class III Environmental Assessment: Projects that do not clearly fall within Class I or Class II. These projects require assessments to determine their environmental significance.
Erosion Control Designer	The person assigned to specify the proper methods for control of the flow of particulates and sedimentation for a given project.
Expansion Joint	A joint in concrete that allows expansion due to temperature changes, thereby preventing damage to the surface.
Expressway	Highways that provide for safe and efficient high speed and high volume traffic movements.
Extra Work	Work not included in any of the contract items as awarded but determined by the Engineer necessary to complete the project according to the intent of the contract. This may be paid on a negotiated price, force account, or established price basis.
Failsafe System	Failsafe system is hard wired to the signal controller and operates independently of any other signal function. The default state of a failsafe system is flashing mode.
Falsework	A temporary construction on which permanent work is wholly or partially supported until it becomes self-supporting. For cast-in-place concrete or steel construction, it is a structural system to support the vertical and horizontal loads from forms, reinforcing steel, plastic concrete, structural steel, and placement operations.
FHWA	Federal Highway Administration.
Final Review	The last in the review process; PS&E must be complete.
Fiscal Year	For the State of Oregon, July 1 through June 30 of the next year.
Flood Plain	An area that would be inundated by a flood.
Forms	A structural system constructed of wood or metal used to contain the horizontal pressures exerted by plastic concrete and retain it in its desired shape until it is hardened.
Freeway	A fully access controlled throughway.
Freeway Median	The space between inside shoulders of the separated one-way roadways of a divided highway.
Functionally Obsolete Bridges	Those bridges which have deck geometry, load carrying capacity, clearance, or approach roadway alignment which no longer meets the usual criteria for the system of which they are a part as defined by the Federal Highway Administration.
Geotextiles	Sheets of woven or non-woven synthetic polymers or nylon used for drainage and soil stabilization.
Glare Shield	A device used to shield a driver's eye from the headlights of an oncoming vehicle.
Grade Separation	A crossing of two highways or a highway and a railroad at different levels.
Green Concrete	Concrete that has set but not appreciably hardened.
Grout	A mixture of cementitious material and water having a sufficient water content to render it a free-flowing mass, used for filling (grouting) the joints in masonry, for fixing anchor bolts, and for filling post-tensioning ducts.
High Speed	When the posted speed on a roadway is $\geq$ 45 mph.
Highway	(ORS 801.305) Every public way, road, street, thoroughfare and place, including bridges, viaducts and other structures within the boundaries of this state, open, used or intended for use of the general public for vehicles or vehicular traffic as a matter of right.
Highway Capacity Manual (HCM)	The Highway Capacity Manual is the standard "Bible" for most traffic analysis; however, the HCM does not provide procedures that are appropriate for work zone analysis.
HOV Lanes	High-Occupancy Vehicle lanes, special road lanes which can only be used by vehicles with more than one occupant.

TERM	DEFINITION
Hydration	The process by which cement combines with water to form a hard binding substance.
Hydrodemolition	Process to abrade or remove a surface, such as concrete, by streams of water ejected from a nozzle at high velocity.
Incidental Work	Work necessary for fulfillment of the contract but which is not listed as a pay item in the contract and for which no separate or additional payment will be made.
Intermodal connectors	Short lengths of roads that connect intermodal facilities to the state highway system.
International System of Units (SI)	The modernized metric system.
Intersection	The area of the roadway created when two or more roadways join together at any angle.
ISTEA	Intermodal Surface Transportation Efficiency Act, passed by Congress in 1991.
ITS	Intelligent Transportation System.
Key Number	Number assigned to a project by Program Section to identify it in the Project Control System (PCS). All structures in a project have the same key number; bridges are numbered separately.
Lane Closure Restrictions	ODOT often limits the hours that work zone traffic lanes and roads may be closed in an effort to reduce motorist delay, inconvenience and crash potential.
Leveling	A course of construction to restore horizontal and vertical uniformity to existing pavements, normally continuous throughout the project limits.
Lift	The nominal compacted thickness of material placed by equipment in a single pass.
Live Load	Force of the applied moving load of vehicles and/or pedestrians.
LOS	Level of Service – a range of operating conditions defined for each type of facility and related to the amounts of traffic that can be accommodated at each level.
Low Speed	When the posted speed on a roadway is ≤ 40 mph.
Low Volume Road	Any roadway with an AADT < 400 vehicles.
Mandatory Source	A material source provided by ODOT from which the contractor shall obtain materials.
Manual Classification of Traffic Counts	Federal Government directed vehicle classification that breaks the class of vehicles into 16 types. Traffic counts with vehicles broken down into their 16 types are necessary for most ODOT project work.
Manual Traffic Counts	Performed by ODOT personnel and available from ODOT Traffic Data Section in the Transportation Development Branch. Traffic counts used for analysis should be close to the work area and on the same type of highway designation and should also have been taken in the last three years.
Material	Any natural or man-made substance or item specified for use in the construction of the project.
Median	A continuous divisional island which separates opposing traffic and may be used to separate left turn traffic from through traffic in the same direction as well. Medians may be designated by pavement markings, curbs, guideposts, pavement edge or other devices.
Median Pedestrian Island	A non-traversable median section designed to provide an area where pedestrians can take refuge while crossing the traffic stream approaching from the left, and then the traffic stream approaching from the right.
Micro Silica (Silica Fume) (MC)	Very fine non-crystalline silica used as an admixture in concrete to improve the strength, permeability, and abrasion resistance.
Mode of Transportation	A means of moving people and/or goods.
Modular Expansion Joints	Multiple, watertight joint assemblies for bridges requiring expansion movements greater than 4".
MPO	Metropolitan Planning Organization – a planning body in an urbanized area of over 50,000 population which has responsibility for developing transportation plans for that area.
Mylars	Drawings on mylar. The final "legal" drawing used for signatures and printing contract plans.
NHS	National Highway System – a system of Statewide and Interstate Highways and intermodal connectors meeting federal criteria (approximately 155,000 miles total), designated by Congress in the National Highway System Designation Act of 1995.
Non-traversable Median	A median which, by its design, physically discourages or prevents vehicles from crossing it except at designated openings which are designed for turning or crossing movements and are designed to impede traffic from crossing the median. Examples include curbed medians or concrete barrier medians, also included are depressed grass or landscaped medians.
OAR	Oregon Administrative Rules – Rules written by a government agency intended to clarify the intent of an adopted law.
Occupancy	The amount of time motor vehicles are present in a detection zone expressed as a percent of total time. This parameter is used to describe vehicle density, a measure of highway congestion. The number of passengers in a vehicle which, when used in conjunction with vehicular volume, provides information on the total number of persons accommodated on a transportation link or within a transportation corridor.
Operating Rating (Permit Loads)	The absolute maximum permissible stress level to which a structure may be subjected. It is that stress level that may not be exceeded by the heaviest loads allowed on the structure. Special permits for heavier than normal vehicles shall be issued only if such loads are distributed so as to not produce stress in excess of the operating stress.
OR Route	A route system established and regulated by the Oregon Transportation Commission to facilitate travel on main highways throughout the state.
ORS	Oregon Revised Statues – The laws that govern the State of Oregon.
OTC	Oregon Transportation Commission – ODOT's governing body; the Commission has five members appointed by the Governor.
Outer Separation	The area between the traveled ways of a through traffic roadway and a frontage road or street.

TERM	DEFINITION
Pavement	Asphalt concrete or Portland cement concrete placed for vehicular use on highway, road and street traveled ways, shoulders, auxiliary lanes, and parking areas.
Peak Hour	Hour of the day with the most traffic, usually during morning and evening commute times. Generally not the design hour.
Pedestrian	A person on foot, in a wheelchair, or walking a bicycle.
Pile	A long, slender piece of wood, concrete, or metal to be driven, jetted, or cast-in-place into the earth or river bed to serve as a support or protection.
Plastic Deformation	Deformation of material beyond the elastic range.
Preliminary Plans	75% complete plans, normally sent at 20 weeks.
Preliminary Review	In the review process, plans should be approximately 75% complete.
Prestressed Concrete	Concrete in which there have been introduced internal stresses (normally pretensioned steel) of such magnitude and distribution that the stresses resulting from given external loadings are counteracted to a desired degree.
Pretensioned	Any method of prestressing in which the strands are tensioned before the concrete is placed.
Principal Arterial (Urban, Controlled Access)	A street or highway in an urban area which has been identified as unusually significant to the area in which it lays in terms of the nature and composition of travel it serves. The principal arterial system is divided into three groups: Interstate freeways, other freeways and expressways, and other principal arterials (with no control of access). Principal arterials should form a system serving major centers of activity, the highest traffic volume corridors, and the longest trip desires and should carry a high proportion of the total urban area travel on a minimum of mileage.
Project Manager	The Engineer's representative who directly supervises the engineering and administration of a contract.
Proposal	A written offer by a bidder on forms furnished by the Division to do stated work at the prices quoted.
Plans Specifications and & Estimates (PS&E)	Plans, Specifications, and Estimates: Usually it refers to the time when the plans, specifications, and estimates on a project have been completed and referred to FHWA for approval. When the PS&E has been approved, the project goes to bidding.
Pumping	The ejection of mixtures of water, clay, and/or silt along or through transverse or longitudinal joints, crack or pavement edges, due to vertical movements of the roadway slab under traffic.
Queue	A line of vehicles waiting to be served by the highway system. The queue can be determined graphically, as shown in the WZ Traffic Analysis Guide, Chapter 2.
Raised Median	A non-traversable median where curbs are used to help delineate the boundary between the median and the adjacent traffic lane and to elevate the surface of the median above the surface of the adjacent traffic face.
RAME	Region Access Management Engineer – An individual, who is a registered professional engineer and who, by training and experience, has comprehensive knowledge of ODOT's access management standards, policies, and procedures and has professional expertise in traffic engineering concepts which underlie access management principles.
Realignment	Rebuilding an existing roadway on a new alignment where the new centerline shifts outside the existing right-of-way and where the existing road surface is either removed, maintained as an access road, or maintained as a connection between the realigned roadway and a road that intersects the original alignment.
Redline	Marked up drawing, typically in red pencil, with review comments or changes proposed.
Region Traffic Engineer/Manager	Registered Professional Engineer, or person working under direct supervision of a Registered Professional Engineer, responsible for traffic operations in the Region. Actual position titles may vary from region to region.
Right-of-Way	A general term denoting publicly-owned land, property or interest therein, usually in a strip acquired or devoted to transportation purposes. The entire width between the exterior right-of-way lines including the paved surface, shoulders, ditches, and other drainage facilities in the border area between the ditches or curbs and right-of-way line.
Riprap	A facing of stone used to prevent erosion. It is usually dumped into place, but is occasionally placed by hand.
Road Designer	The person assigned to specify the project requirements for the road portion of a given project.
Roadside Barrier	A longitudinal barrier used to shield roadside obstacles or non-traversable terrain features. It may occasionally be used to protect pedestrians from vehicle traffic.
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.
Rubble	Irregularly shaped pieces of varying size stone in the undressed condition obtained from a quarry.
Sand	Particles of rock that will pass a No. 4 sieve and be retained on a No. 200 sieve.
Scaffolding	Temporary elevated walkway or platform to support workmen, materials and tools.
Scarify	To loosen, break up, tear up, and partially pulverize the surface of soil or of a road.
Scour	Erosion of a river bed area caused by water flow.
Screeding	The process of striking off excess material to bring the top surface to proper contour and elevation.
Seal	A concrete mass poured under water in a cofferdam that is designed to resist hydrostatic uplift. The seal facilitates construction of the footing in dry conditions.
Seasonal Adjustments	Adjusting the traffic count data so that it reflects the time of year during which construction will take place, if different from the traffic count date.
Seed File	A CAD file which has been set up with certain generic parameters. Typically they come with certain reference files attached.
Shoofly	Detour alignment of temporary roadway around a fixed object, such as a railroad track or bridge. Very similar to an on-site diversion, yet often less formal in its design and anticipated duration.
Shotcrete	Mortar or concrete pneumatically projected at high velocity onto a surface.

TERM	DEFINITION
Shoulder(s)	[ORS 801.480] The portion of a highway, whether paved or unpaved, contiguous to the roadway that is primarily used by pedestrians, for the accommodation of stopped vehicles, for emergency use and for lateral support of base and surface courses, exclusive of auxiliary lanes, curbs, and gutters.
Shrinkage	Contraction of concrete due to drying and chemical changes, dependent on time.
Shy Distance (E-Distance)	The distance from the edge of the traveled way beyond which a roadside object will not be perceived as an immediate hazard by the typical driver, to the extent that the vehicle's placement or speed will be changed. Often it is an extra 2' added to the right shoulder where roadside barriers are used. The left shoulder is increased only when the shoulder is 10' or more.
Sight Distance	The length of roadway ahead visible to the driver.
Silt	Soil, passing a No. 200 sieve, that is non-plastic or exhibits very low plasticity.
Slope	The degree of inclination to the horizontal. Usually expressed as a: ●ratio, such as 25:1, indicating 1 unit rise in 25 units of horizontal distance or run, i.e. run/rise ratio, ●decimal fraction (0.04), ●degree (2˚) or ●percent (4%).
Slope Paving	Pavement placed on the slope in front of an abutment to prevent soil erosion.
Special Event	Any planned activity that brings together a community or group of people for an expressed purpose including, but not limited to, parades, bicycle races, road runs and other activity that result in changes to traffic volumes on the state highway creating total or partial closure of state highways or state highway sections.
Special Provisions	The specifications for a project that augment and have authority over the standard and supplemental specifications. They are commonly referred to as "specials".
Specifications	The body of directions, provisions, and requirements, together with written agreements and all documents of any description, made or to be made, pertaining to the method or manner of performing the work, the quantities, and the quality of materials to be furnished under the contract.
Standard Detail	A detail which can be copied from one project to another and can be modified to fit the project needs.
Standard Drawings	Detailed drawings for work or methods of construction that are selectively included in a project book.
Standard Specifications	Detailed specifications for project work, found in the Oregon Standard Specification Construction Book.
State Highway	The State Highway System as designated by the Oregon Transportation Commission, including the Interstate system.
State Highway Index Number	An Oregon Transportation Commission approved identifier assigned to a highway. Every state highway has a state highway index number, commonly referred to as a State Highway Number.
State Highway Name	An Oregon Transportation Commission approved name used in conjunction with a State Highway Index Number to identify a state highway.
State Highway System	Public roads owned and operated by the State of Oregon through the Oregon Department of Transportation.
State Plane Coordinates	The plane-rectangular coordinate system established by the United States Coast and Geodetic Survey. Plane coordinates are used to locate geographic position.
Station	A distance of 100 feet measured horizontally.
Stirrup	Vertical U-shaped or rectangular shaped bars placed in concrete beams to resist the shearing stresses in the beam.
Structures	Bridges, retaining walls, endwalls, cribbing, buildings, culverts, manholes, catch basins, drop inlets, sewers, service pipes, underdrains, foundation drains, and other like or similar features which may be encountered in the work.
Subbase	A course of specified material of specified thickness between the subgrade and a base.
Subgrade	The top surface of completed earthwork on which subbase, base, surfacing, pavement, or a course of other material is to be placed.
Sufficiency Rating	A method of evaluating data by calculating four separate factors to obtain numeric value which is indicative of bridge sufficiency to remain in service. The result of this method is a percentage in which 100% would represent an entirely sufficient bridge and 0% would represent an entirely insufficient or deficient bridge.
Superelevation	The difference in elevation between the inside and outside edges of a roadway in a horizontal curve; required to counteract the effects of centrifugal force.
Superstructure	Those parts of a structure above the substructure, including bearing devices.
TEA-21	The Transportation Equity Act for the 21st century.
Tining	Used on finished concrete deck or slab surfaces to provide friction and reduce hydroplaning. Grooves are placed in the plastic concrete or cut into the hardened concrete.
Traffic Control Device (TCD)	Any sign, signal, marking, or device placed, operated or erected for the purpose of guiding, directing, warning or regulating traffic. Any device that remotely controls another traffic control device by electrical, electronic, sound or light signal. Any sign that is held or erected by a highway maintenance or construction crew working in the highway.
Traffic Lane	That part of the traveled way marked for moving a single line of vehicles.
Traveled Way	That part of the roadway for moving vehicles, exclusive of shoulders and auxiliary lanes.
Traversable Median	A median that by its design does not physically discourage or prevent vehicles from entering upon or crossing it and are typically built to provide a separation between opposing traffic but do not impede traffic from crossing the median. Such medians include painted medians and continuous two-way left-turn lanes.
Typical Section	A cross-section established by the plans which represents in general the lines to which the contractor shall work in the execution of the contract.
UGB	Urban Growth Boundary – The area surrounding an incorporated city in which the city may legally expand its city limits.

TERM	DEFINITION
US Route	A route system established by the US Congress to facilitate travel on main highway throughout the nation. This route system is regulated by an AASHTO committee.
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 utility shall also mean the utility company, district, or cooperative, including any wholly owned or controlled subsidiary.
V/C Ratio	Volume to Capacity Ratio – A measure of roadway congestion, calculated by dividing the number of vehicles passing through a section of highway during the peak hour by the capacity of the section. V/C is the mobility criteria for Oregon highways, as defined in the 1999 Oregon Highway Plan.
VMT	Vehicle Miles of Travel – Miles traveled per vehicle multiplied by the total number of vehicles.
Warning Lights	Portable, lens-directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady-burn or flashing mode. Refer to MUTCD, Section 6F.72.
Warrants	The criteria by which the need for a safety treatment or improvement can be determined.
Water/Cement Ratio	The weight of water divided by the weight of cement in a concrete; ratio controls the strength of the concrete.
Wearing Surface	The top layer of a pavement designed to provide structural values and a surface resistant to traffic abrasion.
Weep Hole	A drain hole through a wall to prevent the building up of hydraulic pressure behind the wall.
Wet Signature	Final mylar plots requiring the signature of the responsible professional and must be signed by hand. Electronic versions of professional stamps are acceptable, but signatures are not.
Work Zone (WZ)	An area of a highway with construction, maintenance or utility work activities. It extends from the first warning sign to the "End Road Work" sign or the last traffic control device.
WZ Traffic Analysis Request Form	The form requesting to have WZ Traffic Analysis performed for a project. Most commonly filled out by TCP Designers or Project Leaders and sent to a WZ Traffic Analyst. A copy of the ODOT Request Form is included in Appendix C.

APPENDIX C – FORMS

OREGON DEPARTMENT OF TRANSPORTATION
Traffic-Roadway Section
Traffic Standards & Asset Management Unit MS#5
4040 Fairview Industrial Drive SE
Salem, Oregon 97302-1142

WORK ZONE SPEED REDUCTION REQUEST FORM

Reset Form | Save As | Print Form

Complete this form to request a speed reduction in a work zone on an Oregon State Highway. **The presence of one or more factors from Section 6 of this form may not necessarily result in a reduced speed.** Traffic Engineering staff will determine if a speed reduction is needed from a review of the construction scope of work and the traffic control plan. Some conditions may benefit better from temporary traffic control measures other than a speed reduction.

The request must be reviewed and signed by the Construction Project Manager, Traffic Control Plan Designer, and Region Traffic Manager before submitting to the Traffic-Roadway Section for a Letter of Support or Construction Speed Zone Order. With a State Traffic Engineer Letter of Support and no changes to the traffic control plan, only the Construction Project Manager review and signature is required before resubmitting the Form to the Traffic-Roadway Section for a Construction Speed Zone Order. For permit projects, only the District Manager review and signature is required before submittal.

Submit this form and a copy of the Traffic Control Plan to the ODOT Traffic-Roadway Section (Attn: Kathi McConnell) for review. Please allow 10 business days for review and response of the request.

For help and instructions, see the Form's Instructions and Definitions document. Work zone speed zone reductions are generally not warranted when:

- Activities are more than ten feet from the edge of the traveled way; or,
- Activities are an intermittent or mobile operation on the shoulder.

SECTION 1 - PROJECT INFORMATION

PROJECT NAME	CONTRACT, KEY, BUNDLE #		BID DATE	START WORK DATE
HIGHWAY [?]	PROJECT START MP	PROJECT END MP	COUNTY	
REQUESTING A: ☐ State Traffic Engineer Letter of Support ☐ Construction Speed Zone Order ☐ Amend Existing Const. SZ Order		CONST. SPEED ZONE ORDER REQUESTS: ☐ Have STE Letter of Support ☐ No changes to Traffic Control Plan		REQUEST DATE

SECTION 2 - EXISTING CONDITIONS

EXISTING POSTED SPEED [?]	AADT (VEH/DAY) [?]	SPIS PERCENTILE [?]

Describe in detail any unique site conditions that may conflict with normal driver expectancy (e.g.: limited sight distance due to changes in horizontal/vertical alignments, etc.)

SECTION 3 - DESCRIPTION OF NEED

Describe in detail the scope of work, and condition or operation which would merit a construction speed reduction. Identify the portion(s) of the traffic control plan that impacts normal driver expectancy and would benefit from a speed reduction. If more than one condition or operation, describe in separate paragraphs.

SECTION 4 - LOCATION

Describe the operation's or condition's location. Include beginning and ending milepoints. Include the requested speed limit for each operation or condition. If other than milepoints, please describe using the Traffic Control Plan. If more than one condition or operation, describe in separate paragraphs.

WORK ZONE SPEED REDUCTION REQUEST FORM
PROJECT: HIGHWAY: , **MP - MP**
DATE: COUNTY:

SECTION 5 - TIMING

Describe when the operation or condition will be in place using stage/phase, specific activity, project milestone, or time of day, etc. If more than one condition or operation, describe in separate paragraphs.

SECTION 6 - FACTORS

Select the work type and factor(s) for the construction speed zone reduction and explain. Work type definitions and diagrams are located in the Form's Instructions and Definitions. ***The presence of one or more factors does not necessarily result in a reduced speed.*** *Some conditions may benefit better from temporary traffic control measures other than a speed reduction.*

GENERAL CONDITIONS

- ☐ Temporary horizontal curve is designed and includes an advisory speed >10 mph below pre-construction posted speed.
- ☐ Reduced safe speed for stopping sight distance.
- ☐ Condition conflicts with normal driver expectancy.

SHOULDER ACTIVITIES

- ☐ Uninterrupted traffic flow with workers present for extended periods, within 10 feet of the traveled way, unprotected by barrier.

LANE ENCROACHMENTS, CENTERLINE ENCROACHMENTS, OR LANE CLOSURES

- ☐ Uninterrupted traffic flow with workers present for extended periods, within 10 feet of the traveled way or in a closed lane, unprotected by barrier.
- ☐ Barrier within 2 feet of the traveled way.
- ☐ Pavement edge drop-off (>2 inches) within 2 feet of the traveled way.
- ☐ Lane width reduction resulting in a lane width of ≤11 feet on freeways, ≤10 feet on non-freeways.

TEMPORARY ON-SITE DIVERSION

- ☐ Temporary on-site diversion lane widths ≤11 feet.
- ☐ Advisory speed for temporary on-site diversion's horizontal curvature >10 mph below the pre-construction posted speed.

SECTION 7 - SIGNATURES

The request must be reviewed and signed by the Construction Project Manager, Traffic Control Plan Designer, and Region Traffic Manager before submitting to the Traffic-Roadway Section for a Letter of Support or Construction Speed Zone Order. With a State Traffic Engineer Letter of Support and no changes to the traffic control plan, only the Construction Project Manager review and signature is required before resubmitting the Form to the Traffic-Roadway Section for a Construction Speed Zone Order. For permit projects, only the District Manager review and signature is required before submittal.

REQUESTED BY	EMAIL	PHONE
CONSTRUCTION PROJECT MANAGER*	SIGNATURE	DATE
	X	
TRAFFIC CONTROL PLANS DESIGNER**	SIGNATURE	DATE
	X	
REGION TRAFFIC MANAGER**	SIGNATURE	DATE
	X	

*For permit work: District Manager
**Not needed for permit work

Work Zone Speed Reduction Request Form
734-2874 (3/12)

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Oregon Department of Transportation
Traffic-Roadway Section

OREGON DEPARTMENT OF TRANSPORTATION
Traffic-Roadway Section
Traffic Standards & Asset Management Unit MS#5
4040 Fairview Industrial Drive SE
Salem, Oregon 97302-1142

Work Zone Speed Reduction Request Form Instructions and Definitions

Purpose

The purpose of the Work Zone Speed Reduction Request Form is to identify and document reasons for requesting a reduced posted speed through a construction work zone on a state highway.

Background

The 2009 MUTCD[1], Section 6C.01 states that *"Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so."* National research[2] has shown that retaining the pre-construction posted speed (i.e., no speed reduction) through work zones may result in fewer crashes. Research[2,3] and the MUTCD agree that if a reduced speed is needed, it *"should be used only in the specific portion of the TTC zone where conditions or restrictive features are present."*

The ODOT methodology to determine if a reduced work zone speed is appropriate is based on research and recommendations found in National Cooperative Research Program (NCHRP) Report 3-41(2) titled *Effectiveness and Implementability of Procedures for Setting Work Zone Speed Limits*[2]. The report identifies a procedure to set work zone speed limits in order to maximize work zone safety. The procedure classifies work zones by potential hazards, as represented by the location of work activities or traffic control in relation to the traveled way. Seven common work types are addressed, and maximum speed limit reductions are suggested. The procedure recommends that speed reductions should only be implemented if warranted by the presence of certain factors, listed in the table below.

NCHRP Guidelines for Determining Work Zone Speed Limit Reduction

Work Type	Maximum Speed Limit Reduction	Factors That Justify a Speed Limit Reduction
Roadside activity (greater than 10 ft from travel lanes)	None	None
Shoulder activity (2 to 10 ft from travel lanes)	10 mph	Workers present for extended periods within 10 ft of travel lane(s) not protected by barriers Horizontal curvature that might increase vehicle encroachment rate
Lane encroachment (from edge to within 2 ft of travel lanes)	10 mph	Workers present for extended periods within 2 ft of travel lane(s) not protected by barriers Horizontal curvature that might increase vehicle encroachment rate Barrier or pavement edge drop-off within 2 ft of travel lane(s) Reduced design speed for stopping sight distance Unexpected conditions
Moving activity on shoulder	None	None
Lane closure (between center line and edge line)	10 mph	Workers present for extended periods in the closed lane unprotected by barriers Lane width reduction of 1 ft or more with a resulting lane width of less than 11 ft TCDs encroaching on a lane open to traffic or in a closed lane within 2 ft of the edge of the open lane Reduced design speed for taper length or speed change lane length Barrier or pavement edge drop-off within 2 ft of travel lane(s) Reduced design speed for horizontal curve Reduced design speed for stopping sight distance Traffic congestion created by a lane closure Unexpected conditions
Temporary diversion	10 mph	Lane width reduction of 1 ft or more with a resulting lane width of less than 11 ft Reduced design speed for detour roadway or transitions Unexpected conditions
Center line or lane line encroachment	10 mph	Workers present on foot for extended periods in the travel or closed lanes unprotected by barriers Remaining lane plus shoulder width is less than 11 ft Reduced design speed for taper length or speed change lane length Barrier or pavement edge drop-off within 2 ft of travel lane(s) Reduced design speed for horizontal curve Reduced design speed for stopping sight distance Traffic congestion created by a lane closure Unexpected conditions

TCDs = traffic control devices.

Request Process

The State Traffic Engineer has the authority to set a reduced speed in a work zone or other temporary condition on State Highways[4]. The request form must be reviewed and signed by the Construction Project Manager, Traffic Control Plans Designer, and Region Traffic Manager before submitting to the Traffic-Roadway Section for review. For permit projects, only the District Manager review and signature is required before submittal. Send requests to the Traffic-Roadway Section and include the Request Form and a copy of the project's traffic control plan.

Requesting a work zone speed reduction is a 2-stage process:

1. Request a State Traffic Engineer Letter of Support, and
2. Request a Work Zone Speed Zone Order.

Letter of Support

Requesting a Letter of Support should be done around the Preliminary Plans stage of project development since the Letter of Support will be based on the traffic control plans. The Letter of Support is not a Speed Zone Order and cannot be used to place speed signs on the project[4]. The intent of a Letter of Support is to:

- Let the Traffic-Roadway Section, project manager, and Region traffic manager know of an upcoming project that may have a reduced posted speed before a formal Order is requested;
- Begin dialog between TCP designers and the Traffic-Roadway Section on the use of a Work Zone Speed Reduction and alternative temporary traffic control measures;
- Improve the design of Work Zone Speed Reductions;
- Provide a means to estimate reduced speed sign quantities in the project estimate; and
- Accelerate the Order request process when an order is needed during construction.

Allow 10 business days for review and response of the Letter of Support request.

Work Zone Speed Zone Order

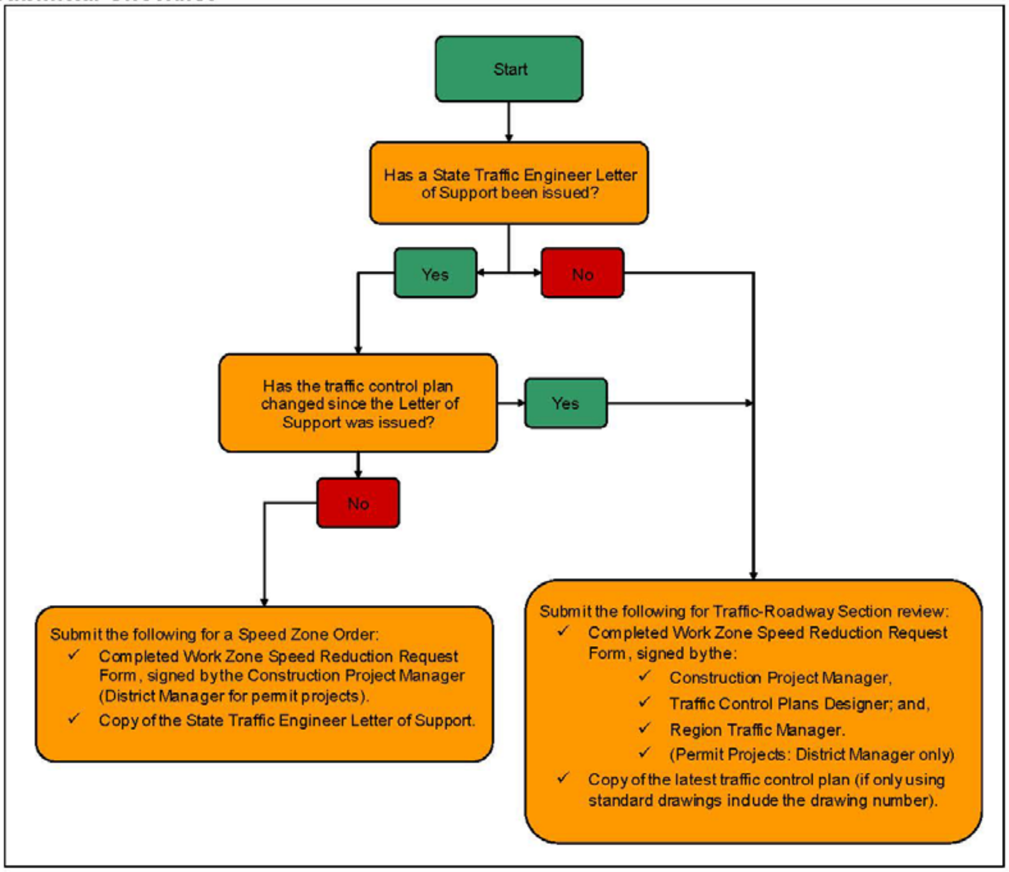
A Work Zone Speed Zone Order should be requested after the contract is awarded and the contractor and project manager (or District Manager for permit projects) have agreed on project staging and traffic control. Allow 10 business days for review and response of the request.

If a State Traffic Engineer Letter of Support has been issued and there have been no changes to the traffic control plan since the Letter of Support was issued, the Construction Project Manager (or District Manager for permit projects) need only review and sign the request form before re-submitting to the Traffic-Roadway Section for a speed zone order.

Traffic Engineering staff will determine if a speed reduction is needed from a review of the proposed construction operation and the traffic control plans. Speed zone orders for a work zone are written specifically for the conditions present in the work zone. The presence of one or more conditions or factors from Section 6 of the Form may not necessarily result in a reduced speed. Some conditions may be better mitigated with temporary traffic control measures other than a speed reduction.

Use the flow chart on the next page to determine what needs to be submitted for Traffic-Roadway Section review.

Submittal Checklist



✓ Submit the request to Kathi McConnell at:

kathleen.e.mcconnell@odot.state.or.us or

Kathi McConnell
Oregon Department of Transportation
Traffic-Roadway Section, MS#5
4040 Fairview Industrial Drive SE
Salem, Oregon 97302-1142

Work Zone Speed Reduction Request Form

Complete the Work Zone Speed Reduction Request Form to request a speed reduction for a work zone. The following explains required fields in the Form and includes related website links for more information.

Section 1 – Project Information

Complete this section with general information about the project, the project location, and what is being requested.

- **Project Name** – Enter the full project name.
- **Contract, Key, Bundle # –** Enter the project's contract number, key number, or bundle number, if known.
- **Bid Date –** Enter the project's bid date. If the project is still in design, estimate the month and year the project will go to bid.
- **Start Work Date –** Enter the date work will actively begin at the project site. If the project is still in design, estimate the month and year work will actively begin at the project site.
- **Highway –** Enter the ODOT highway number the project is predominantly located on from the pull-down menu (Route-State Highway Cross Reference Table).
- **Project Start MP –** Enter the beginning milepoint of the project's limits.
- **Project End MP** – Enter the ending milepoint of the project's limits.
- **County –** Enter the county the project is predominantly located in from the pull-down menu.
- **Requesting –** Select what this request is for. Typically, a Letter of Support is requested during design, and a Speed Zone Order is requested during construction.
- **Const. Speed Zone Order Requests –** This area is for Construction Speed Zone Order requests only (not a Letter of Support). If a Letter of Support has been issued, select "Have STE Letter of Support." If the Traffic Control Plan has not changed since the Letter of Support was issued, select "No changes to Traffic Control Plan."
- **Request Date –** Enter the date of the request.

Section 2 – Existing Conditions

Complete this section with general information about the existing conditions at the project site.

- **Existing Posted Speed –** Enter the existing posted speed at the project site (not an advisory speed). To check existing speed zone orders, visit the Speed Zoning Program website.
- **AADT** – Enter the most recent existing Annual Average Daily Traffic at the project site from the ODOT Traffic Counting Program's Transportation Volume Tables. Select an AADT that best characterizes the project site.
- **SPIS Percentile –** Enter the highest, most recent Safety Priority Index System (SPIS) percentile at the project site from the most recent statewide SPIS report. If you are not an ODOT employee, contact the Region SPIS Contact for this information (ODOT Region Map).
- Describe in detail any unique site conditions that may conflict with normal driver expectancy such as limited sight distance due to changes in horizontal or vertical alignments, etc.

Section 3 –Description of Need

Complete this section with detailed information on the scope of work, and the condition or operation causing this speed reduction request. Answer this question: *why* is a speed reduction needed?

Section 4 – Location

Complete this section with detailed information on the location of the condition or operation causing this speed reduction request. Include the beginning and ending milepoints and the requested speed limit for each operation or condition. If more than one condition or operation needs a speed reduction, describe in separate paragraphs. Answer this question: *where* is a speed reduction needed?

Section 5 – Timing

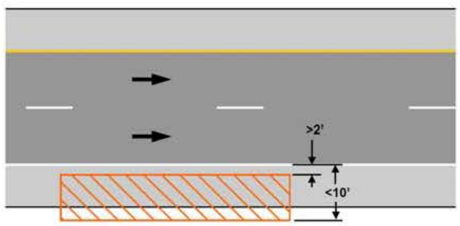
Complete this section with detailed information on when the condition or operation causing this speed reduction request will be in place. Use stage/phase, specific activity, project milestone, or time of day to describe the time. If more than one condition or operation needs a speed reduction, describe in separate paragraphs. Answer this question: *when* is a speed reduction needed?

Section 6 – Factors

Complete this section by selecting the work type and factor(s) for the speed reduction request and explain each factor. Work types are the section headers in the table and include the following:

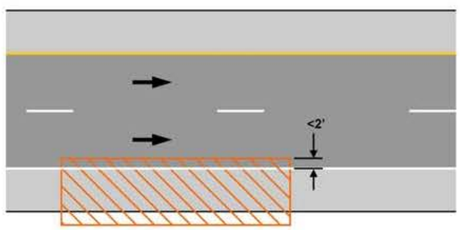
General Conditions – These conditions are general considerations that are common to several work types.

Shoulder Activities – Shoulder activities are activities that encroach on the area closer than 10 feet, but not closer than 2 feet, to the edge of the traveled way. Work activities encroach on the shoulder but not on the traveled way. These activities have an effect on traffic, but not as much effect as activities at the edge of the traveled way. Typical applications include culvert extensions, guardrail repair, structural work, and shoulder repair.



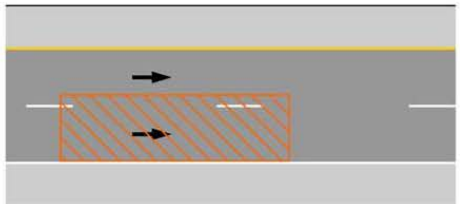
SHOULDER ACTIVITY

Lane Encroachments – Lane encroachments are activities that encroach on the area from the edge of the traveled way to 2 feet from the edge of the traveled way. These activities are on the roadway shoulder very close to or just upon the traveled way. Typical activities for this condition are utility work, guardrail maintenance, and shoulder work.



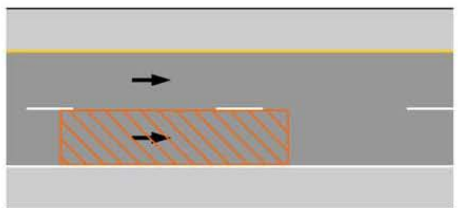
LANE ENCROACHMENT

Centerline Encroachments – A centerline or lane line encroachment is an activity that encroaches on the area on both sides of a centerline of a roadway or lane line of a multilane highway. These include stationary activities that close a lane and encroach on an adjacent lane, or stationary activities that involve unprotected workers on foot in the traveled way.



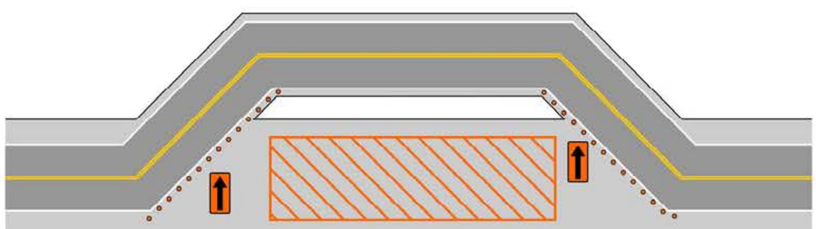
CENTERLINE OR
LANE LINE ENCROACHMENT

Lane Closures – Lane closures are activities that encroach on the area between the centerline or lane line and the edge of the traveled way. Lane closures are critical because they directly interfere with existing traffic patterns.



LANE CLOSURE

Temporary On-Site Diversion – A temporary on-site diversion is a temporary alignment within the project right-of-way to divert traffic around the work area. A diversion can be built to accommodate all the existing lanes of traffic or a reduced number of lanes. Single lane diversions controlled by a temporary traffic typically do not need a speed reduction.



Temporary On-Site Diversion

Speed reduction factors are listed under each work type. These speed reduction factors are based on findings in NCHRP Report 3-41(2)[2]. Select the checkbox next to each factor that matches the field condition or operation and explain in detail what the condition is, where it is located, when it will be in place, and why it cannot otherwise be mitigated.

Section 7 –Signatures

The work zone speed reduction request must be reviewed and signed by the Construction Project Manager, Traffic Control Plan Designer, and Region Traffic Manager before submitting to the Traffic-Roadway Section for review. For permit projects, only the District Manager review and signature is required.

If a State Traffic Engineer Letter of Support has been issued and there have been no changes to the traffic control plan since the Letter of Support was issued, the Construction Project Manager (or District Manager for permit projects) need only review and sign the request form before re-submitting to the Traffic-Roadway Section for a speed zone order.

Submit the request to Kathi McConnell at:

kathleen.e.mcconnell@odot.state.or.us or

Kathi McConnell
Oregon Department of Transportation
Traffic-Roadway Section, MS#5
4040 Fairview Industrial Drive SE
Salem, Oregon 97302-1142

References

(1) *Manual on Uniform Traffic Control Devices (MUTCD)*. 2009 ed. Washington, D.C.: U.S. Department Of Transportation, Federal Highway Administration, 2009.

(2) Migletz, James, Jerry L. Graham, Brian D. Hess, Ingrid B. Anderson, Douglas W. Harwood, and Karin M. Bauer. *NCHRP Report 3-41(2): Effectiveness and Implementability of Procedures for Setting Work Zone Speed Limits*. Washington, D.C.: Transportation Research Board, 1998.

(3) Finley, Melisa D. "Field Evaluation of Motorist Reactions to Reduced Work Zone Speed Limits and Other Work Zone Conditions." *Transportation Research Record: Journal of the Transportation Research Board Online* 2258 (2011): 40-48. http://trb.metapress.com/content/w2934753t1077144/fulltext.pdf (accessed January 27, 2012).

(4) *ODOT Traffic Manual*. Revision 3. Salem, Oregon: Oregon Department of Transportation, 2009. http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/Traffic_Manual_09.pdf?ga=t (accessed January 27, 2012).

OREGON DEPARTMENT OF TRANSPORTATION
Traffic-Roadway Section
Traffic Standards & Asset Management Unit MS#5
4040 Fairview Industrial Drive SE
Salem, Oregon 97302-1142

TEMPORARY TRANSVERSE RUMBLE STRIP REQUEST FORM

TRAFFIC CONTROL PLANS UNIT USE ONLY	
Received By:	Date Received:
Assigned To:	Date Completed:

Complete this form to request Temporary Transverse Rumble Strips (TTRS) in a work zone on an Oregon State Highway. The State Traffic Engineer must approve all TTRS applications on State Highways. Traffic Engineering staff will determine if using TTRS is acceptable from a review of the construction scope of work and the traffic control plan.

The request must be reviewed and signed by the Construction Project Manager and Traffic Control Plan Designer before submitting to the Traffic-Roadway Section for a State Traffic Engineer Approval Letter. For permit projects, only the District Manager review and signature is required before submittal.

Submit this form and a copy of the Traffic Control Plan to the ODOT Traffic-Roadway Section (Attn: Scott McCanna) for review. Please allow 15 business days for review and response of the request.

TTRS are meant to attract the driver's attention to highly unusual conditions, such as conditions requiring a stop when one is not expected. Some conditions may benefit better from temporary traffic control measures other than TTRS. Studies have shown that TTRS are generally not effective as speed control devices. Generally, TTRS should not be placed:

- On sharp horizontal or vertical curves;
- Through pedestrian crossings;
- On bicycle routes; or
- On roadways used by bicyclists unless a minimum clear path of 4 feet is provided:
    - at each edge of the roadway, or
    - on each paved shoulder as described in AASHTO's "Guide to the Development of Bicycle Facilities."

SECTION 1 - PROJECT INFORMATION

PROJECT NAME	CONTRACT KEY NUMBER		START WORK DATE	REQUEST DATE
HIGHWAY [?]	PROJECT START MP	PROJECT END MP	COUNTY	

SECTION 2 - EXISTING CONDITIONS

POSTED SPEED [?]	AADT (VEH/DAY) [?]	

Describe in detail any unique site conditions that may conflict with normal driver expectancy (e.g.: a required stop or abrupt alignment change when one is not expected, etc.)

SECTION 3 - DESCRIPTION OF NEED

Describe in detail the scope of work, and condition or operation which would benefit from transverse rumble strips. If more than one condition or operation, describe in separate paragraphs. Answer this question: why are TTRS needed?

SECTION 4 - LOCATION

Describe the operation's or condition's location. Include beginning and ending milepoints. If other than milepoints, describe using the Traffic Control Plan. If more than one condition or operation, describe in separate paragraphs. Answer this question: where are TTRS needed?

Temporary Transverse Rumble Strip Request Form
734-2886 (8/12)

Page 1 of 2

Oregon Department of Transportation
Traffic-Roadway Section

TEMPORARY TRANSVERSE RUMBLE STRIP REQUEST FORM
PROJECT:
DATE:

HIGHWAY: , MP - MP
COUNTY:

SECTION 5 - TIMING

Describe when the operation or condition will be in place using stage/phase, specific activity, project milestone, or time of day, etc. If more than one condition or operation, describe in separate paragraphs. Answer this question: when are TTRS needed?

SECTION 7 - SIGNATURES

The request must be reviewed and signed by the Construction Project Manager and Traffic Control Plan Designer before submitting to the Traffic-Roadway Section for a State Traffic Engineer Approval Letter. For permit projects, only the District Manager review and signature is required before submittal.

REQUESTED BY	EMAIL	PHONE
TRAFFIC CONTROL PLANS DESIGNER*	SIGNATURE	DATE
	X	
CONSTRUCTION PROJECT MANAGER**	SIGNATURE	DATE
	X	

*Not needed for permit work
**For permit work: District Manager

BORDERING STATE PROJECTS LETTER

Oregon

John A. Kitzhaber, M.D., Governor

{Telephone}
{FAX}

DATE: {Date}

TO: (Name)
(Title)
(Organization)
(Address, Phone #)

RE: {Project Name, Highway, County, KN}

ODOT is presently preparing contract plans for the (Project Name) Project. This will be a (Project Description) project. ODOT anticipates the need for advance warning signing and traffic control to extend into the State of (State). This project is scheduled to be open for contractor bidding on (Month, Day, Year).

ODOT will be using Standard Drawing RDXXX for temporary traffic control during the construction of this project. The detail that we propose to use on Standard Drawing RDXXX will be the “(Detail Title)”. This Standard Drawing has been included for your reference.

ODOT will also be requiring that the Contractor include the State of (State), the (State DOT formal title), the (State) Director of Transportation, officers, and employees of the State of Idaho as additional insured named on insurance policies issued for this project, or furnish an additional insured endorsement naming the same as Additional Insured but only with respect to the Contractor’s activities to be preformed under this contract.

ODOT requests the authority to install and maintain temporary traffic control signs and devices, within the state of (State) right-of-way for the duration of this project. Please advise regarding the lead time and other permit information required.

Your timely reply to this request will be appreciated. If you have any questions regarding this project please feel free to contact (Designer name) at (503) (Designer Phone #) or (Name) at (503) (Phone #)

Sincerely,

(Manager’s Name)
(Managing Engineer’s Title)

TECHNICAL SERVICES
Traffic Engineering and Operations Section
Office Phone: (503) 986-3568
Fax Number: (503) 986-4063

TRAFFIC SIGNAL APPROVAL REQUEST FORM

Reset | Save As | Print

Under provisions of OAR 734-020-0430 and the delegated authority, the State Traffic Engineer must approve all traffic signal installations, modifications, and removals.

Permanent Signal: ☐ **New** ☐ **Modification** ☐ **Removal**

Temporary Signal: ☐ **Intersection** ☐ **Work Zone/Bridge**

Expected Duration of Use: **from** ________ **to** ________

Project Name:			**Location:**		
Highway Name:			**At:**		
Route No.		**File Code:**		**M.P.**	
Region:	**District:**	**County:**		**City:**	

Applicant:	**Title:** Region Traffic Manager
Phone:	**E-mail:**
Contact Name:	**Phone:**

The required Traffic Signal Engineering Investigation (See ODOT Traffic Manual) including the following elements is attached.

- ☐ Diagram of Intersection (showing current and future vehicular and pedestrian volumes)
- ☐ Traffic Signal Warrants Analysis
- ☐ Conceptual Traffic Signal Design
- ☐ Safety Analysis
- ☐ Operational Analysis
- ☐ Transportation Plan Consistency
- ☐ Other Agency Support (local, rail, etc.)
- ☐ Application for State Highway Approach
- ☐ Other (specify) ________

Additional Information:

Signature: **Date:**

************* Traffic Engineering and Operations Section Use Only **************

Received By:	Date Received:
Assigned to:	Date Completed:
File Code:	

rev. 11/30/04

Traffic Analysis Work Request Form

Key No: __________ Prefix: ________________ County: _________________

Project Name: ____

Hwy. Name: __________________________________ Hwy. No.: __________

Beginning MP:__________ End MP:__________

Requested by: __________________________________ Phone: ________________

Section: ____

Request Date: __________ Due Date:__________ Date Out: __________

Job Field Options

- ☐ Project Analysis
- ☐ Interchange Analysis
- ☐ Signal Analysis
- ☐ Storage Analysis
- ☐ Cost Analysis
- ☐ Detour Analysis
- ☐ Work Zone

Projected Work Required

- ☐ Two Way - One Lane
- ☐ Daily Lane Closures
- ☐ Extended Lane Closures
- ☐ Limited Total Closures/Blasting
- ☐ Full Closures/Detour
- ☐ Chip Seal
- ☐ Left Turn Storage
- ☐ Signals
- ☐ Slow Downs
- ☐ Extra Closure Lengths

Brief Project Summary:

APPENDIX D - TRAFFIC CONTROL PLANS CHECKLIST

Traffic Control Task/Item	Notes	
This list is an attempt to capture all of the items included in Traffic Control Plan Development and is by no means comprehensive.		
Transportation Management Plan	See the FHWA Publication Developing and Implementing TMP for Work Zones - Appendix A for TMP Checklist	☐
Project Description		
Project Background		☐
Project Type		☐
Project Area/Corridor		☐
Project Goals and Constraints		☐
Permit Requirements		☐
Proposed Construction Phasing/Staging		☐
General Schedule and Timeline		☐
Related Projects		☐
Existing Conditions		
Roadway Characteristics		☐
Pre-Construction Posted Speed		☐
Traffic Data (volumes, speed, capacity, etc)		☐
Traffic Operations		☐
Crash Data		☐
Community Input		☐
Project Conditions		
Roadway Characteristics		☐
Vertical/Horizontal Clearances		☐
Abrupt Edges		☐
Traffic Projections		☐
Mobility		☐
Delay		☐
Motor Carrier Notification and Coordination		☐
Traffic Operations		☐
Temporary or Portable Signals		☐
Haul Routes & Waste Sites		☐
Traffic Analysis		☐
Lane Allowances and Restrictions		☐
Local Events		☐
Holidays & Weekends		☐
Community Input		☐
Construction Approach/Phasing/Staging Strategy		☐
Utility Operations		☐
Alternative Contracting Methods		☐

Temporary Traffic Control Strategies		
Traffic Control Strategies		☐
Speed Zone Reduction (Temporary), STE Approval		☐
Traffic Signal (Temporary), STE Approval		☐
Shoulder Closure		☐
Lane Closure(s)		☐
Full Closure		☐
Detour		☐
Weight Restrictions		☐
Vertical/Horizontal Clearances		☐
Detour Signs/Striping - Both Directions		☐
Geometrics		☐
Local government/community notification and input		☐
Access - Business/Residential		☐
Non motorized user detours		☐
Emergency/Public Transit/School/Mail impacts		☐
Detour Agreement		☐
Crossover		☐
Rolling Slowdown		☐
Diversion		☐
Extended Traffic Queue's		☐
Night Work		☐
Flaggers/Pilot Cars		☐
Lane Shift		☐
Blasting Traffic Control - closure		☐
Traffic Control Devices		☐
Temporary Signs (see TCP Cost Estimator for list of signs)		☐
Temporary Striping		☐
Channelization Devices		☐
Rumble Strips, STE Approval		☐
Pavement Markers		☐
Barricades		☐
Barrier (Concrete & Guardrail		☐
Glare Shields		☐
Temporary Barrier Panels		☐
Impact Attenuators		☐
Sequential Arrow Signs		☐
Portable Changeable Message Signs		☐
Temporary Traffic Signals (Portable)		☐
Flagger Station Lighting		☐
Portable Traffic Management System		☐
Steel Plates in Roadway		☐

Traffic Control Bid Items(Check TCP Cost Estimator)	
TEMPORARY PROTECTION AND DIRECTION OF TRAFFIC	
TEMPORARY WORK ZONE TRAFFIC CONTROL, COMPLETE	
TEMPORARY SIGNS	
TEMPORARY BARRICADES, TYPE II or III	
TEMPORARY GUARDRAIL, TYPE 2A, 3, or 4 REFLECTORIZED	
TEMPORARY GUARDRAIL TERMINALS, FLARED or NON-FLARED	
TEMPORARY GUARDRAIL TRANSITION	
TEMPORARY BRIDGE CONNECTIONS	
TEMPORARY CONCRETE BARRIER, REFLECTORIZED	
TEMPORARY CONCRETE BARRIER, TALL, REFLECTORIZED	
MOVING TEMPORARY CONCRETE BARRIER	
TEMPORARY IMPACT ATTENUATOR	
MOVING TEMPORARY IMPACT ATTENUATORS	
TEMPORARY IMPACT ATTENUATOR, TRUCK MOUNTED	
TEMPORARY GLARE SHIELDS	
MOVING TEMPORARY GLARE SHIELDS	
REFLECTIVE BARRIER PANELS	
PEDESTRIAN CHANNELIZING DEVICES	
REPAIR TEMPORARY IMPACT ATTENUATOR	
SURFACE MOUNTED TUBULAR MARKERS	
REPLACE SURFACE MOUNTED TUBULAR MARKERS	
TEMPORARY PLASTIC DRUMS	
TEMPORARY DELINEATORS	
TEMPORARY REFLECTIVE PAVEMENT MARKERS	
TEMPORARY FLEXIBLE PAVEMENT MARKERS	
TEMPORARY REMOVABLE TAPE	
TEMPORARY NON-REMOVABLE TAPE	
TEMPORARY NON-REFLECTIVE TAPE	
TEMPORARY STRIPING	
TEMPORARY PAVEMENT LEGENDS	
TEMPORARY PAVEMENT BARS	
TEMPORARY TRANSVERSE RUMBLE STRIPS	
STRIPE REMOVAL	
LEGEND REMOVAL	
TEMPORARY ILLUMINATION	
TEMPORARY TRAFFIC SIGNAL	
PORTABLE TRAFFIC SIGNAL	
SEQUENTIAL ARROW SIGNS	
PORTABLE CHANGEABLE MESSAGE SIGNS	
OVERHEIGHT VEHICLE WARNING SYSTEM	
PORTABLE TRAFFIC MANAGEMENT SYSTEM MOBILIZATION	
PORTABLE TRAFFIC MANAGEMENT SYSTEM	
FLAGGERS	
FLAGGER STATION LIGHTING	
AUTOMATED FLAGGER ASSISTANCE DEVICE	
TRAFFIC CONTROL SUPERVISOR	
PILOT CARS	

Public Information Strategies		
Public Awareness Strategies		☐
Business Access Delineation & Signing		☐
Pilot Car Local Residence/Business Notification		☐
Motorist Information Strategies		☐
Portable Traffic Management Systems		☐
Use of Permanent VMS		☐
Transportation Operations Strategies		
Demand Management Strategies		☐
Emergency Vehicles		☐
Corridor/Network Management Strategies		☐
Work Zone Safety Management Strategies		☐
Positive Protection for Workers		☐
Traffic/Incident Management and Enforcement Strategies		☐
Work Zone Enforcement		☐
Tow Truck		☐
Contract Deliverables		
Specifications		☐
Standard Specifications		☐
Boilerplate Special Provisions		☐
Unique Special Provisions		☐
Custom Special Provision		☐
Plans		☐
Standard Drawings		☐
Traffic Control Details		☐
Traffic Control Plans - Stage and Phase Plans		☐
Detour Plan		☐
Cross Sections		☐
Estimate		☐

APPENDIX E - DESIGN CONVERSION CHARTS

METRIC AND ENGLISH UNITS

Sizing Increments	
English (Inches)	**Metric (mm)**
3	76
6	152

Sign Letter Heights	
English (Inches)	**Metric (mm)**
4	102
5	127
6	152
8	203
10	254
10 2/3	271
12	305
13 1/3	339
15	381
16	406
18	457

Border / Radius Sizes	
English (Inches)	**Metric (mm)**
½	13
1	25
1 ½	38
2	51
3	76
6	152
9	229
12	305

Arrow Sizes	
English (Inches)	**Metric (mm)**
4 X 6	102 X 152
5 X 7	127 X 178
6 X 9	152 X 229
8 X 12	203 X 305
10 X 16	254 X 406
15 1/8 X 24 ¼	384 X 616
18 ¼ X 29 ¼	464 X 743
22 ¼ X 35 5/8	565 X 905

APPENDIX F - TCP TEAM MEMBER ROLES & RESPONSIBILITIES

TCP TEAM MEMBER ROLES & RESPONSIBILITIES

STATE TRAFFIC CONTROL PLANS ENGINEER

- Responsible for developing, updating, teaching and interpreting statewide design standards and practices used in the development of temporary traffic control plans for highway construction projects.
- Provides technical information and recommendations regarding the development and implementation of temporary traffic control plans.
- Assists in the development of Standard Specifications, Special Provision language and Standard Drawings to be used in the development of temporary traffic control plans within ODOT highway construction contracts.
- Provides construction support for Region and OBDP personnel in helping to interpret or implement traffic control measures and/or traffic operation issues within project traffic control plans.
- Publishes ODOT's "*Traffic Control Plans Design Manual*".
- Publishes ODOT's "*Short Term Traffic Control Handbook for Operations of 3 Days or Less*".
- Publishes ODOT's "*Work Zone Tour Summary Report*".
- Delivers ODOT's 3-day TCP Design Course.
- Leads ODOT Traffic Control Plans *Resource Issues Group (RIG)* quarterly meetings. Meetings are used to maintain statewide consistency and uniformity of Traffic Control Plan design standards and practices. Meetings are also used for the sharing of information and current developments within each Region as they pertain to the temporary traffic control discipline.

TCP QUALITY ASSURANCE ENGINEER

- Responsible for development, maintenance, interpretation of traffic control plan quality assurance program.
- Researches, develops, and implements standards, specifications, and procedures related to work zone traffic control plans design statewide. Reviews and makes recommendations on exceptions to design standards, specifications and procedures statewide.
- Reviews plans, specifications and engineering estimates prepared by Tech Centers, consultants, and local agencies for quality assurance. Reviews completed plans for conformity with design standards, safety features and funding limitations.
- Provides technical assistance to Region Traffic Control Plans Designers, City and County Public Works agencies and consulting firms in the design of Traffic Control Plans.
- Provides temporary traffic control plans design training to Region Traffic Control Plans Designers and consultants.
- Provides work zone traffic analysis training to Region Traffic Control Plans Designers and consultants.
- Consults with construction project designers on the requirements of stage construction of some projects.
- Participates in the ODOT Traffic Control Plans *Resource Issues Group (RIG)* quarterly meetings. Meetings are used to maintain statewide consistency and uniformity of Traffic Control Plan design standards and practices.

TCP STANDARDS ENGINEER

- Responsible for development, maintenance, interpretation of temporary traffic control plans design practices and standards, standard specifications, special provisions, standard drawings, and cost estimate data.
- Researches, develops, and implements standards, specifications, and procedures related to work zone traffic control plans design statewide. Reviews and makes recommendations on exceptions to design standards, specifications and procedures statewide.
- Reviews plans, specifications and engineering estimates prepared by Tech Centers, consultants, and local agencies for quality assurance. Reviews completed plans for conformity with design standards, safety features and funding limitations.
- Provides technical assistance to Region Traffic Control Plans Designers, City and County Public Works agencies and consulting firms in the design of Traffic Control Plans.
- Participates as a member of the Qualified Products List Committee. Provides input to the committee regarding the testing, application, approval or disapproval of temporary traffic control devices and products submitted by vendors.
- Provides temporary traffic control plans design training to Region Traffic Control Plans Designers and consultants.
- Consults with construction project designers on the requirements of stage construction of some projects.
- Assists Region and/or field personnel in determining appropriate construction signing techniques and/or traffic handling methods for situations that arise during construction of projects.
- Participates in the ODOT Traffic Control Plans *Resource Issues Group (RIG)* quarterly meetings. Meetings are used to maintain statewide consistency and uniformity of Traffic Control Plan design standards and practices.

WORK ZONE TRAFFIC ANALYST

- Responsible for development, maintenance, and interpretation of Work Zone Traffic Analysis tool.
- Researches, develops, and implements standards, specifications, and procedures related to work zone traffic analysis statewide. Reviews and makes recommendations on exceptions to design standards, specifications and procedures statewide.
- Researches, develops, and implements standards, specifications, and procedures related to work zone traffic control plans design statewide. Reviews and makes recommendations on exceptions to design standards, specifications and procedures statewide.
- Reviews plans, specifications and engineering estimates prepared by Tech Centers, consultants, and local agencies for quality assurance. Reviews completed plans for conformity with design standards, safety features and funding limitations.
- Provides technical assistance to Region Traffic Control Plans Designers, City and County Public Works agencies and consulting firms in the design of Traffic Control Plans.
- Provides temporary traffic control plans design training to Region Traffic Control Plans Designers and consultants.
- Provides work zone traffic analysis training to Region Traffic Control Plans Designers and consultants.
- Consults with construction project designers on the requirements of stage construction of some projects.
- Publishes ODOT's "*Work Zone Traffic Analysis Manual*".
- Delivers ODOT's 2-day WZTA Design Course
- Participates in the ODOT Traffic Control Plans *Resource Issues Group (RIG)* quarterly meetings. Meetings are used to maintain statewide consistency and uniformity of Traffic Control Plan design standards and practices.

REGION TRAFFIC CONTROL PLANS DESIGNERS

- Region TCP Designers are viewed as the Region temporary traffic control "Experts" in answering questions and requests for technical support, advice, interpretation and resources
- Region TCP Designers play a key role in determining work area mobility impacts and communicating that information to ODOT Motor Carrier Transportation Division's Freight Mobility Representatives and the local Regional Mobility Manager
- Region TCP Designers are primarily responsible for developing the Traffic Control Plans for ODOT highway construction projects within their Region. The TCP for these projects typically includes the following:
    - Traffic Control plan sheets
    - Project-specific Special Provisions
    - A TCP-related cost estimate

  Projects assigned may vary greatly in complexity. Roadway types may vary from freeways to urban arterial highways to rural, two-lane highways. Project scopes may range from:
    - Modernization upgrades or capacity improvements
    - New facility construction
    - Facility reconstruction or rehabilitation
    - Transit system retrofits; or even,
    - Emergency repairs or corrections
- TCP Designers frequently review and make comment on consultant-designed TCPs for ODOT projects, as well as local City or County Public Works agency projects
- TCP Designers also attend ODOT Project Development Team meetings and work with project team members to refine TCPs for their projects
- Designers will frequently visit project sites to obtain vital physical data to be used in the development of their TCPs
- Designers may be involved with conducting the work zone traffic analysis, used to develop Lane Restrictions for highway construction contracts
- Designers provide post-award TCP construction support to Region Construction personnel for situations that may arise during construction
- Designers participate in quarterly meetings of the ODOT TCP Resource Issues Group (RIG) – the statewide discussion group of ODOT TCP Designers
- For TCP-related questions concerning an ODOT STIP, OTIA or other In-house project, please contact the appropriate Region TCP Designer