Oregon

DATE: January 5, 2008

TO: Traffic Control Plans Designers

FROM: Scott M. McCanna, P.E.
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SUBJECT: 2008 Traffic Control Plans Design Manual – Revision 5

PURPOSE

The purpose of this manual is to introduce Traffic Control Plans Designers to their responsibilities within this discipline and provide an organized collection of traffic control plan design standards, guidelines, policies, and procedures to apply in their designs.

Keep in mind, this manual is a living document. Holders of this manual may at any time make recommendations or suggestions for changes to the manual. ODOT technical staff will review all suggestions and notify Holders of any changes to any portions of this document.

The TCP Design Manual is intended to be utilized by TCP Designers within ODOT, members of City or County Public Works offices and private consulting engineering firms responsible for the development of temporary traffic control and highway construction staging plans.

Care should be taken in applying any portions of this manual to projects developed by professionals outside the Department. Differences may exist between the ODOT TCP Design practices and policies established by other agencies which may lead to conflicts in the design of a particular Traffic Control Plan.

This technical manual is not intended to replace any existing ODOT Design policy, however, portions of this manual may supersede portions of other ODOT design manuals. This manual is to be used as a technical reference as well as a teaching aide. Please contact the ODOT Traffic Control Plans Unit in Salem for clarification or interpretation of any standards, practices or policies within this manual.

MANUAL ORGANIZATION

From front to back, this manual discusses Traffic Control Plans Design in general (job description, design processes) and progresses to specific TCP design elements (Traffic Control Devices, standard drawings, bid estimates, specifications, etc.).

UPDATES

We intend to update this manual on an annual basis; however, recommended changes or additions to the manual will be accepted any time.

TRAFFIC CONTROL PLANS DESIGN CLASS

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CHAPTER 1 – TCP DESIGN INTRODUCTION

Chapter 1

1.0 – KEY POINTS OF THIS CHAPTER

- Safety – TCP Primary Function
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1.1 – SAFETY - TCP PRIMARY FUNCTION

SAFETY IN TCP DESIGN IS PRIMARY

Safety is primary in TCP Design. Take a look at Chapter 6 of the MUTCD to see how safety management is emphasized.

The principal function of a Traffic Control Plan (TCP) is to provide for ***safe*** and efficient movement of road users through or around work zones while protecting workers and equipment and while providing for the efficient construction and maintenance of the highway.

The goal is to route road users through the work zone efficiently by:

- Using clear signs and pavement markings well in advance of the work zone,
- Avoiding frequent and/or abrupt changes in roadway geometry or speed, and
- Using devices that highlight or emphasize the appropriate path.

The following elements are important for worker safety and TCP Management:

- Training – All workers should be trained to work next to motor vehicle traffic in a way that minimizes their vulnerability.
- Local Accesses – Know where all accesses in the work zone are and how each will be accommodated.
- Emergency Vehicles – Make sure they have planned access at all times.
- Apparel – All workers exposed to moving roadway traffic or construction equipment should wear high-visibility vests, shirts, jackets and hats.
- Speed Reduction – Reducing the speed of traffic should be considered.
- Off-Peak Work Hours – Work off-peak, if possible.

- Lighting – For nighttime work, the TCP zone and approaches may be lighted.
- Special Devices – Are used to alert road users and includes rumble strips, changeable message signs, hazard beacons, flags and warning lights.
- Be Credible – Cover, Turn or Remove signs or devices that are not in use.
- Traffic Control Supervisor – A Traffic Control Supervisor (TCS) may be designated to see that required traffic control devices are in place, each worker is safe, and traffic control persons perform their duties safely.

ODOT partners with the MUTCD to recognize and outline the purpose and function of TCP design.

FROM THE MUTCD

TCP Definition from the 2003 MUTCD Chapter 6a

"When the normal function of the roadway is suspended, TTC 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."

"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 feature 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."

"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."

ADDITIONAL ODOT PERSPECTIVE

ODOT perspective on the function of TCP Design lines up the MUTCD. If designed with these principles in mind, the TCP will:

- Minimize the inconvenience to traffic during construction which will
- Minimize the number of accidents, and
- Minimize the severity of accidents.

A TCP is a *required* portion of all ODOT contract plans and will include, as a minimum:

- Special Provisions,
- a Pay Item Schedule and
- a list of ODOT Standard Drawings specific to the project.

Additional TCP plan sheets may be included if additional details are needed to convey more complex traffic and construction staging. All contract plans shall include a representative TCP based on the scope of work.

1.1.2 – TCP STANDARDS - RULES THAT GUIDE US

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

One of the reasons that ODOT uses the guidance of the MUTCD in the design of TCPs is that ODOT is mandated by the Oregon Administrative Rules (OAR) and the Oregon Revised Statutes (ORS) to use the Manual on Uniform Traffic Control Devices (MUTCD) as the reference for the specifications of uniform standards for traffic control devices for use upon highways within this state. Section of the MUTCD 6A.01 of the MUTCD 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 Temporary Traffic Control (TTC or TCP) zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents."

Section 6B.01 B "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."

This is the basis for the requirement that Traffic Control Plans be prepared for all ODOT contract plans.

THE TCP DESIGN MANUAL

ODOT's TCP Design Manual is the *design standard* for Traffic Control Plans on state highways.

The MUTCD provides a foundation for Oregon's TCP design guidelines. The TCP Design Manual builds on the foundation to develop specific design standards as they relate to Temporary Traffic Control Design for construction, maintenance, and utility work on state highways. In many instances the design standards in the TCP Design Manual are more rigorous and stringent than those in the MUTCD.

The Traffic Control Plans Design Manual is not intended to replace or substitute for other design manuals, policies or specifications referenced in this document. This design manual is meant to supplement the referenced manuals and provide additional information as it relates to the practice of Temporary Traffic Control Design.

OAR & ORS

There are a number of Oregon Administrative Rules (OAR) and Oregon Revised Statutes (ORS) that pertain to work zone and construction area traffic control. For example:

- 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 734-020-0032 and 0034 pertains to Portable Traffic Signals,
- OAR 734-020-0410 requires the State Traffic Engineer's approval of all traffic signals, temporary, portable, or permanent, and
- ORS 811.230, .231, .232, and .233 cover double fines and yielding to highway workers.

It is worth your time to be familiar with these and other OAR and ORS that pertain to work zone and construction area activities.

1.2 – TCP STRUCTURE & FORM

1.2.1 – TRAFFIC CONTROL PLAN STRUCTURE

WORK ZONE COMPONENTS

A work zone is composed of four distinct areas:

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

The Advance Warning Area - is where traffic discerns that a work zone is approaching. This area incorporates the advance warning signs. Generally, the sign spacing and font size increases with the speed of the facility.

The Transition Area - is where traffic is redirected from the normal travel path. This redirection is accomplished by the placement of traffic control devices on the roadway. A decision for traffic to make a maneuver or merge is needed. Resulting in the majority of accidents occur within this area. The application of the correct taper length will improve traffic flow and significantly increase the safety performance of the transition area.

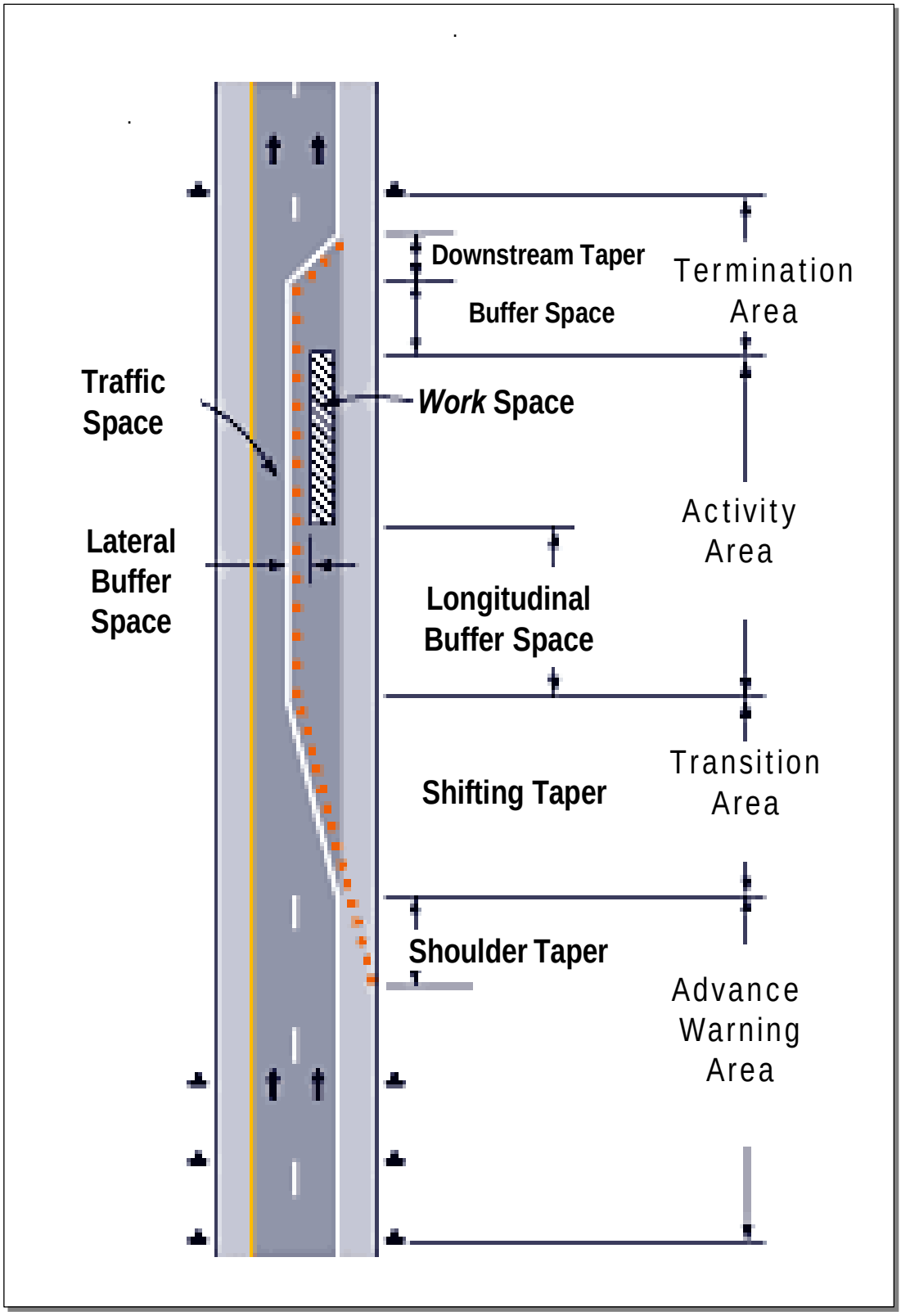
There are three different taper types. The merging is a full taper length "L". The shifting is ½ L. The shoulder is $^1/_3$ L. The taper length is calculated for speeds 45 mph or higher by L=WS where: W=width of offset and S=posted speed. For speeds 40 mph or less $L=WS^2/60$.

The Activity Area - is where the actual work is being constructed. Within the activity area two types of buffer spaces separate traffic from the work space. A longitudinal buffer space provides a margin of recovery for traffic prior to reaching the work space. A lateral buffer space is the shy distance from the edge of travel lane to the edge of the work space.

The Termination Area - is where public exits the work zone, returns to existing roadway and resumes normal flow. Contractor's equipment and workers should not be present in the downstream buffer space. MUTCD 6C.06 Contractor haul vehicles may egress to work area and merge with the public traffic.

Detours and Diversions – A detour is a traffic control measure used when closing a roadway to move traffic from the existing facility to an adjacent roadway often outside the project limits. A diversion generally uses a temporary surface constructed within the right-of-way to divert traffic from the work area by providing additional roadway width.

Now that the functions of the work zone areas have been shown, the next issues to consider are the TCP elements that explain how the work is to be done.


Downstream Taper
Buffer Space
Termination Area
Traffic Space
Work Space
Activity Area
Lateral Buffer Space
Longitudinal Buffer Space
Transition Area
Shifting Taper
Shoulder Taper
Advance Warning Area

STANDARD SPECIFICATIONS FOR CONSTRUCTION

The first TCP element that explains how the work is to be completed is the specifications. The Oregon Standard Specifications for Construction, Special Provisions, Standard Drawings along with Plan Sheets, and Unique Specifications (if any), are intended to collectively describe all of the items of Work necessary to complete the Project. As such, TCP Standard Specifications are included in every project.

Oregon Standard Specifications for Construction, commonly called "Standard Specs" are available in hard copy form and on-line at the ODOT web site in the Highway section, Specifications Unit.

These specifications apply to all contract plans. The TCP designer does not need to take any action with these Standard Specs as they prepare the TCP except to understand that Sections 00220 and 00225 of the specs apply to their project.

Standard Specs are dynamic and change from year to year as construction techniques and requirements develop. Oregon Standard Specifications have recently gone through a thorough rewriting process and the new "Spec Book" will be printed after the first of 2008.

SPECIAL PROVISIONS (BOILERPLATES)

Special Provisions, commonly called "The Boilerplate", are specifications that cover specific issues of a project that are not covered in the Standard Specs. These are additional written guidelines the contractor will follow during construction.

TCP Special Provisions are included in every project.

For our purposes here, boilerplates are prepared documents that can be used much the same way you would use a form letter. Boilerplates can be thought of as generic fill-in-the-blanks documents where the TCP Designer will insert additional project-specific information.

Special Provisions modify and/or replace the Standard Specifications on issues that are different than or not covered in the Standard Specs. Special Provisions that are commonly used may be written into the Standard Specs when they are updated about every five years.

The TCP Designer includes all of the Special Provision in Sections 00220 and 00225 and uses "Track Changes" to strike through those that do not directly apply to their project. The document appears in "Track Change" format only for internal reviewers, such as spec. writers at Advance Plans, and PS&E. The final hard copy version appears in "normal text" format with the edits "Accepted".

Special provisions for Sections 00220 and 00225 are prepared in the first person tense using the imperative mood. This will provide consistency with the way the Standard Specifications have been written.

This example will provide a clear distinction of the desired format:

Instead of writing:

The contractor shall install temporary markers 10' feet apart along both sides of driveways within the work area.

Write the following:

Install temporary markers 10' apart both sides of driveways within the work area.

Section 00220 & 00225 boilerplates on the ODOT web site under the highway link

The Special Provisions are available on the ODOT Specifications web site. The TCP Designer should download a new copy of the boilerplates from the specifications web site **every time** they begin a new project. Boilerplates are updated frequently and the TCP Designer should always use the most recent edition available.

NOTE: If several months pass between the time you first download the boilerplates and the completion of the project, you may consider downloading a newer copy of the boilerplates and updating your Special Provisions for your project.

UNIQUE SPECIFICATIONS

Unique Specifications are additional written guidelines in Section 00220 & 00225 that the contractor will follow during construction. These specs are narrow in scope and describe very specific issues. Examples of Unique Specs such as "Railroad Crossing Flagger", "Rumble Strips", "Falsework Illumination" and others may be found on-line on the ODOT web site in the Unique Specifications page on the Specifications section.

Unique Specs are narrow in scope and pertain to specific project issues. Unlike Special Provisions, a designer will only "cut and paste" those Unique Specs that apply to specific issues of the project and for that reason a TCP may not include any Unique Specs.

STANDARD DRAWINGS

The Oregon Standard Drawings are a work product developed by ODOT and American Public Works Association (APWA) for use on public work projects in Oregon. The Standard Drawings that describe Traffic Control in Work Zones are in TM 700 section of the TRAFFIC DRAWINGS. These drawings are available on-line on the ODOT web site, in the Standard Drawings pages of the Traffic-Roadway Section.

These drawings show traffic control designs for many common work zones such as 2 Lane, 2 Way Roadways, Freeway Sections, Bridge Constructions and Signalized Intersections. If a project is straight forward and uncomplicated it is possible to convey enough information to the contractor by using the Standard Drawings that project-specific staging plan sheets may not be needed. Standard Drawings are discussed in more detail in Chapter 5.

PROJECT-SPECIFIC CONSTRUCTION STAGING PLAN SHEETS

When Standard Drawings Aren't Enough

Some projects will be complex with specific design issues that make it impractical to use Standard Drawings to relay the information. In these situations it is necessary for the TCP Designer to develop Project-Specific Construction Staging Plan Sheets, commonly called "Plan Sheets".

Plan Sheets may be needed when the work needs more than one stage; this is called a "staged plan". In a staged project one side of the roadway may be closed for construction while traffic is moved to the other side. In the next stage the work would be carried out on the second side of the roadway, closing that side to traffic and moving the vehicles to the first side. Plan sheets are necessary to describe how the lanes would be closed, how traffic would be diverted and how the work area would be designed, etc.

Another example of a project that would need plan sheets is one that requires a detour route. Plan sheets are discussed in more detail in Chapter 3.

The Special Provisions, Standard Drawings, possibly Plan Sheets, along with a list of pay items make up the basic elements of a TCP. Next, some of the TCP design elements will be explored.

1.2.2 – TRAFFIC CONTROL PLANS DESIGN

DESIGN CONSIDERATIONS

TCP Design Form

There are two basic "forms" that a Traffic Control Plan can take: a "Written TCP" or a "TCP with Plan Sheets". The form of TCP that is written depends on a number of factors; however, generally a Written TCP is used for a simpler project, like a preservation project.

A Written TCP will include:

- Special Provisions and appropriate Unique Specs if any,
- Appropriate Standard Drawings but no additional plan sheets.
- Few or one stage with no detours
- Short project duration, i.e. < 6 months.
- Clear, uncomplicated scope

TCP with Plan Sheets may have:

- Plan Sheets
- Detour Route
- Long Duration, i.e. several months to years
- Challenging geometry with demanding physical constraints
- Complex Scope that could not be conveyed with Standard Drawings alone.

More information on TCP designs can be found in Chapter 3.

DESIGN POLICIES

A number of design policies that help to create safe and efficient work zones are listed below. More in-depth information on these policies is shown in Chapter 3.

Design Speed - The **Pre-construction Posted Speed** shall be used as the "Design Speed" for diversions, crossovers, sign spacing, tapers, sign letter heights, and similar speed dependant design elements. See Chapter 3 for exceptions.

Device Spacing – Maximum spacing for channelization devices is

- 10 feet for intersection radii and at speeds < + 30 mph
- 20 feet for speeds between 20 and 40 mph and
- 40 feet for 45 to70 mph and on freeways.
- For sign spacing and concrete barrier flare rate, see tables on TM700

Crossover Design - A crossover is a staging technique used to shift traffic from one side of a divided roadway or freeway into either the median or into a portion of the roadway that is not under construction. When a crossover is created, a temporary roadway alignment is build to carry traffic to the other side of the roadway or median. Crossovers are typically used on freeways, but may be used on divided highways or multi-lane roads and are often referred to as "on-site diversions," Drawings and design details for crossovers are shown in Chapter 3.

Vertical & Horizontal Design Constraints – the horizontal roadway width and vertical height constraints of the work zone are critical to statewide mobility, especially for the freight industry. Minimum horizontal width and vertical height limits are outlined in Chapter 3.

There are two different sets of limitations that designers need to be familiar with; design restrictions and notifications requirements.

1.2.3 – TRANSPORTATION MANAGEMENT PLAN (TMP)

Federal Highways administration (FHWA) WORKZONE SAFETY & MOBILITY RULE
In September, 2004, the FHWA published updates to the work zone regulations at 23 CFR 630 Subpart J, referred to as the Work Zone Safety and Mobility Rule. These rules apply to all State and local governments that receive Federal-aid highway funding.
A key requirement in the Rule is the development and inclusion of a Transportation Management Plan (TMP) as part of the project development and administration processes.
A TMP can be thought of as a Project Diary. It is a tool used by the agency to document and track critical decisions made throughout the course of project development, as well as a method for referring back to those decisions during the administration and construction of that project.
The complete "Work Zone Safety and Mobility Rule" is available on the FHWA web site in the Resources web pages of the Work Zone section.

DEFINITION – DECISION LOG FOR TCP DEVELOPMENT

FHWA is asking agencies to develop a TMP for every project receiving federal-aid dollars. Projects will include a TMP relative to the scope – one for a "significant" project and one for all other projects.

Within the Rule, a "significant" project is:

" . . . one that, 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."

The Rule identifies all Interstate system projects within a designated Transportation Management Area (TMA) as "significant".

ODOT has developed additional criteria for identifying "significant" projects. All projects with a construction budget greater than $5 million will be considered "significant".

As a "significant" project, the Rule requirements that the State develop a TMP that consists of:

- Temporary Traffic Control (TTC) plan and
- Addresses both Transportation Operations (TO) and mitigation strategies to be considered or implemented during construction, coordination efforts, and
- Any agreements with affected stakeholders, as well as Public Information (PI) and notification campaign tactics.

For individual projects or classes of projects that the State determines to have less than significant work zone impacts, the TMP may consist only of a TTC plan. States are encouraged to consider TO and PI issues for all projects.

The development of a TMP should begin in conjunction with the beginning of the project development process. The TMP is a living document and will be edited and added to throughout the life of the project's design phase. Upon completion of the design, the TMP is distributed to Team Members (including Consultant staff) and the agency's Construction

Project Manager or Coordinator. The TMP is ***not*** to be included in the Bid Documents. However, upon award and throughout Construction, refer to the information and decisions made within the TMP if changes to the Traffic Control Plan are proposed by the contractor.

1.2.4 – WORKZONE INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

DEFINING INTELLIGENT TRANSPORTATION SYSTEMS

Advances in computer aided traffic reporting technology called "Intelligent Transportation Systems" or ITS make it possible for the work zones to be monitored with real-time traffic data being reported back to the traffic technical centers. The traveling public can be kept informed of potential congestion and delays using communication equipment such Variable Message Signs (VMS) and/or Portable Changeable Message Signs (PCMS). Road users can also use their personal computers, PDAs, or radios to keep informed of delays and congestion caused by road construction. Drivers can then make informed choices relating to their trips, the route they may use and the amount of time they spend on the roadway.

HOW ITS IS USED IN WORK ZONES

ITS technology in work zones is being studied and assessed in several areas of the U.S. Case studies of ITS in work zones have been collected by AASHTO and are available at the AASHTO web site. FHWA also has case studies available on their web site under "work zone" and "ITS".

WORK ZONE ITS IN OREGON

Oregon has begun researching the use of ITS in selected work zones in an effort to determine the best way to provide drivers with real-time work zone traffic information. If all goes as planned, using ITS to monitor work zone traffic information will soon become common practice for major projects on the state highway system.

ODOT currently uses ITS to report road conditions on some state highways. See ODOT's ITS "Trip Check" link on the ODOT web site.

1.2.5 – TRAFFIC CONTROL DEVICES (TCD)

USING TCD TO CREATE A SAFE WORK ZONE

Traffic Control Devices are used to regulate, warn and safely guide traffic through the work zone. If there is orderly and uniform usage of TCD the safety of the work zone is increased and it will perform two vital functions:

- Reduce the frequency of accidents
- Reduce the severity of accidents

TCD PRINCIPLES

Implementing TCD correctly is imperative to provide the road user with the information needed to safely negotiate the work zone. If the following five principles are used when setting up TCD, drivers will be able to pass through the work zone with few surprises, and the work zone will be safer for all.

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

NCHRP REPORT 350 AND TCD CRASHWORTHINESS

All traffic TCDs used in a work zone on the National Highway System (NHS) are required by the FHWA to be "crashworthy". If an errant vehicle strikes a TCD, it is crucial that the vehicle and all parties involved are as protected as practical. "Crashworthy" means they have met the test and evaluation criteria of National Cooperative Highway Research Program (NCHRP) Report 350 and/or have received a "Letter of Acceptance" from the FHWA.

A list of products that meet NCHRP Report 350 requirements can be found on the FHWA web site in the Safety section, Road Hardware page.

CATEGORIES OF TCD

In relation to the NCHRP 350, work zone TCD have been classified into four categories, each having its own testing requirements. Briefly, the categories are:

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

Category 2 – devices with more mass that pose a greater risk to the public. These devices, such as barricades, sign stands, and substrate may require crash testing.

Category 3 – these devices may pose a greater risk to the public and therefore require specific crash testing. Category 3 devices include Impact Attenuators, Concrete Barrier, Guardrail, Bridge Rail, etc.

Category 4 – devices are usually trailer mounted and should be delineated and shielded from traffic where possible. These devices do not currently require crash testing. Sequential Arrow Board, Portable Light Plants, and Portable Traffic Signals are examples of category 4 devices.

More details on TCD categories and crash testing are listed in Chapter 2.

TCD AND THE QUALIFIED PRODUCTS LIST

All TCD used on Oregon State Highway construction projects must be listed on the ODOT Qualified Products 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. The ODOT QPL web site can be found at the ODOT web site, Highway, Construction, and QPL.

NOTE: All of the TCD on the QPL are known to be crashworthy, so if a device is chosen from the QPL, no further proof of crashworthiness is needed.

1.2.6 – MOBILITY

Highway Mobility Operations Manual & Oregon Bridge Delivery Partners

When it was discovered that over 400 bridges on the Oregon highway system needed to be repaired or replaced, ODOT worked closely with the Oregon Motor Carrier Transportation Division to coordinate the delay that drivers would experience while these bridges were under construction on Oregon's highways. This was the beginning of Oregon's Statewide Mobility Program.

Oregon Bridge Delivery Partners (OBDP) was created to manage the bridge construction program that would take place over the next eight years. The Statewide Mobility Program in cooperation with OBDP created delay thresholds for construction travel delay for Oregon highway's main corridors. These thresholds are the maximum amount of delay that is acceptable from all construction and maintenance projects on a corridor**.** The delay thresholds are calculated from construction and/or maintenance activities on a corridor and do not include normal delay experienced during peak travel periods.

See Highway Mobility Operations Manual for additional information and Appendix B for the highway corridor delay thresholds on line at the ODOT web site in the Highway and Highway Mobility Operations.

Coordinating Travel Delay Estimates Since the total travel delay resulting from all construction and maintenance projects on a corridor has to be below the corridor delay threshold, coordination of all corridor project and maintenance activities delay are essential. Each ODOT Region has a Mobility Liaison Engineer who is responsible for this coordination.

ODOT's Region Mobility Liaison Engineers and additional information on corridor mobility are listed at the end of Chapter 4.

1.3 – DESIGNER RESOURCES & WEB LINKS

TCP DESIGNER WEB LINKS

There are hundreds of ODOT, federal and non-government websites with valuable TCP information for both project-related and administrative tasks. Because websites and their locations are highly dynamic, there is a web link to a list of the top useful websites for TCP designers on the TCP website. This list of websites is continually updated to help ensure that designers have access to the most up to date information.

The link to the list of TCP Designer websites is located on the ODOT web site on the Traffic Control Plans page of the Traffic Engineering Publications section.

ADDITIONAL SOFTWARE

GuidSIGN 4.4 by Transoft Solutions is a software program that automates the design of highway signs. It uses panel styles from the standard library of federal MUTCD styles and then adds text, route markers, arrows, and exit panels.

CHAPTER 2 – TEMPORARY TRAFFIC CONTROL DEVICES (TCD)

Chapter 2

2.0 – KEY TOPICS COVERED IN THIS CHAPTER

- Purpose & Principles of Traffic Control Devices
- Crashworthy Devices
- Categories of Traffic Control Devices
- 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 the work zone. Safety is enhanced when there is uniform usage of TCD to regulate, warn, and guide traffic. The orderly traffic control is established by installing the TCD on, over, and adjacent to the roadway. The application of TCD in the work zone will perform 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 work zones are knowledgeable in the principles of TCD.

The following five principles are guidance for use of TCD in the work zone:

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

The correct application of TCD is imperative to provide the road user necessary information to negotiate the work zone safely. TCD inconsistent with the traffic control plan should be removed or covered. The legibility and visibility of the TCD should be maintained through the life of the project. TCD that become dirty, damaged, or broken may periodically need replacing.

2.2 – CRASHWORTHY DEVICES

The Federal Highway Administration (FHWA) policy requires all traffic control TCD used in a work zone on the National Highway System (NHS) be crashworthy. FHWA adopted the testing guidelines established by National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features".

This testing includes 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 the contractor may use the device while ODOT conduct field evaluation.

"Crashworthy" means they have met the test and evaluation criteria of Report 350 and/or have received a "Letter of Acceptance" from the FHWA.

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

Category 1 - devices are low mass with a know performance history, which require no specific crash testing. Vendors may self-certify the crashworthiness.

Category 2 - devices may pose a greater risk to the public; therefore specific crash testing may be required. Vendors may certify crash testing for generic designs.

Category 3 - devices may pose a greater risk to the public; therefore specific crash testing may be required. Vendors may certify crash testing for generic designs.

Category 4 - devices are usually trailer mounted and should be delineated and shielded where possible. Remove the device from the roadway when not in use.

2.3 – CATEGORY 1

CATEGORY 1	
Self Certification	Examples of Devices Included:
Light Weight devices < 100 lbs.  	• Tubular and Conical Markers • Plastic Drums • Plastic Drums with Warning Lights • Temporary Delineators

TUBULAR AND CONICAL MARKERS

The most commonly used temporary traffic control device for delineating the roadway and channelizing traffic through the work zone are tubular markers and cones. These are a two part device with the base weighing between 12 and 18 pounds.

The standard spacing for tubular markers and cones will be either 20’ or 40’. At speeds greater than 40 mph the 40’ spacing is used.

Tubular markers can override existing paving marking in short term applications. For long term applications the existing markings shall be removed.

Three different types of tubular markers:

- **Standard Tubular Markers -** orange plastic with silver-white reflective bands
- **Surface Mounted Tubular Markers -** installed with adhesive base to restrict movement of device
- **Business Access Tubular Markers -** blue plastic with blue reflective bands are used to delineate private business access points

TEMPORARY PLASTIC DRUMS

Temporary Plastic Drums are the largest, most visible of the “soft” channelizing devices. Plastic Drums are used to delineate travel lanes, identify work areas, construct lane closure tapers, delineate PCMS installations, and create a visual separation between the work area and travel lanes under traffic.

Plastic Drum sheeting is classified as "Orange and Silver-White encapsulated lens reflective sheeting." Due to their proximity to traffic, drums have the tendency to be moved slightly by larger passing vehicles. To compensate, the drums include a rubber ring (weighing 10 lbs.) installed around the base to add ballast to the drum without impeding its crashworthiness. On occasion, wind and traffic is strong enough to move the drum despite the rubber base ring. Therefore, a second ring can be added to the drum base to further resist movement.

TEMPORARY DELINEATORS

Temporary delineators are used to supplement the edge delineation to indicate the roadway alignment, which provides guidance for the vehicle path through the work zone. The mounting height of the reflector should be approximately four feet above the edge of the roadway.

Type W-1 delineators are along both sides of a 2-Way roadway and along the right side of a one-way roadway. The left side of the one-way roadway will be delineated with Type Y-1 delineators.

Spacing of delineators will be as shown on the TCP or as directed. Delineator standard spacing for an open roadway is shown on Standard Drawing RD800. Spacing for intersections and interchanges is shown on Standard Drawing RD805.

2.4 – CATEGORY 2

CATEGORY 2	
Crash Testing	Examples of Devices Included:
1800 Lbs. car @ 20 and 60 mph impact at 0 and 90 degrees	• Barricades – Type I, Type II, and Type III • Sign Stands – Portable, TSS, and Posts • Tripod mounted devices

TYPE I, II AND III BARRICADES

Barricades are used for a number of purposes including, but not limited to:

- Delineating signs mounted on Temporary Sign Supports (TSS)
- Placed at regular intervals within a closed lane to remind drivers that the lane is unavailable to them.
- Placed in the roadway in advance of and at the point of road closures.
- Placed at the point of closure for sidewalks and multi-use paths.

- Type III barricades (the most common) can be specified in 4', 6' and 8' widths, as is appropriate to the application and available width.
- Type I and II barricades are typically used for sidewalk closures due to their smaller, more appropriate size.

When used on TCP sheets, be sure to include the proper designation for each barricade:

- For placing an 8' Type III Barricade on the right of incoming traffic, the designation on the plan sheet(s) would be: 8' III(B)R. The "R" refers to side of the road that the barricade is to be placed – in this case, the right side. The stripes on the panels will point down and to the left.
- For placing two 8' Type III Barricades for a road closure, the designation on the plan sheets would be: 2 – 8' III(B)LR. The "LR" indicates the stripes on the panels will slope both directions – left and right.
- The MUTCD allows the installation of temporary signs on barricades; however, this is not practiced by ODOT. Temporary signs that must be installed on portable supports in the roadway for durations exceeding three consecutive days should be installed on a TSS. The barricade is then placed in front of the TSS, as per ODOT Standard Drawings, to further delineate the sign.
- All barricades must be selected from the QPL and conform to ODOT Standard Drawing TM750. See ODOT standard drawings for examples of the Barricades placed in various work zones.

TEMPORARY SIGNS

TCP Designers should 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", published and maintained by the FHWA
- Manual on Uniform Traffic Control Devices

Temporary signage is used to convey regulatory, guidance, and warning messages. Construction work taking place on or near the roadway requires signage to be updated as activities change. Temporary signs can be moved within the work zone or installed in fixed locations.

SIGN SHEETING

"O4" Work zone signs designated as Type "O4" will have Fluorescent orange sheeting with black, nonreflective permanent legend on sheet aluminum or plywood. Type "O4 sheeting complies with ASTM Type VII, VIII, IX, and X retro-reflectivity specifications.

"O3" There are a few specific signs which call for Type "O3" sheeting. This type uses an orange, ASTM Type III or Type IV sheeting background with black nonreflective permanent legend and red retroreflective symbols on sheet aluminum or plywood. (Stop or Yield Ahead Symbol sign)

"O5" Occasionally, it may be desirable to fabricate a sign with removable legend. This type sign uses fluorescent orange, Type VII, Type VIII, Type IX or Type X sheeting with black nonreflective removable legend on extruded aluminum panels.

Standard highway signs using various other sheeting types are used as listed for the individual signs required. These signs do not differ from the permanent signs. One exception to this is that any Type "Y1" sign can be fabricated using Type "O4" sheeting for work zone applications.

Roll-up sign sheeting for work zones uses fluorescent orange and, at a minimum, complies with ASTM Type VI retro-reflectivity specifications.

SIGN FLAGS AND SIGN FLAG BOARDS

Sign Flags and Flag Boards are used to enhance the visibility and accentuate various temporary signs. All roll-up signs on portable sign supports are to include Sign Flags.

Sign Flag Boards are installed on those signs identified in the project plans and Special Provisions. Flag Boards are to meet the requirements shown on ODOT Standard Drawing TM204. The initial "ROAD WORK AHEAD" sign in the work zone requires sign flag boards.

CLIPPED SIGNS

The MUTCD, ***Section 6F-15 – Warning Sign Function, Design and Application***, makes allowances for altering the standard diamond shape. Option: *"Mounting or space considerations may justify a change from the standard diamond shape."*

However, based on past experiences with the improper design and construction of clipped signs, ODOT is ***discontinuing the use of clipped signs*** for its highway construction projects, effective at the time of this publication.

In lieu of clipped signs, where median shoulder widths are less than 4 feet, ODOT asks the TCP Designer to specify the next smaller standard sign size according to Part VI of the MUTCD. For example, a 48" diamond sign would be replaced by a 36" diamond. Additional signing on the right-hand shoulder would remain at the larger standard size of 48" x 48".

The TCP Designer should consider alternative installation locations or mounting methods to avoid using the smaller sign sizes.

BICYCLES ON ROADWAY

ODOT requires the inclusion of the "Bicycle" symbol sign (with "ON ROADWAY" rider) in the Traffic Control Plan for projects where a significant number of bicycles can be expected, and:

- Where the roadway is a designated Bicycle Routes, e.g. US101
- Where the construction operation occupies the normal bicycle facility (shoulder, bike lane, etc.) and forces bicycles to share the travel lane with live traffic

ROAD WORK XX MPH & LOOSE GRAVEL XX MPH

Definition

The proper sign to provide advisory travel speeds through work zones is called the "ROAD WORK XX MPH" sign, where "XX" is the numerical advisor speed in miles per hour.

In addition, the "LOOSE GRAVEL XX MPH" sign is for use on Emulsified Asphalt Surface Treatment (Chip Seal) pavement preservation projects.

Explanation

Avoid the overuse of these signs, as with overuse, these signs will quickly lose their effectiveness. Use sound engineering judgment when including these signs in the TCP.

Responsibility

In determining the appropriate numeric speed for the "XX" portion of the signs, confer with ODOT Region Traffic or ODOT Traffic-Roadway Section.

As a general application, a 10-mph reduction below the preconstruction posted speed may be used for the "XX" placard. However, further reductions in speed are heavily dependant upon the type of work being conducted and other traffic control measures in place on the project.

The "XX" portion of the sign may either be legend or a Velcro placard. The "XX" portion of the sign shall be fluorescent orange background with black legend. Do not use white sheeting and black legend for the XX portion of these signs.

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 (CG20-8-48)

The project ID sign is used to identify an ODOT and OTIA highway construction project. Below is a list of criteria used to determine when the Project ID Signs are to be added to the Traffic Control Plan.

Use on ODOT and OTIA projects if all of the following are met:

- Project duration is to exceed one month
- Highway segment has an ADT > 500
- Project budget exceeds $1 million

Project ID signing should be installed in advance of all other work zone signing. The Engineer will determine the sign legend once the contract is awarded. The "KEEPING OREGON ON THE MOVE" rider is included with the Project ID sign.

BUSINESS ACCESS SIGN (CG20-11-24)

The business access sign is used to identify a private business access, which may be obscured or otherwise impacted by construction. In combination with "Business Access" sign, blue tubular markers are used to delineate the business access, which is under construction. When a temporary business access is provided the business access signs are intended provide greater conspicuity.

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 on ODOT Standard Drawing TM670.

METAL SIGN POSTS

Metal sign posts are an alternative to wood posts for the installation of Temporary Signs. Metal posts are listed on the QPL. Sizing and gauge of the posts based on the sign size table provided by the post manufacturer. Metal sign post installation details may be found on ODOT Standard Drawing TM681.

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)

Temporary Sign Supports (TSS) are used in lieu of post mounted signs. Temporary Supports are moveable and can be positioned so as to maximize the effectiveness of a temporary sign. If the installation of a post in the ground is not practical, temporary sign supports are an effective alternative. The following are possible reasons for using a temporary sign supports:

- Sign is to be located on existing pavement surface in roadway
- Roadside ground is too hard or too soft to make the installation of a post practical
- Sign is expected to move several times throughout the life of the project
- Sign is in place for a short duration (i.e. less than one week)
- Location of sign may be in conflict with utilities

See ODOT Standard Drawing TM775 for details in constructing a TSS. TSS are crashworthy from all four directions. Single-Post and Double-Post designs are available.

When not in use the sign on the TSS should be covered, turned or removed. The TSS should not to be tipped over if the sign is temporarily not needed, because it could result in damage to the device.

In addition, if a TSS is within the clear zone and not behind guardrail or concrete barrier, the TSS must be delineated by placing a Type III barricade in front of the TSS.

The sign size limitation allowed with a TSS is: (5’ x 8’) 40 ft^2. It is impractical to install larger signs on TSS, as these larger signs should be post mounted.

PORTABLE SIGN SUPPORT

The Portable Sign Support is used to mount a roll-up sign for short-term or intermittent work. Portable Sign supports are only to be installed for a maximum of 72 consecutive hours.

For example, if a Roll-up sign is installed for a daytime project and taken down at the end of the shift (overnight), this practice may be repeated for the duration of the project. If the Roll-up is set up for continuous 24-hour work, the sign must be removed within 72 hours. If the sign is needed longer, use of a TSS or post-mounted sign is warranted. Portable signs should be removed when workers are not present.

CONCRETE BARRIER SIGN SUPPORT

Used to install temporary signs on concrete barrier where room for a TSS or post-mounted sign does not exist. See ODOT Standard Drawing TM775 for details. The sign support can be mounted on either standard 32" barrier or the taller 42" barrier.

EXISTING SIGN SUPPORTS

With the aide and approval of a Structural Designer, temporary signs may be installed on existing highway sign supports and structures. When adding additional signs to existing supports check with Structural Designer for wind loading capacity.

2.5 – CATEGORY 3

CATEGORY 3	
Crash Testing Levels	Examples of Devices Included:
TL-2 – 1800 lb. car with 20° at 45 mph 4400 lb. truck with 25° at 45 mph TL-3 – 1800 lb. car with 20° at 45 mph 4400 lb. truck with 25° at 60 mph TL-4 – 17600 lb. single unit truck with 15° at 50 mph TL-5 – 79000 lb. tractor trailer truck with 15° at 50 mph TL-6 – 79000 lb. tractor tanker truck with 15° at 50 mph	• Temporary Impact Attenuators • Temporary Pre-cast Concrete Barrier • Temporary Guardrail, Connections, Transitions, and End Terminals • Temporary Bridge Rail • Breakaway Sign Supports

TEMPORARY PRECAST CONCRETE BARRIER

Temporary concrete barrier is one of the most common temporary traffic control devices used in construction work zones. It provides drivers with positive guidance through the work area and effective protection between traffic and construction employees.

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

Temporary Concrete Barrier is used to:

- Provides positive separation between the work area and traffic
- Protect opposing traffic streams from cross-over
- Protect construction workers from live traffic
- Protect traffic from deep excavations or hazards adjacent to the traveled way
- Redirect errant vehicles away from the work area

STANDARD "F" BARRIER - PIN AND LOOP

Requirements:

Standard "F" Barrier must meet the specifications shown on ODOT Standard Drawing RD500 and the requirements of Section 00820.

A flat paved surface 3 feet in width is required behind unpinned temporary concrete barrier. Do not place Temporary Concrete Barrier on dirt or gravel surfaces. For barrier placed next to obstructions (e.g., bridge falsework, abutments, sheet piling, temporary retaining walls, columns) a minimum clearance of 1 foot from the obstruction is required **and** the barrier must be pinned.

At each point where the barrier terminates, whether in the open or against guardrail, barrier or bridge rail, use the following appropriate techniques to protect the blunt end(s):

- Install a Temporary Impact Attenuator at the end of the barrier run.
- Use a Temporary Connection to the guardrail run or bridge rail.
- Overlap the exposed end with the other run of Concrete Barrier.

TALL 42" BARRIER – PERFORATED C-SHAPE

Requirements:

Install Tall 42" barrier on the shoulders of interstates and the State Highway Freight System where adverse geometry, such as alignments with curve radii smaller than 28^0 (205 ft) or where severe consequences at specific locations might occur if barrier is penetrated by a heavy vehicle.

Tall 42" Barrier must meet the specifications shown on ODOT Standard Drawing RD545. The same placement requirements for Standard "F" barrier apply to Tall 42" barrier.

Install on other facilities with:

- High truck usage (DHV>250) in the traffic stream

- Adverse geometry (i.e. curve radii less than 28^0 (205 ft))
- Severe consequences result from heavy vehicle penetrating the barrier

The Tall "F" barrier provides effective protection against median crossover crashes – particularly from large trucks. During Level 3 and 4 testing, the Tall "F" barrier performed very well, seeing deflections of a mere 32 inches.

The primary use for Tall "F" barrier is in the median on ODOT Interstate and Highway freight routes. As a secondary use, Tall "F" barrier can be used as shoulder barrier for these same routes.

In the Traffic Control Plan, 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.

For pinning "Tall F" barrier to the roadway, see ODOT Drawing RD516.

BARRIER PLACEMENT

Due to the nature of temporary concrete barrier, its physical properties and its needs to remain crashworthy, there are strict requirements for the placement of concrete barrier.

Temporary concrete barrier must be:

- Set on a level asphalt concrete (AC) or portland cement concrete (PCC) surface
- Installed with a 3-ft clearance behind the barrier – measured from the back face of the barrier to the edge of pavement or the nearest obstacle
- Pinned to an AC surface, if the 3-ft clearance cannot be provided. See TM745 for pinning details
- Restrained on a PCC surface, if the 3-ft clearance cannot be provided. See TM745 for restraint details
- Installed with a minimum 1-ft clearance behind the barrier, even when pinned or restrained

When installing temporary concrete barrier:

- 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
- Do not install without connecting the barrier sections together

HIGHWAY MEDIAN APPLICATIONS

A frequent component in freeway construction projects is the removal and replacement of the permanent concrete median barrier. When this work is done, ODOT prefers to specify the following practice:

- Place an equal length of temporary concrete barrier along side the existing barrier to be removed.
- The contractor will be given a quantity of "temporary barrier move" equal to the length of the temporary barrier for each lift of paving to be done, if applicable.

The contractor must provide appropriate connections or protection for any exposed barrier ends before leaving the work area.

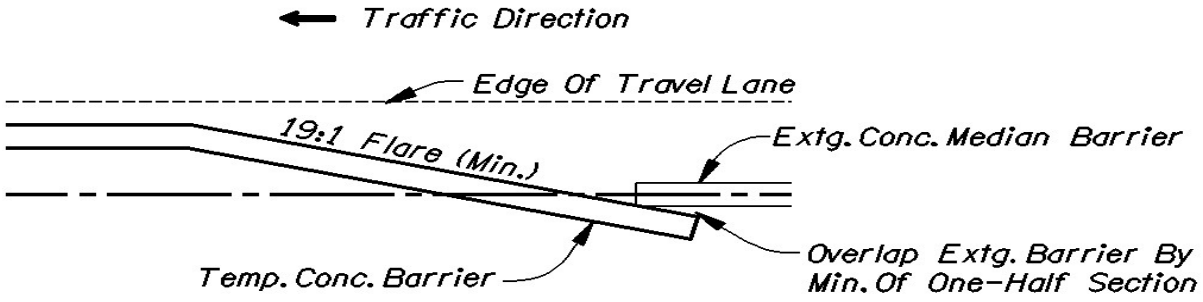
NOTE: Providing a "clear zone" between opposing lanes in lieu of temporary barrier is not an acceptable practice and exposes ODOT to unnecessary risk in the chance of a crossover crash.

Temporary concrete barrier can be used as "Permanent" barrier as long as the barrier is in ***new*** condition when delivered to the job site.

BLUNT END TREATMENTS

The blunt ends of temporary concrete barrier should not be exposed to traffic. When concrete barrier is placed on the project site, there are a number of methods 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:
   - Drum Array – Sand-filled array of plastic drums. See TM755 and TM760 for additional details.
   - Narrow Site – The Narrow Site Impact Attenuator is used to protect the blunt end of concrete barrier, bridge rail, columns or other narrow, fixed objects within the clear zone. The device is approximately two-feet wide, making it a valuable device in protecting traffic from these hazards when a full-size drum array attenuator will not physically fit.
   - Truck Mounted Attenuator (TMA) – The TMA is typically used for short-duration work (less than three consecutive days) or for mobile operations to either protect a fixed roadway hazard or workers and their equipment in a closed lane or shoulder. The TMA is not to be used for the long-term protection of a barrier run. Place the TMA in the closed lane in advance of the equipment, located as recommended by the manufacturer and approved by the Engineer. If the TMA is not available when the work requires its use, postpone the work until the TMA is available.



2) 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.

3) 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 Details DET140 and DET142.

4) 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.

ODOT ***does not recommend*** using the following techniques for "protecting" the blunt end of temporary concrete barrier:

Barrier Mounds: - Following a letter issued by the Federal Highway Administration (FHWA) in February of 2003, ODOT no longer allows the use of barrier mounds as a means of protecting the blunt ends of concrete barrier.

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.

TEMPORARY BARRIER/GUARDRAIL CONNECTIONS

Use Temporary Connectors to connect one type of retaining system to another. Use Temporary Connectors as an alternative to Temporary Impact Attenuators, overlapped or buried ends, or other blunt end treatments for these devices. Several devices are available to connect runs of temporary concrete barrier with other barrier systems including existing barrier, bridge rail and guard rail sections.

BARRIER-TO-GUARDRAIL CONNECTORS

Some barrier installations are situated where either the leading or trailing end may need to be connected to guardrail. This requires a secure connection between the two runs to prevent a vehicle from snagging. For example, see Standard Drawing RD530 and others depending on the needed connection.

Temporary Connectors are paid for under the "Temporary Protection & Direction of Traffic" 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 Standard Drawings BR203 for example of this type of connection.

MOVEABLE CONCRETE BARRIER (ZIPPER)

Moveable Concrete Barrier is typically used for staging projects which require multiple and frequent moves of the concrete barrier.

Moveable Concrete Barrier must be moved by a special machine designed to transfer the barrier in a mobile operation. Both the barrier and the machine are included in the contract as a pay item. ODOT currently owns a transfer machine and over two miles of Moveable Concrete Barrier. If it is advantageous to include this device on your project, consult with Region 1.

There are Narrow Site Attenuators available for the Moveable Concrete Barrier. The attenuators attach to the end of the barrier run and can be picked up and placed by the same machine used for the barrier.

Because Moveable Concrete Barrier has a higher deflection when struck by an errant vehicle, use caution in placing this barrier too close to a deep excavation of drop-off.

2.6 – CATEGORY 4

CATEGORY 4	
Crash Testing currently not required	Examples of Devices Included:
Primarily trailer mounted. Need to be delineated or shielded. FHWA will continue to monitor the in-service crash performance Encourage the design and testing of crashworthy versions. Good placement practices	• Sequential Arrows ('Arrow Boards') • Portable Changeable Message Signs • Portable Light Plants • Portable Traffic Signals

TEMPORARY ELECTRICAL SIGNS

SEQUENTIAL ARROW SIGNS

Sequential Arrows shall only be used to indicate a lane closure. Do not use a sequential arrow sign to shift traffic or indicate a "Keep Left" or "Keep Right" condition, unless it is for a lane closure.

Sequential arrows can be measured and paid for on an hourly or "per each" basis.

PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)

Installation and delineation details for a PCMS can be found on ODOT Standard Drawing TM700.

ODOT published a quick reference field guide "**Oregon Department of Transportation Guidelines for the Use of Portable Variable Message Signs on State Highways"** regarding proper messages, application and placement for PCM.

In composing messages for use on PCMS, consider the complete thought. Keep in mind that drivers generally need to know what they should do and a good reason for doing it. Normally one panel will be used to give the reason and one panel will be used for the requested action. While normally one or two panels should be used on a PCMS, occasionally it may be necessary to use an additional panel to address a segment of drivers (e.g., trucks, oversize vehicles). In no case should there be more than three panels. Preferably it may become necessary to add additional PCMS. By adding additional PCMS the message can be separated while each PCMS utilizes two panels.

Due to limitations in the number of characters, abbreviations may be required. Arrows and chevrons may be used. Graphics shall not be used. Messages may include distance information expressed in feet or miles. Each panel is limited to three lines and eight characters per line.

2.7 – OTHER TCD BID ITEMS

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 durations greater than three days. Temporary Markings are also used to enhance and delineate runs of temporary concrete barrier and temporary diversions.

TEMPORARY STRIPING

The most common type of temporary markings is temporary striping (paint). Temporary striping is a fast, economical, an effective means of providing the required markings, and can be paved over easily without affecting the new pavement.

Temporary and permanent striping must be accounted for during all aspects of construction staging. The TCP Designer will need to determine the best placement for temporary striping while also considering the placement of permanent striping. Additional considerations must be made regarding the duration of the temporary striping. Temporary striping must meet the same layout requirements for permanent striping. Refer to the ODOT Traffic Line Manual for striping details.

Consider the duration of the project when calculating quantities for Temporary Striping. If the project duration is expected through multiple seasons, a second (or even third) application of Temporary Striping may be needed. Inclement weather, sanding treatments 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. Grinding of striping is not permitted on permanent wearing surfaces, which are not scheduled for overlay. If temporary striping is used, removal of conflicting existing pavement markings and reflectors is required. If durable materials are to be used for permanent striping, ensure that Temporary Striping will not adversely affect placement of the durable materials.

TEMPORARY STRIPING ON STAGE SURFACES

Often times, the total depth of the new pavement surface will be so thick that completion of the entire section in one pass is not possible. Layers, or “lifts”, of pavement are placed,

one at a time. Drivers may be required to drive on an intermediate lift until the final, or "finish", lift can be placed. Drivers may also be required to drive on a temporary surface adjacent to the existing roadway so as to allow the completion of the new pavement surface without having to move traffic around the work area multiple times.

In either case, the interim driving surface will require pavement markings until such time as the next lift, or finish lift can be applied and markings can be placed.

In some cases, temporary striping is placed on the finish lift of pavement to allow for other road work to be completed before permanent striping is applied and traffic is shifted into its final position.

There are two current practices for the placement of temporary striping on the finish lift pavement:

- Temporary striping is placed adjacent to the location of the permanent striping. The permanent striping is placed and over time the temporary paint fades or wears off.
- Permanent striping is placed directly on top of temporary striping. To meet the installation specifications for the permanent striping, enough of the temporary paint must have either worn off or be removed before permanent striping can be applied.

TEMPORARY PAVEMENT CHANNELIZATION ARROWS & CROSSWALKS

Pavement Arrows 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. Common examples include right-turn-only arrows, left-turn arrows in the left turn bay at a signalized intersection.

Quantities and payment for Pavement Arrows will be the nominal area determined by multiplying the width times the length of the marking. No deductions will be made for corners or irregular shapes.

Temporary Striping is also used for Crosswalks in areas where construction either obscures the existing markings or the Crosswalk is altered.

To calculate the quantity of striping needed for a Crosswalk, calculate each stripe of the Crosswalk as three 4" stripes times the length of the crosswalk. Pay for temporary Crosswalks under the Temporary Striping pay item.

STRIPING QUANTITIES FOR WINTER

Some construction projects continue through the winter months, while others are shut down and must "winter over." The winters in Oregon can be very hard on our pavement markings, especially in our work zones. Therefore, when calculating your Temporary Striping quantities, consider if your project is expected to "winter over."

If the project is shut down over the winter, adjust your temporary striping quantities to account for an additional (or multiple) application(s) of temporary striping. The ADT and geographical location of your highway segment can affect the quantities for your temporary striping.

DURABLE STRIPING

Durable striping (methyl methacrylate, DuraStripe, 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, the TCP Designer must 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 the durable markings with a temporary removable tape
- Place channelization devices (cones, tubular markers, drums) to create new lanes for the shifted traffic.

Your decision should be based on factors such as duration, quantity, location, age of the existing durable markings, traffic volumes and complexity of the temporary traffic shift. The TCP Designer should also discuss the decision with the Region Construction office and other relevant members of the Project Team to avoid unnecessary removal of the durable striping.

TEMPORARY TAPE

Temporary Tape can be used in lieu of Temporary Striping. When consideration is needed for damage to the roadway surface temporary tape can become an excellent alternative. 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
- Non-Reflective.

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.

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

- To secure pavement markers for EAC or CIR preservation projects
- Used as temporary markings prior to an AC overlay

Temporary Non-Reflective Tape – is used to temporarily cover durable markings. When a facility has existing durable markings consider use of non-reflective tape as an alternative to grinding off the existing marking. This is desirable when no final wearing course is part of the scope.

The MUTCD does not allow existing striping to be painted black to "hide" it. Therefore, the two remaining practices used for long term projects are to remove all inappropriate striping or to cover it with temporary non-reflective tape. The intent is to mask the existing durable striping. When staging is completed the tape is removed and the existing durable striping is retained.

While temporary 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
- Flexible Oiling Pavement Markers
- Flexible Overlay Pavement Markers

Temporary Reflective Pavement Markers:

These 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 ODOT Standard Drawing TM747 for examples of pavement marker use.

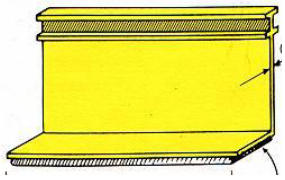
Bi-directional markers are used to delineate the centerline of a two-lane roadway or the double-yellow markings in the median or turn-lane of a multi-lane, non-freeway section.

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 "F" Mix AC pavements the adhesive has a tendency to penetrate nearly 1" into the pavement. When removing the temporary markers, attached AC pavement could be removed with the marker, significantly damaging the pavement.

NOTE: Care should be taken 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.

Flexible Oiling Pavement Markers:

These are used primarily during Chip Seals preservation projects to simulate the existing striping. These 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 and the ADT of highway section.

PROTECTIVE NETTING/SHEETING

Protective netting/sheeting 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 screening.

Protective netting/sheeting 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 which may require the use of protective netting/sheeting include, but are not limited to:

- Overpass construction

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

If Protective Screening/Netting is called for in the project, include the language provided from Unique Specifications:

TEMPORARY PEDESTRIAN WORK ZONE DELINEATION FENCING

Use Temporary Pedestrian Work Zone Delineation Fencing to guide and protect pedestrians through work zones. Temporary Pedestrian Work Zone Fencing must come from the QPL.

Fencing may be used at the following locations:

- Installation of retaining/sound walls
- Street reconstruction/construction
- Sidewalk reconstruction/construction
- Around pole base or other excavations near pedestrian facilities
- To delineate construction material stockpile sites

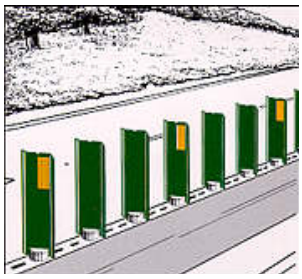
Temporary Pedestrian Work Zone Delineation Fencing is paid for as part of the "Temporary Protection & Direction of Traffic" lump sum pay item.

TEMPORARY CHAIN LINK FENCING

Use Temporary Chain Link Fencing to guide and protect pedestrians through work zones. Temporary Chain Link Fencing must come from the QPL and according to Standard Drawing RD815.

Chain Link Fence is primarily used to create a temporary pathway for bicycles/pedestrians through a work area or across a bridge during staging. Chain Link Fence can also be used to contain construction debris and keep an adjacent roadway open to traffic.

TEMPORARY GLARE SHIELDS



Temporary glare shields are installed on concrete barrier between two opposing traffic lanes. The purpose of glare shield is to prevent opposing traffic headlights from impairing the visibility of opposing traffic.

The typical application for using temporary glare shields is where traffic is maneuvering through a freeway crossover. This situation could also be warranted depending on the geometric layout of the facility and the width of the median shoulder.

Space glare shields along the top of concrete barrier in accordance with the following table:

Curve Radius (ft)		Number of Blades per Section	Spacing Feet
From	To		
Tangent Section		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” ±

REFLECTIVE BARRIER PANELS

Reflective barrier panels are used to delineate the face of Temporary Concrete Barrier. Panels of alternating fluorescent orange and silver-white are attached to the barrier facing incoming traffic.

Barrier panels are typically installed in the leading and trailing reversing curves of a barrier run to help delineate the alignment and assist drivers through the unfamiliar shift.

Barrier Panels will be measured and paid for as “per each”.

FALSEWORK ILLUMINATION

Falsework Illumination refers to a lighting system attached to the falsework of a bridge 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" lump sum pay item.

OVERHEIGHT VEHICLE WARNING SYSTEM

The OVWS is a warning system used to alert overheight 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 a 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.

TOW TRUCK

The Tow Truck is used to remove a stalled vehicle or one involved in an accident from the work area. In work zones where access is restricted and smooth traffic flow is critical, the addition of a Tow Truck should be considered.

A Tow Truck can be located at each end of the project, placed on call, patrols the work area, clears stranded vehicles, responds to accidents, or any combination of situations. The use of the Tow Truck should be discussed amongst the Project Team.

Tow Trucks must also be selected based on the vehicle most likely being hauled off the project site. If it is necessary to remove a semi-truck, a much larger Tow Truck would be needed. The Tow Truck is typically paid on an hourly basis; however, depending on discussions within the Project Development Team, this item can be paid for by 24-hr/day or even on a weekly rate.

POLE BASE COVERS

Pole base covers are meant to protect pedestrians from footing excavations due to the installation of a new or replacement utility pole. Pole base covers are comprised of utility grade plywood sheeting.

If excavations of this nature are anticipated in the project and may impede pedestrian traffic or jeopardize their safety, include the bid item.

Pole Base Covers are paid for as part of the "Temporary Protection & Direction of Traffic" lump sum pay item.

TEMPORARY TRAFFIC SIGNALS

Temporary Traffic Signals are typically used to safely control the flow of traffic through a one-lane, two-way work area. The signals are often used in lieu of Flaggers due to the duration of the 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:

- 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 as more economical

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. Depending on volumes, economic impacts and political climates, it may be necessary to incorporate the private access into the signal as described above.

Temporary Traffic Signals are used in a variety of situations and provide an automated method for directing and controlling traffic flows through a work zone. Temporary Signals can be used under the following:

- One-lane, Two-way, configurations.
- During the installation of a new permanent signals.
- To control traffic movements through a highway intersection being reconfigured.
- For the reconstruction of an interchange ramp terminal(s).

Temporary signals are often chosen over flagging operations when construction is expected to last several weeks or more. As an example, for a two-lane bridge replacement using two Flaggers 24-hours/day and two advance Flaggers 8-hours/day, the installation of a Temporary Signal will be more cost-effective when construction is expected to last more than approximately 28 days.

Temporary Signals must be installed in locations where adequate sight distance is available and where side streets and local accesses can be closed, relocated or incorporated into the Temporary Signal. The design of the Temporary Signal may be prepared by a Region Tech Center Signal Designer or consulting Engineer.

The process of approving the use of a Temporary Traffic Signal as part of a Traffic Control Plan will be submitted to the State Traffic Engineer.

PORTABLE TRAFFIC SIGNALS

Portable traffic signals have some limitations to the applications, because they are limited to two phase operations. No access can be located between the two portable signals stop bars.

Some rural applications where power is not readily available can utilize the portable signal. These devices are solar powered and have sufficient battery supply to fit most situations.

The process of approving the use of a Portable Traffic Signal as part of a Traffic Control Plan will be submitted to the State Traffic Engineer.

Use portable traffic signals from the QPL. The TCP layout will be consistent with Standard Drawing TM735.

2.8 – FLAGGERS

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 freeways. A flagger can be used for the following activities:

- Controlling the flow of traffic through a two-way, one-lane section of roadway.
- Stopping traffic to allow the entrance/exit of construction equipment/ vehicles onto/off of the highway.
- Slowing traffic on a highway segment where workers and equipment are immediately adjacent to live travel lanes.
- Direct traffic through a signalized or unsignalized intersection under construction. If signalized, the signal must be turned off during flagging operations.

Flaggers are included in the contract as a separate pay item. Flagging Hours needed for a particular project are to be determined by the Cost Estimating Unit.

2.9 – PILOT CARS

Pilot Cars are used, in conjunction with flaggers, to guide queues of vehicles through a work zone that is restricted to two-way, one-lane operations. Pilot cars are typically present on pavement preservation projects where the construction operations cover a distance of one mile or more.

In determining the need for a Pilot Car, the TCP Designer should consider the following:

- Type of Operation – Paving, guardrail, excavation, shoulder rock, striping, etc. Multiple tasks occurring simultaneously in multiple work zones require further consideration.
- Length of Closure – The longer the closure, the more likely a Pilot Car will be used.
- Proximity to Centerline – If workers are immediately adjacent to live traffic, consider using a Pilot Car.
- Flagger line of sight – if line of sight between flagger stations is obscured due to project site environment/conditions.
- Topography/Geography – mountainous conditions, narrow lanes/shoulders, sharp vertical & horizontal curvature, communication limitations (radio, cell coverage), etc.
- Accesses – intersections and/or private accesses can affect efficiency of flagger/pilot car operation.

Pilot Cars are measured and paid for by the hour. Like Flagger hours, Pilot Car hours are determined by the Cost Estimating Unit.

2.10 – TRAFFIC CONTROL SUPERVISOR (TCS)

The Traffic Control Supervisor (TCS) is a position employed by the contractor or working as a subcontractor whose primary responsibility is to implement and oversee the Traffic Control Plan (TCP) by inspecting and maintaining the temporary Traffic Control Devices (TCD), replacing damaged devices, monitoring traffic flows through the work zone or the effectiveness of a detour and making recommendations to ODOT and the contractor to improve upon the TCP, if necessary.

The TCS must be certified and carry a valid certificate verifying their certification. The person assigned to the TCS role shall not be the Project Superintendent. For every day a TCS is to be on the project, the Engineer must be notified 24-hours in advance.

TCS are typically measured and paid for on a work shift basis. One payment will be made for a TCS regardless of length of the work shift. Payment will not be made until a Daily Traffic Control Report is completed for each day the TCS has finished a work shift.

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 Policies

3.4 – Design-Related Specifications

This chapter is intended to introduce TCP Designers to three key components of TCP Design

- Measures a designer can use to stage live traffic during construction of the project
- The array of considerations that must be examined when developing their TCP
- The varied design concepts they will use to develop these measures.

3.1 – TRAFFIC CONTROL MEASURES (TCM)

Traffic Control Measures (TCM) are the strategies used by both a TCP Designer and field personnel to implement a safe and effective temporary traffic control plan during a highway construction project. These processes utilize a combination of various design policies, construction staging strategies, and temporary traffic control devices to safely guide traffic through or around the work area, as well as to protect workers from live traffic.

TCM are proportional to the scope of work and will range from extremely complex to simple, straightforward approaches. Nonetheless, every strategy should be uniquely designed for each project.

You will learn more specifics about Traffic Control Measures as you learn more about TCP development in Chapter 5.

By their unique nature, each project will present the TCP Designer with a broad range of design challenges. In this chapter, we have outlined a number of common considerations that the Designer should explore in putting together their plans.

3.2 – TCP DESIGN CONSIDERATIONS

A key component in developing a safe, effective, efficient, buildable traffic control plan is that the level of detail within the plan is comparable and appropriate for the scope of work.

A number of factors should be considered in developing the traffic control plan. Adequate consideration of these factors will also aid in developing a robust, yet durable Transportation Management Plan.

PROJECT SCOPE: Take into account all of the work activities being done for your project. Pay particular attention to any 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.

Every project type requires a TCP Designer to address a wide array of important design-related questions. Examples include, but are not limited to:

- ***BRIDGE PROJECTS***

- New bridge or repair of existing?
    - If new, will new bridge be in different location or same location?
    - What are the plans for demolition and removal of the existing bridge?
  - What is the existing bridge configuration and can traffic be staged, if necessary?
  - Are there limited in-water work timeframes?
  - Can existing traffic capacity be reduced during construction?
  - Are there alternative routes available for one or both directions of traffic, if necessary?
  - Is the construction schedule being accelerated?
  - Are there topographical or other environmental constraints?

- ***PAVEMENT PRESERVATION PROJECTS***

  - What work is being done to the existing pavement surface?
  - What type of material is being used to replace/repair the existing pavement?
  - Can multiple lanes be closed to accelerate the work, where practical?
  - What is the roadway type?
  - What is the extent of the accesses within the project limits?
  - Is there the need for an accelerated schedule?

- ***NEW CONSTRUCTION OR MODERNIZATION PROJECTS***

  - Making geometric changes to the alignment?
  - Adding a new facility or capacity to the roadway?
  - Affecting, adding, removing a traffic signal(s)?
  - Affecting local public services? Transit? Mail? Schools? Police/Fire?

Many of the questions above are interchangeable within these project types. It is the responsibility of the TCP Designer to consider all of the appropriate questions and see that they are addressed in some fashion within their Traffic Control Plan.

PROJECT DURATION: The time it takes to complete a project and the project schedule will have a significant impact on the way your TCP is developed.

Projects that take more than a year to complete will affect pay item quantities such as pavement markings or Flagger hours, etc. A project that must "winter over" will allow some work to continue through the winter months, while other tasks – paving, concrete flatwork – may need to wait until spring or be finished by fall.

Be aware of accelerated or aggressive work schedules, or projects that have critical components that have to be completed within a specific timeframe.

Shorter-duration projects can sometimes have their bid dates moved based on other project due dates and anticipated workloads. They may also be combined with larger projects for various reasons.

Occasionally, an "Emergency" project will arise and need your immediate attention. It is important to remember to abide by fundamental design protocols as much as possible. Do not use a project's "emergency" status to assemble a haphazard project. A safe, effective TCP can be developed for even the most emergent project. Use human resources wisely to aid in the expedited development of the TCP.

LEVEL of COMPLEXITY: The complexity of the 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 which would benefit from a higher level of staging detail.

FACILITY TYPE: Carefully examine the type of facility your project is on. Look at roadway features, traffic types, travel patterns, facilities that connect to your facility. Like the project scope, the degree of complexity for your TCP should match that of your facility type.

Remember the concept of "driver expectancy". Different facility types mean different drivers, driver behaviors, and therefore, different degrees of driver expectancy. Examples of the various facility types that you may encounter include urban roadways, rural two-lane highways, access-controlled freeways, high-speed, multi-lane arterials, low-speed, residential city streets, etc.

PROJECT LOCATION & SITE TOPOGRAPY: The physical features of a roadway facility will also play an important part in the development of your TCP. From selection of staging strategies to the type of devices or pavement markings used, the location and terrain of your facility are highly influential.

Be aware of special environments such as desert climates with high temperatures and remote locations, marine conditions with a tendency toward inclement weather (fog, rain); and, mountainous regions which can generate problems for large vehicles and trucks. Other examples include highly-populated urban centers and environmental features – rivers, lakes, geologic formations, wildlife habitats, and archeological sites, etc.

ACCESS MANAGEMENT: In developing the construction staging plan, a Designer should be aware of private or public accesses within the project limits and if they will be impacted over the course of the project.

According to the Standard Specifications (see Section 00220), some access types can be closed for short durations. In addition, as part of the Work Zone Traffic Analysis results and working with the Project Team and affected stakeholders, some accesses can be closed for

longer durations (See Special Provision Section 00220.40). Nevertheless, the TCP Designer must include mitigations for these closures within the TCP. By using language in the 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.

PROJECT TEAM INTERACTIONS: Remember the importance of frequent discussions with Project Team members regarding TCP or staging plan detail needs. Especially valuable, as the design progresses, is the interaction you have with the Construction Project Manager. PMs are a very valuable resource in developing the construction staging aspect of your design.

Equally important are the conversations you have with any other discipline representatives – bridge, roadway, environmental, right-of-way, etc. They too can help simplify and streamline your design process by giving you the data you need to help eliminate impractical or unfeasible staging concepts.

CONSTRUCTABILITY REVIEW: The Constructability Review is an effective tool used to narrow or refine your TCP. It is a method used to collect valuable, practical feedback from potential contractors regarding the constructability of your current TCP.

Typically, a short list of contractors is gathered to review a set of the Preliminary Plans for a given project. Contractors may suggest or request additional details for the construction staging plan. Contractors are asked to provide comments, suggestions or recommendations as to whether the current plans are feasible or if there is a better, safer way to construct the project. Constructability Reviews are not difficult to conduct, but they often provide invaluable feedback for the Project Team and the TCP Designer.

ENGINEERING JUDGMENT: Without prompting from a manual or other design reference, a TCP Designer may add additional details to the TCP for clarity and to avoid potential delays or added costs to the project. Additions and/or modifications may be based largely on an Engineer's individual experiences. While being founded on a minimum design threshold, an Engineer's final design solution or process may not be previously documented. However, their decision process and final recommendation or solution should be thoroughly documented including any relevant assumptions. (See the discussion on Transportation Management Plans in Chapter 1)

TRAFFIC CONTROL PLAN FORM: Traffic Control Plans can be separated into two distinct categories – A "Written" plan or a TCP that requires project-specific Plan Sheets.

A TCP Designer should consider the following project characteristics when determining what type of traffic control plan they might develop and what level of effort 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 Provisions.

  In compiling the Special Provisions, the TCP Designer will include only the appropriate language from the Special Provision "boilerplates" (See Chapter 4), any additional references to other Special Provision Sections, and any appropriate language from the "Unique" Special Provisions (see Chapter 4). 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 or traffic shifts
- No detours
- Short list of Pay Items
- Shorter Duration (< 6 months+)
- Clear, straight-forward scope that is 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 and/or traffic shifts
- Detour routes
- An extensive list of Pay Items with medium to large quantities
- Medium to long durations (several months to years)
- Complex scope and elements that can *NOT* be easily conveyed through special provision language or Standard Drawings alone

3.3 – TCP DESIGN POLICIES

The following section includes a number of significant policies 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 Traffic Control Plans website. Our site is a buried a bit, but persistence will pay off. Start by looking under the website for the ODOT "*Highway*" Division.

From there, look for successive links to:

Technical Services
Sections
Traffic-Roadway Section
Programs/Disciplines
…and finally our website under *Traffic Control Devices*

TCP DESIGN EXCEPTIONS

Currently, there is no formal Design Exception process for most of the components of Traffic Control Plan design. However, if an element of your design should fall below or exceed published design thresholds, ODOT asks Designers to contact the State Traffic Control Plan Engineers (STCPE) office to discuss the details of your modification with the STCPE.

Modifications to roadway design elements – alignment details, pavement designs, drainage considerations, etc. - that do not meet minimum standards must be filed through the formal Roadway Design Exception process.

ABRUPT EDGES

Abrupt edges can occur as a result of numerous activities, all of which must be addressed within the Traffic Control Plan.

Abrupt edges can occur as a result of, but not limited to, the following:

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

Depending on the nature of the abrupt edge, there are a number of methods available to protect traffic.

PAVING

Depending on the depth of the pavement surface(s) being applied, the contractor is required to employ various traffic control measures to protect traffic.

From the Standard Specifications in Section 00745.61, the contractor is given the following instructions:

When placing HMAC under traffic, schedule work for the nominal thickness being laid as follows:

- More Than 2 Inches – Schedule work so at the end of each working shift the full width of the area being paved, including shoulders, is completed to the same elevation with no longitudinal drop-offs.
- Less Than or Equal to 2 Inches – Schedule work so that at the end of each working shift one panel of new travel lane pavement does not extend beyond the adjoining panel of new travel lane pavement more than the distance normally covered by each shift. At the end of each workweek complete the full width of the area to be paved, including shoulders, to the same elevation with no longitudinal drop-off.

If unable to complete the pavement without drop-offs as described above, the contractor must do the following:

- Provide warning signs and markings according to Section 00225 where abrupt or sloped edge drop-offs 25 mm (1 inch) or more in height occur
- Construct and maintain a wedge of HMAC at a slope of 1V:10H or flatter along the exposed longitudinal joint
- Remove and dispose of the wedge before continuing paving operations
- Construct, maintain, remove and dispose of the temporary wedge at no expense to the Agency, except that HMAC for the temporary wedge will be paid for at the pay item price

A TCP Designer should be aware of these instructions as they will affect how the staging plan is assembled and the quantity of temporary traffic control devices that will be 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.

Lastly, the ODOT Traffic Control Standard Drawings (TM700 Series) contain several instructions, requirements and practices to be followed during paving operations to adequately protect abrupt edges. Examples include:

- *For 2-Lane, 2-Way Roadways*: When paving operations create an abrupt edge, protect traffic by installing signing according to the "2-Lane, 2-Way Roadway Overlay Area" detail shown on Standard Drawing TM710.
- *For Multi-Lane, Two-Way, Non-Freeways*: When paving operations create an abrupt edge, protect traffic by installing signing according to the "Overlay Area Signing" detail shown on Standard Drawing TM715.
- *For Two-Lane Freeway projects*: When paving operations create an abrupt edge, protect traffic by installing signing according to the "Divided Freeway Overlay Work Area" detail shown on Standard Drawing TM725.
- *For Multi-lane (**>** 2 lane) Freeway Projects*: When paving operations create an abrupt edge, protect traffic by installing signing according to the "Divided Freeway Two Lane Overlay Work Area" detail shown on Standard Drawing TM730.

PAVEMENT REMOVAL (COLD PLANING)

Depending on the depth of the pavement surface being removed, the contractor is required to employ various traffic control measures to protect traffic.

From the (2008) Standard Specifications in Section 00620.40, the contractor is given the following instructions for *Cold Plane Pavement Removal*:

a) **General –** Remove the existing pavement to the depth, width, grade and cross section shown or as directed. The use of a heating device to soften the pavement is not permitted.

b) **Depth 1 Inch to 2 Inches (25 mm to 50 mm)** – If the depth of the existing pavement to be removed is 2 inches (50 mm) or less, but more than 1 inch (25 mm), and the section will be under traffic, schedule the work so the full width and length of travel lane pavement can be removed during the same shift. Remove the shoulder area within 24 hours.

c) **Depth over 2 inches (50 mm) –** If the depth of the existing pavement to be removed is over 2 inches (50 mm) and the section will be under traffic, schedule the work so the full width and length of the travel lanes and shoulders can be removed, leaving no longitudinal or transverse drop-offs during the same shift.

d) **Pavement Removal Alternative –** If unable to complete the pavement removal according to 00620.40(b) and (c), then within the same day construct a wedge of

asphalt concrete at a slope of 1V:10H, or flatter, along each exposed longitudinal drop-off and 1V:50H, or flatter, along each exposed transverse drop-off. Place wedges completely across the milled area at intersections, points of beginning and ending of the milling operation, and around manholes, valve boxes and other structures. Longitudinal drop-offs of 1 inch (25 mm) or less do not require a wedge. Maintain wedges as long as the area remains under traffic or until pavement is replaced. Remove and dispose of wedges before placing new pavement.

e) **Warning Signs -** Provide warning signs as required where abrupt or sloped drop-offs occur at the edge of the existing or new surface according to Section 00225.

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)".

CROSSOVERS OR "ON-SITE DIVERSIONS"

A crossover is a construction staging technique used to shift traffic from one side of a divided roadway into either the median, onto a portion of the remaining half of the roadway not under construction; or onto a temporary alignment adjacent to the original mainline alignment. Crossovers are an effective method for completing construction of a roadway (typically a divided highway or freeway), replacing or repairing a bridge or culvert, yet maintaining live traffic in both directions.

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 crossover and for additional right of way.

Construction of a crossover typically consists of a temporary roadway alignment that may also require the construction of a temporary structure. The limits of the crossover extend from the initial reversing curve (Curve 1) leaving the existing roadway to the final reversing curve tying the alignment back into the existing roadway (Curve 4), see *Figure 3.3a*, below.

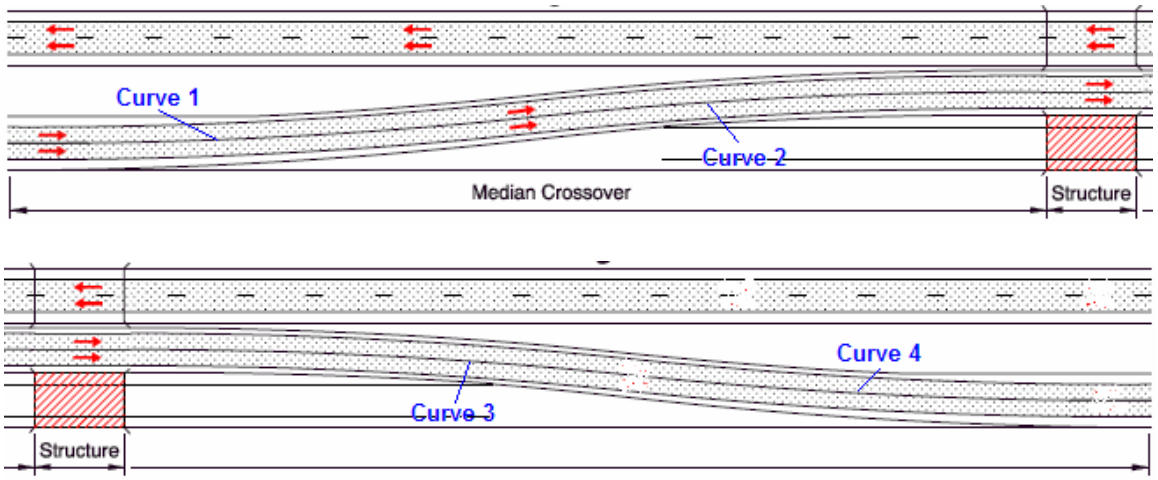


Figure 3.3a

Often referred to as an "on-site diversion," crossovers are typically used on freeways, but can also be used on divided highways or multi-lane non-freeways with two-way continuous left-turn medians.

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, unless the existing alignment is non-linear. The TCP Designer should provide at least one cross-section taken somewhere along the crossover alignment and show this on the TCP plan sheets, see Figure 3.3b.

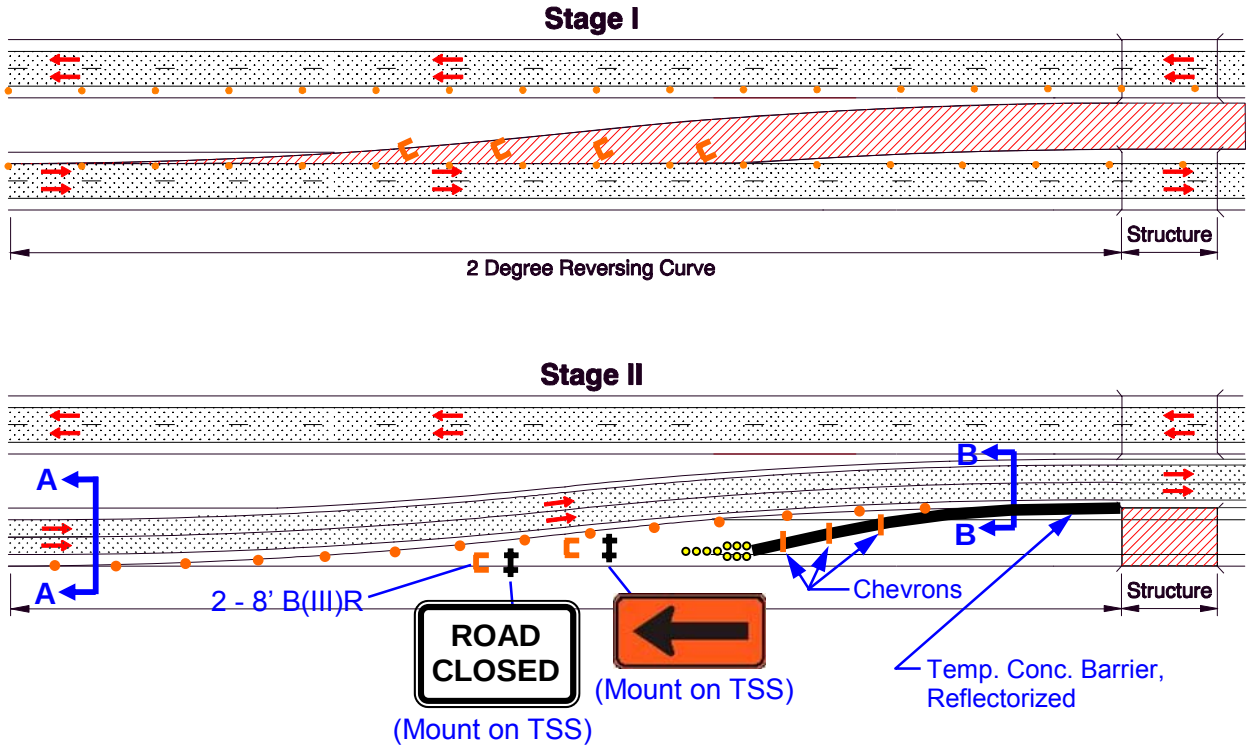


Figure 3.3b

CROSSOVER DESIGN

The following are design standards for the development of a temporary median crossover:

ALIGNMENT

- For Freeways with a 65 mph pre-construction posted speed, the minimum horizontal curve radius shall be 3274 feet (1^0 45')
- For Freeways and non-freeways with a pre-construction posted speed of 60 mph or less, the minimum horizontal curve radius shall be 2854 feet (2^0).
- For consistency in driver expectations and design of a crossover in ***tangent*** sections, a TCP Designer should utilize values available on *Table 5-6 – Safe Speed*, of the Highway Design Manual (HDM), in designing Curves 1 through 4 of the crossover (see *Figure 3.3a*, above).
- For existing ***curvilinear*** mainline alignments, the Designer may select appropriate radii and superelevation rates from *Table 5-3 – Open Road*, of the HDM in designing

the crossover. If site conditions do not accommodate values from the *Open Road* table, use values from the *Safe Speed* table. The use of spirals, spiral segments or partial spirals may be necessary to transition from the existing mainline alignment to the temporary crossover alignment.

- Superelevation rates on the existing alignment shall match the crossover alignment at both the departure point and the point of return to the existing alignment.
- If Crossover departures and return points are in close proximity to an existing entrance or exit ramp, the TCP Designer should include details on plan sheets that show the placement of channelization devices (typically, plastic drums) that mimic ramp acceleration lanes or exit gores.

  Entrance ramps, in particular, need to include minimum acceleration lane lengths and an appropriate terminal taper.
- If exit ramps are too close to the return point of a crossover, consider closing the exit ramp. If closed, include an appropriate detour route and signing plan.

WIDTHS

- Where existing mainline shoulder widths cannot be accommodated through the crossover, use minimum shoulder widths of 4 feet for multi-lane crossovers.
- Maintain a minimum horizontal width of 19-ft between positive barriers (concrete, guardrail or other rigid barrier) for single-lane crossovers.
- Maintain a minimum horizontal width of 32-ft between positive barriers for a two-lane crossover on a freeway.
- Maintain a minimum horizontal width of 28-ft between positive barriers for a two-lane crossover on a non-freeway.

OTHER 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 *Temporary Speed Zone Reduction Orders*, below.
- Add appropriate advisory speed riders to advance “Reversing Curve Arrow” symbol signs to indicate advisory speeds through the crossover curves. Speed zone reductions ***do not*** warrant a reduction in the design speed (See “DESIGN SPEED” below).
- Consider drainage issues on crossovers.
- If lane changes are to be disallowed through the crossover, include the appropriate “NO LANE CHANGES XXXX FEET (X/X MILE)” (OR22-16 or OR22-17, respectively) signs in combination with 4” double, solid white striping along centerline between travel lanes of a multi-lane crossover. Striping starts at the signs and stops at the end of the specified distance.

DESIGN SPEED

The ***Pre-construction Posted Speed shall be used as the "Design Speed"*** for the following alignments and applications, unless otherwise indicated in this manual:

- Temporary roadway alignments, on-site diversions, crossovers
- Spacing of signs and traffic control devices
- Temporary impact attenuator selection
- Lane or shoulder closure tapers
- Lane shifting tapers
- Temporary sign letter heights
- Other speed-dependant design elements

NOTE*:* This manual supersedes Chapter 5.6 of the current ODOT Highway Design Manual (HDM) regarding the discussion of "Detour Design Speeds".

The "***Design Speed***" of a temporary alignment may not be reduced below the pre-construction posted speed. Through a Temporary Speed Zone Reduction Order, the regulatory ***posted*** speed through a work zone may be reduced by 10 mph for a freeway and up to 20 mph (in two – 10 mph steps) for an urban, 2-lane highway.

DEVICE SPACING

The placement of temporary traffic control devices – signs, channelization devices, etc. – is critical for drivers. Properly spaced devices allow drivers to see, interpret and react to the messages the devices are conveying. Devices too closely spaced can be confusing and can make it difficult to absorb all of the information. Devices spaced to far apart – particularly channelization devices – can confuse drivers as to where they are supposed to drive and what hazards they should avoid. Temporary signs spaced too far apart can be forgotten and the driver loses the context of individual messages or the warning or guidance they are providing.

Therefore, proper spacing for both channelization devices and temporary signing are available on ODOT Standard Drawing TM700. See the current "*TRAFFIC CONTROL DEVICE SPACING*" Table shown on ODOT Drawing TM700.

Spacing in low-speed areas (30 mph or less) and around radii for accesses, driveways or locations of emphasis can be reduced to 10-ft.

Some device spacing is addressed in the Special Provisions and is reserved for specific types of work or devices. Spacing requirements included in the Special Provisions will supersede spacing requirements shown on the Device Spacing table shown on TM700.

NOTE**:** For additional information regarding the order of precedence for your TCP documents and drawings, refer to Section 00150.10(a) of the Standard Specifications.

"DO NOT PASS" SIGNING

Through interpretation of Chapters 2B and 3B of the 2003 MUTCD, ODOT requires the installation of "DO NOT PASS" and "PASS WITH CARE" signs at the respective limits of existing No Passing Zones anytime road work obliterates centerline pavement markings.

Additional requirements for contractors are included in Section 00225.02 of the following "Unique" Special Provisions used for our pavement preservation projects:

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

For long preservation projects with low volumes, primarily "chip seal" jobs, 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.

FLAGGING – GENERAL PRINCIPLES

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 freeways. A flagger can be used for the following activities:

- Controlling the flow of traffic through a two-way, one-lane section of roadway.
- Stopping traffic to allow the entrance/exit of construction equipment/ vehicles onto/off of the highway.
- Slowing traffic on a highway segment where workers and equipment are immediately adjacent to live travel lanes.
- Direct traffic through a signalized or unsignalized intersection under construction. If signalized, the signal must be turned off during flagging operations.

Flaggers are included in the contract as a separate pay item. Flagging Hours needed for a particular project are to be determined by the Cost Estimating Unit.

While the day-to-day requirements for Flaggers and their certified training are not the responsibility of the TCP Designer, there are several basic principles of flagging that have a significant impact on the development of the Traffic Control Plan and that a Designer should be aware of.

MULTI-LANE ROADWAYS

Flaggers are allowed to control only one lane of traffic at a time. A single flagger cannot be allowed to control two lanes approaching simultaneously in the same direction. In multilane sections, one approach lane must be closed in advance of the flagging sign sequence.

For an example, see the "4-LANE, 2-WAY ROADWAY" detail on the ODOT Drawing TM740 – Blasting Zones. This technique should be applied to any flagging operation where multiple lanes are approaching a flagging operation.

Therefore, if a project requires flagging on a multi-lane section, be sure to include a quantity of temporary signs and devices for the lane closure(s).

INTERSECTIONS

When flagging in intersections, one flagger should be used for each leg of the intersection where total approach volumes exceed 400 ADT for the intersection. Therefore, as an example, a four-leg intersection with an ADT of 750 vehicles would require four flaggers.

See ODOT Drawing TM705, "*2-LANE, 2-WAY, ONE LANE CLOSURE*" for an example of a flagging operation in an intersection.

If flagging in a multi-lane intersection, as mentioned above, one approach lane must be closed (See TM705). In the case of flagging a multilane approach, conduct 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.

SIGNALIZED*:* When flagging a signalized intersection, the signal ***must be turned off***, unless flagged by uniformed police officer(s).

See ODOT Drawings TM765 and TM770 for details regarding work in a signalized intersection.

If flagging in these intersections, move any lane shifts, closures and all appropriate traffic control devices and signing away from the intersection to allow for the insertion of the required flagger signing and flagger station.

UNSIGNALIZED*:* If flagging a stop-controlled intersection, the existing "*STOP*" signs must be covered according to ***ORS 811.260*** and ***265***.

See ODOT Drawing TM705 for details regarding work in an unsignalized intersection.

FREEWAYS

Flagging used to stop or hold traffic on a freeway is not allowed in Oregon. Flaggers may be used on a freeway to ***SLOW*** traffic only, but it is not recommended. Contractors will often place a flagger in a closed lane of a freeway paving operation to slow traffic around the paving equipment or at the access point for material delivery vehicles. See ODOT Drawing TM725 or TM730 for additional details.

If temporary, short-term closures of all freeway travel lanes are needed, the "Rolling Slowdown Method (RSM)" is a safe, effective tool to conduct this type of traffic control. See, *"ROLLING SLOWDOWN METHOD*", below, for additional details.

SIDE ROADS WITHIN THE WORK ZONE

For lengthy preservation projects, place a Flagger and appropriate signing at each intersecting through-road within the limits of the work zone.

Additional Flaggers may be required at high-volume accesses (i.e. shopping or recreational centers, residential neighborhoods, campgrounds, or other high-volume generators).

Low-volume, dead-end roads within the work zone can be addressed on a project-by-project basis based on the function of the road and services it feeds.

Individual residences along the highway within the work area can be personally contacted and informed of the needed processes for entering and exiting the work zone. Work closely with the Construction Project Managers office to determine the extent of parties affected by construction and determine if additional mitigations in the TCP are needed.

At non-through-road accesses or intersections, ODOT does ***not*** allow the use of the following signs or signs similar in nature: "*WAIT HERE FOR PILOT CAR*", "*FOLLOW PILOT CAR*", "*WAIT FOR PILOT CAR*", etc.

EXTENDED TRAFFIC QUEUES FOR ADVANCE FLAGGING

When traffic volumes are high enough and construction operations limit the ability to completely dissipate traffic queues approaching a work zone under a two-lane, one-way operation (i.e. flagging), extended ("residual") traffic queues will likely develop.

It is important to consider this likelihood in the development of the construction staging plan. Depending on the volumes approaching the work zone and the severity of the 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 highway lanes.

The "*EXTENDED TRAFFIC QUEUES FOR ADVANCE FLAGGING*" detail shown on ODOT Drawing TM710 describes the placement and conditions when the additional traffic control devices and the Advance Flagger are needed to mitigate the extended queues. During construction, the two key conditions field personnel must look for are:

- When traffic queues extend beyond the initial advance warning sign (typically the "ROAD WORK AHEAD" sign); or,
- When sight distance from the approaching driver to the back of the stopped queue is limited to less than 675 feet

Therefore, in calculating quantities for "Flagger" hours, you may need to include an additional number of hours for any Advance Flaggers. In your pay item estimate, "Flagger" and "Advance Flagger" hours can be combined into a single quantity.

FREEWAY CLOSURE – SHORT TERM

Occasionally, as part of a project, it may be necessary to temporarily close one or both directions of a freeway or access-controlled facility to complete major structural work that passes over the lanes of the highway. If a Rolling Slowdown (see *Rolling Slowdown Method (RSM)* below) does not provide ample time to complete the work, a temporary closure may be necessary.

***NOTE*:** Due to the significant impact this process has on traffic capacity, it is likely a closure will only be allowed during times when the lowest volumes occur – late evening or very early morning hours. Work Zone Traffic Analysis should be done to determine the hours when the closure can take place. This information must be entered into the Special Provisions under Section 0022.40(g) – Road Closure.

The full closure will require the Designer to develop a temporary signing and delineation layout as well as a detour plan for the highway traffic. The detour plan can be either:

- A short detour utilizing the existing ramps of the interchange under construction
- A detour using an alternate route, if interchange ramps are not conducive to the short detour described above

In either case, an extensive system of signage and channelization must accompany the detour plan. Typically, for a multi-lane facility, the following activities must be accommodated:

1) Include one or more PCMS in advance of the initial advance warning signage. Messages for the PCMS may include:

FREEWAY	|	ALL
CLOSED	|	TRAFFIC
X MILES	|	EXIT FWY

And/or:

FREEWAY	|	TRAFFIC
CLOSED	|	MUST USE
1 MILE	|	EXIT XXX

The object is to alert drivers of the approaching closure and give them an initial notice of what they must do and where there are going.

2) Close all approaching lanes except one. The Designer must include all necessary signing, channelization and Sequential Arrows needed to direct drivers into the right-most lane. See Standard Drawing TM725 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 Standard Drawing TM730 for additional information relating to a multi-lane closure.

3) 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 example below).

4) As shown in the detail below, it is important to 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.

5) If using the interchange ramps for your detour, additional arrangements may be needed at the ramp terminal to control traffic and give priority to freeway traffic. Traffic signals may need reprogramming, flaggers may be needed, lanes on the crossroad may need to be closed for flagging operations, etc.

***NOTES*:**

- Any alternate route must accommodate the Design Vehicle for the facility being closed. In most cases, the Design Vehicle will be a large, multiple-axle truck.
- If a non-state facility is used for the detour, an agreement with the local agency must be reached prior to specifying the facility in your TCP. Work with your Project Leader to help with these arrangements.

HORIZONTAL AND VERTICAL DESIGN POLICY

Two key aspects in designing your temporary Traffic Control and construction staging plan are the horizontal roadway width and vertical height constraints that may result. As part of ODOT's focus on statewide mobility through our work zones, we must consider the needs of the freight industry, particularly oversized vehicles, using the State highway system.

The following section describes minimums for horizontal width and vertical height design for a construction staging plan. The TCP Designer is responsible for indicating all temporary widths and heights in their TCP as well as all relevant Special Provision language. Any deviations below the minimums shown in this Section or other relevant sections of this Manual are subject to the approval of the State Traffic Control Plans Engineer and concurrence with the Motor Carrier Transportation Division (MCTD).

HORIZONTAL DESIGN

Use the following dimensions for developing your traffic control and construction staging plan.

Freeway Mainline (Not within a Crossover) between positive barrier

The following dimensions assume all vehicle classifications are allowed on the roadway. Over-dimensional vehicles are not being diverted to an alternate facility or route. Use the following dimensions for your temporary facility:

- One Lane: 19 feet
- Two Lanes: 28 feet (2-ft shoulders, 12-ft travel lanes)
- More than two lanes: Maintain a minimum 2-ft shoulder and 12-ft travel lanes.

If over-dimensional loads and annual permits are detoured:

- One Lane: 16 feet (2-ft shoulders, 12-ft travel lane)
- Two Lanes: 28 feet (2-ft shoulders, 12-ft travel lanes)

Freeway Crossover between positive barrier

If all vehicle classifications are allowed on the roadway:

- One Lane: 19 feet
- Two Lanes: 32 feet (4-ft shoulders, 12-ft travel lanes)

If over-dimensional loads and annual permits are detoured:

- One Lane: 16 feet (2-ft shoulders, 12-ft travel lane)
- Two Lanes: 28 feet (2-ft shoulders, 12-ft travel lanes)

Non-Freeway Roadways between positive barrier (Freight Route)

If all vehicle classifications are allowed on the roadway:

- One Lane: 19 feet
- Two Lanes: 28 feet (2-ft shoulders, 12-ft travel lanes)

If over-dimensional loads and annual permits are detoured:

- One Lane: 14 feet
- Two Lanes: 28 feet (2-ft shoulders, 12-ft travel lanes)

The above dimensions are minimums. The TCP Designer should make every effort to increase these dimensions where practical.

Only under conditions of extreme constraint should a reduction in the above widths be considered. If a reduction is necessary, the reductions should be made to the lane widths, starting with the left-most lane (median) lane first, working across the section to the right-hand ("slow") lane. Reductions to the 2-ft shoulders should be avoided.

If reductions in any of the above dimensions are necessary:

- Contact the State Traffic Control Plans Engineer's office; 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.

If ***positive barrier*** (concrete barrier, guard rail, bridge rail, bridge abutments, or other 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 develop your design accordingly.

SPECIFICATIONS

If a width restriction is anticipated as part of the TCP, Designers should include current language from the ODOT Standard Specifications and Special Provisions within Sections 00220 and 00225 that pertain to the contractor's responsibility for MCTD notification in the event of a width constriction between positive barriers.

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 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 advance 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 3 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 you use an OVWS, include the Unique Special Provision language found on the Specifications web site.

SPECIFICATIONS

If a height reduction is anticipated as part of the TCP, Designers should include current language from the ODOT Standard Specifications and Special Provisions within Sections 00220 and 00225 that pertain to the contractor's responsibility for MCTD notification in the event of a height constriction.

LONGITUDINAL SHOULDER RUMBLE STRIPS

On many sections of Oregon's freeways and some highways, ODOT has installed longitudinal rumble strips along the shoulders. Rumble strips have been installed on both median and right-side shoulders.

The rumble strips are a very effective measure in getting the attention of an errant or drowsy driver to alert them and allow them to safely return to their travel lane before leaving the roadway.

Unfortunately, staging or shifting live traffic near or across the rumble strips is not an accepted practice. Leaving the rumble strips in place and forcing drivers to drive on them can be frustrating or confusing and could lead to unnecessary crashes.

Therefore, if present, longitudinal rumble strips that conflict with the path of live traffic due to a shift in traffic patterns or alignment as per the TCP, will be ground (milled) out and paved back prior to the shift.

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.

ROLLING SLOWDOWN METHOD (RSM)

Whenever work takes place overhead, crossing live travel lanes in either or both directions of a highway, use of the "Rolling Slowdown Method" should be considered.

PURPOSE

Rolling Slowdowns are conducted for short-term work that requires working above live travel lanes on facilities of high volume, (freeways, etc.) for durations of less than 20 minutes. Rolling Slowdowns are used on such facilities due to the impracticality of a full highway closure and detour. Cases where a rolling slowdown is valuable include the installation of permanent, overhead Variable Message Signs (VMS), replacement of sign bridges and signs hung from them, installation of bridge girders; and, demolition and removal of structures, etc.

Rolling Slowdowns are used to create a 20 minute (maximum) time gap in traffic to conduct overhead work while keeping the facility open and not stopping live traffic. Slowdowns work best on access-controlled facilities as you will discover in reading the Procedure below.

CONSIDERATIONS

As a TCP Designer, conversations should be held with the Project Manager as to practical time gap lengths needed. The more accesses closures needed to conduct the Slowdown, the more signing and devices needed in the TCP quantity estimate.

It is important for a TCP Designer to know the scope of work and thus the likelihood of a Slowdown. Slowdowns involve the use of a number of pay items, including:

- Pilot Cars (hours) – unless using local Police vehicles
- Flaggers (at closure points)
- Traffic Control Supervisor (TCS)
- Temporary signs (closure & detour signing at on-ramp terminals and along cross roads)
- Barricades
- PCMS (one at each highway access closure, at least one in each direction on mainline)
- Plastic Drums (at closure points)

Fortunately, the TCD may be reused if there are multiple Slowdowns, but quantities needed for TCS and Pilot Cars must be tabulated carefully.

PROCEDURE

1. A Portable Changeable Message Sign (PCMS) shall be placed 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. One PCMS should be placed for each direction affected by the Slowdown.

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.
3. Eventually, a large gap opens between the free-flowing traffic in front of the Traffic Control vehicles and 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: Often times, the distance needed for 20 minutes of clear highway is not 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.

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 following table.

Table 3-1 - Rolling Slowdown Distances

SPEED of MOVING BLOCKADE (MPH)	DISTANCE FOR TRAFFIC GAP (MILES)	ADDITIONAL DISTANCE FOR TRAFFIC TO CLEAR WORK ZONE (MILES)	TOTAL DISTANCE of MOVING BLOCKAGE (MILES)
10	3.3	0.6	4
20	6.7	1.2	8
30	10	1.8	12
40	13.4	2.4	16
50	16.6	3	20
60	20	3.6	24

A detail sheet may be developed and incorporated into the Traffic Control Plan sheets to depict the signs to be used, PCMS and device placement, and the table shown above.

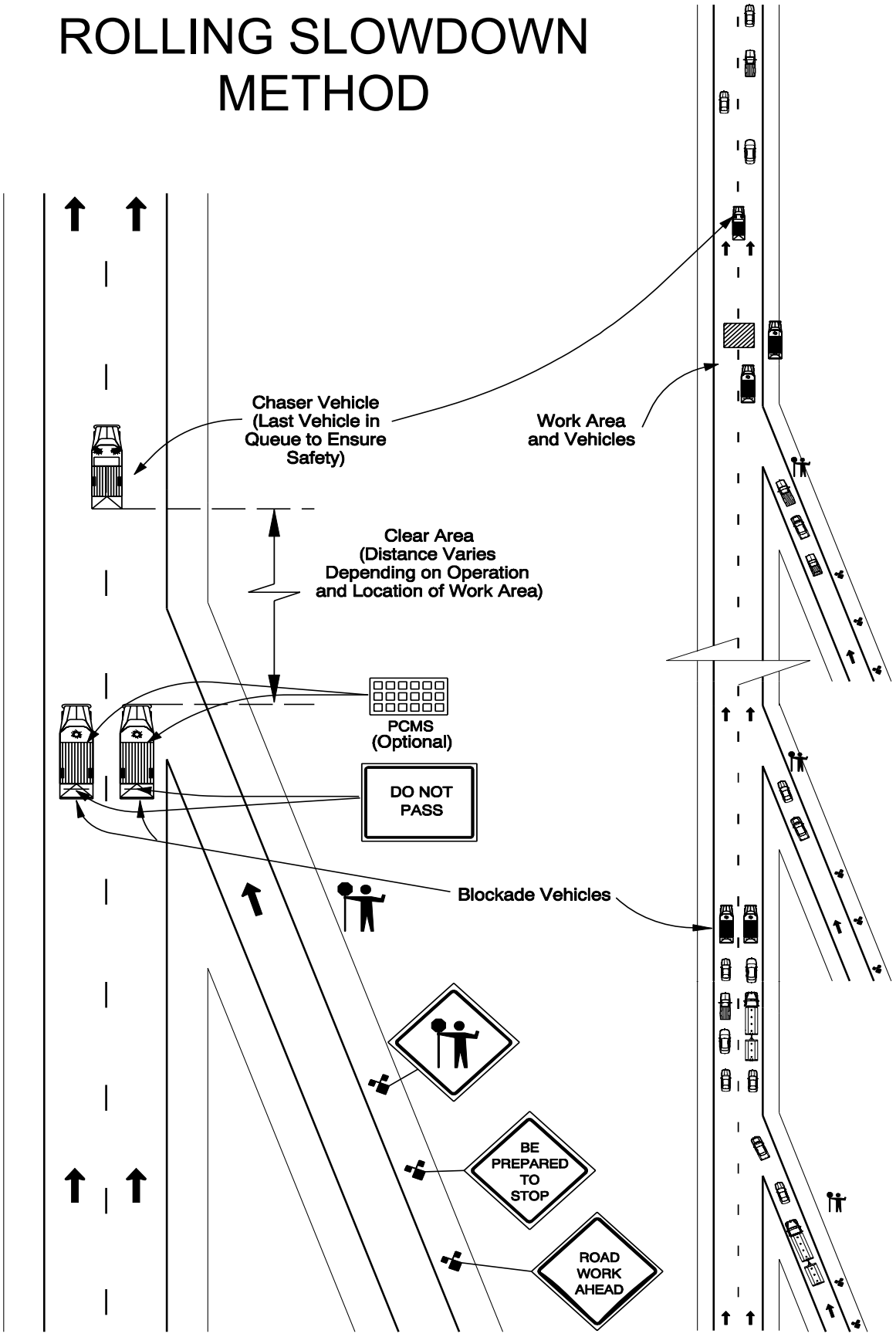
See the illustration below for an example of the Rolling Slowdown operation.

ADDITIONAL INFORMATION

As is stated in the current Special Provision "boilerplate" under Section 00220.40(g), the contractor is required to have contingencies prepared for the following circumstances:

- In the event the work operation is not completed when the moving blockade reaches the work site, all work except that necessary to clear the roadway will cease immediately and the roadway shall be cleared and reopened as soon as practical.
- Radio communications between the work site, the rolling blockade, and flaggers shall be utilized to adjust the speed of the blockade, as necessary, to accommodate the closure time needed.

ROLLING SLOWDOWN METHOD



SIGN PLACEMENT

A critical component in a TCP is the placement of temporary signing. Temporary signing is the primary method we convey warnings, guidance and regulatory messages to drivers entering and passing through our work zones. Therefore, it is imperative that these signs are designed properly, contain a clear, concise message; and, are placed so as to maximize their visibility and the ability for drivers to read, interpret and react to their messages.

A TCP Designer should be very familiar with the *Device Spacing Table* located on *ODOT Standard Drawing TM700*. Part VI, Section 6F, of the MUTCD provides additional information and guidance relating to the placement of temporary signs.

The following items may be useful in assisting you with the development of your TCP with respect to temporary signing:

- Prior to beginning the layout of your TCP, conduct a field investigation and collect an inventory of the existing signing, including the location for these signs

- Use the inventory to place temporary signing within the TCP. Avoid locating temporary signing in the immediate vicinity of existing signing. Designers should try to maintain standard sign spacing between temporary and permanent signing as they would for all temporary signs.

- ***URBAN AREAS*****:** Placement of temporary signing can be 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, designated bicycle lanes, multi-use paths, landscape strips between roadway and sidewalk, and other facilities that may help or hinder the placement of your temporary signing.

    - ***NOTE*****:** To help accommodate Temporary Sign Supports (TSS) in constrained roadside environments, a 4-ft Type III Barricade may be specified (on plans or in Specials) in lieu of the standard 8-ft model.

    - Use the above information before calling for “post-mounted” signs on the “shoulder” of the highway. You may find out, for example, that there is a 2-ft shoulder and the contractor now has no choice but to locate the sign on the sidewalk.

    - Be aware that the “shoulder” may also be a designated Bicycle Lane. Calling for temporary signing to be placed in the “shoulder” (either by Special Provision or shown on your plans) will force cyclists out into live travel lanes creating an unsafe and unnecessary condition.

      NOTE**:** If multiple TSS are required for temporary signing due to a lack of other viable alternatives and will be in place for an extended period of time, add a “**Bicycle**” symbol sign with “**ON ROADWAY**” rider in advance of your sign

sequence. Repeat the "Bicycle" sign and rider combination on approximately 1-mile intervals, 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.

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 the Safe Speed table (Table 5-6) from the Highway Design Manual (HDM).
- A temporary alignment used within a freeway crossover shall not be less than $1^0$45' (3274 feet). A temporary alignment for a freeway segment shall not been less than 2^0 (2854 feet).
- 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. Use a minimum shoulder width of 2-ft. If designing a freeway crossover, use a minimum shoulder width of 4-ft.
- Include in the TCP appropriate pavement markings and channelization devices for temporary alignments.

Pavement design and the materials needed to construct temporary alignments are not included in the Traffic Control Plan. Embankment, aggregates, asphalt concrete, PCC, etc., should be included in the Roadway pay item quantity schedule.

TEMPORARY CONCRETE BARRIER

One of the more common temporary traffic control devices used in an ODOT construction work zone is temporary concrete barrier. Concrete barrier provides drivers and workers with the most effective protection and positive guidance through the work area.

Several factors should be considered when determining the need for temporary concrete barrier in your traffic control plan.

BARRIER WARRANTS

A commonly asked question regarding temporary concrete barrier in developing a TCP is, "Do I need it?"

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. Examples might include:
  - Staging decreases a 30-ft landscaped median to 24-ft
  - Southbound traffic is moved into the median on a temporary crossover
  - Obsolete existing concrete median barrier is being replaced
- Protecting structure falsework or other bridge work
- Separating traffic from deep excavations adjacent to the travelled way. Examples of factors that emphasize this warrant include:
  - Impractical 3:1 aggregate wedges due to the depth of the excavation
  - Exposures where the depth or longitudinal length of the excavation are significant
  - If a minimum 4-ft shoulder cannot be maintained and pavement surface cannot be 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 the list of warrants or conditions above is not complete, they present the Designer with an appropriate amount of lattitude and an opportunity to use engineering judgement in the design of the TCP.

BARRIER PLACEMENT

Due to the nature of temporary concrete barrier, its physical properties and needs to remain crashworthy, there are strict requirements for the placement of concrete barrier.

Temporary concrete barrier must be:

- Set on a level asphalt concrete (AC) or portland cement concrete (PCC) surface

- Installed with a 3-ft clearance behind the barrier – measured from the back face of the barrier to the nearest obstacle
- Pinned to an AC surface, if the 3-ft clearance cannot be provided. See TM745 for pinning details
- Restrained on a PCC surface, if the 3-ft clearance cannot be provided. See TM745 for restraint details. **NOTE:** The final design for a concrete barrier restraint system must be approved by the State Bridge Engineer's office
- When pinned or restrained, barrier must be installed with a 1-ft minimum clearance behind the barrier

NOTE: For NHS Highway projects, a new, crash-tested barrier restraint detail is in process. The new restraint detail will require vertical pinning of the barrier in four locations per barrier piece. Design details have not yet been finalized. Look for updates to this section of the Design manual by Summer, 2008.

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 below)
- Do not install without pinning individual barrier sections together

REFLECTIVE BARRIER PANELS

Reflective barrier panels are a very effective device, when used properly, in aiding with the delineation of temporary concrete barrier. The panels are installed on the face of the barrier and provide drivers with a highly visible, retroreflective series of markers to help them negotiate sometimes narrow and winding sections of concrete barrier.

Due to the reflective nature of the panels, it is best and most effective to install them on barrier placed in a curve where it may be otherwise difficult to see the barrier at night and in inclement weather.

For calculating relective barrier panel quantities, two panels are attached to each piece of barrier. Include a small percentage of the total quantity for replacement – 20-25% is a good place to start. Depending on how many times the barrier is moved, how narrow the shoulders are, traffic volumes and other factors, the need for replacement panels may increase.

Designers must remember to include the Unique Special Provision, "*00225 – Reflective Barrier Panels*".

HIGHWAY MEDIAN APPLICATIONS

An occassional component in freeway construction projects is the removal and replacement of obsolete permanent median barrier. When this work is done, ODOT prefers to specify the following practice:

- Place an equal length of temporary concrete barrier along side the existing barrier to be removed.
- Closure of the adjacent lane is common to afford the contractor sufficient room to work. Occassionally, the adjacent lane on both sides of the highway are closed to conduct placement/removal of barrier segments.
- The contractor will be given a quantity for the "Temporary Concrete Barrier Move" pay item equal to the length of the temporary barrier placed.
- If multiple lifts of paving are needed to repair the pavement under the existing barrier, be sure to include enough quantities for the "Move" pay item for ***each*** lift of paving.The contractor must provide appropriate connections or protection for any exposed barrier ends before leaving the work area. As necessary, include barrier connection details in the TCP (see *Blunt End Treatments*)
- Be sure to include quantities for at least two Truck-Mounted Impact Attenuators (TMA).

NOTE: Providing a "*clear zone*" between opposing lanes in lieu of temporary concrete barrier is not an acceptable practice and exposes ODOT to unnecessary risk in the chance of a crossover crash.

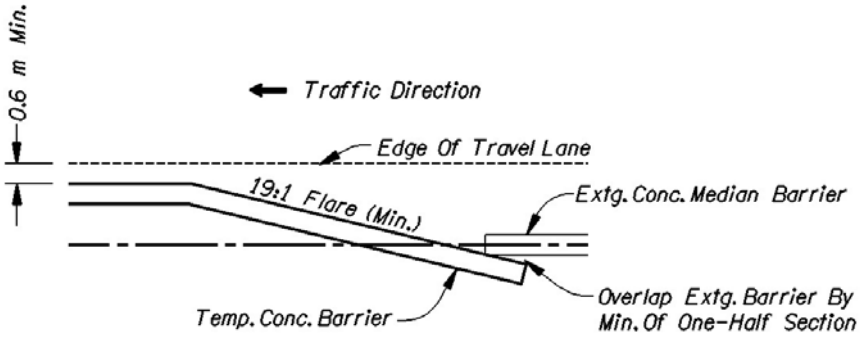
Temporary concrete barrier can be moved into place and used as "Permanent" barrier at the completion of the project as long as the barrier is in ***new*** condition when delivered to the job site.

BLUNT END TREATMENTS

The deadliest portion of temporary concrete barrier is the blunt ends when exposed to traffic. When concrete barrier is placed on the project site, there are a number of methods for protecting the blunt ends.

5) ***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 – Sand-filled array of plastic barrels. See TM755 and TM760 for additional details.
    - Narrow Site system – Approx. 2-ft in width. Used where drum arrays are not practical. See QPL for additional details.
    - Truck-Mounted Attenuator (TMA) – Installed on a truck. Portability gives the TMA greater flexibility in placement. Use of a TMA to protect blunt ends should be limited to three consecutive days – see below.
6) ***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 Drawings RD530, DET110 and others depending on the needed connection.

7) ***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.



DETAIL "A"
(TYP. TEMP. CONC. BARRIER TO EXTG. CONC. BARRIER)

8) ***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 Drawings RD526 and RD566.

9) ***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.

NOTE*:* ODOT ***does not recommend*** using the following techniques for "protecting" the blunt end of temporary concrete barrier:

- ***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.
- ***Using a TMA for greater than three consecutive days*** – TMAs are intended to be used as a short-term, mobile protection device. They may be used during the placement or removal of barrier operations, but long-term usage is not condoned.
- ***Barrier Mounds:*** Following a letter issued by the Federal Highway Administration (FHWA) in February,2003, ODOT no longer allows the use of barrier mounds as a means of protecting the blunt ends of concrete barrier runs.Do not use mounded fill material at the end of a concrete barrier run – either temporary or permanent – to protect the blunt end. Do not include ODOT Drawings RD525, RD565 or DET152 in your Traffic Control Plans.

TALL "F" CONCRETE BARRIER

Tall "F" (42") 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.

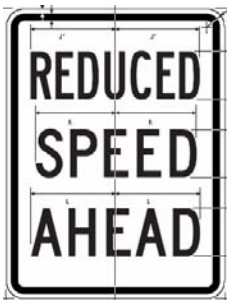
The primary use for Tall "F" barrier is in the median of ODOT Interstate and Highway freight routes. As a secondary use, Tall "F" barrier may be used as shoulder barrier for these same routes.

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 on ODOT Standard Drawing TM745 has not been approved for use with Tall "F" barrier.

For pinning "Tall F" barrier to the roadway, see ODOT Drawing RD516.

TEMPORARY SPEED ZONE REDUCTIONS



Under some circumstances, it may be necessary or advantageous to implement a temporary reduction in the posted speed through a portion, or through the entire length, of 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 can be relieved or eliminated.

In order to have the posted speed through a work zone reduced, permission has to be obtained from the State Traffic Engineer. The memo, "**Worksheet for Determining the Need for a Reduced Speed Zone for Work Zones**" is found in Appendix A or online under the Traffic-Roadway Section web site. Look for links to the Traffic-Roadway "*Publications*" page.

Circumstances which could, not singularly but in combination, justify the warrant for a speed zone reduction include, but are not limited to, the following:

- Reducing the number of lanes for traffic.
- Construction which requires complex staging.
- Construction workers present for extended periods within two feet of travel lanes, without protective barrier.
- Narrow lane widths or construction which creates lane widths less than 12 feet (3.7 meters).
- Horizontal curvature with a safe speed of 10 mph or more less than the posted speed.

- Pavement edge drop-off within two feet of the traveled way for more than ¼ mile.

If a significant number of these types of circumstances exist within the TCP, the Designer or Project Leader can complete the "Worksheet for Determining the Need for a Reduced Speed Zone for Work Zones" memo and submit it to the State Traffic Engineer's office. Contact Jan Gipson – Senior Traffic Investigator with the Traffic-Roadway Section (503-986-3573) for additional information.

SPEED ZONE REDUCTION PROCESS INFORMATION

- Submit requests early in the design process, before Preliminary Plans if possible. Include a copy of the TCP in the submittal.
- Requests should be submit to the State Traffic Engineer's office in the Traffic-Roadway Section.
- If the request is approved, the Designer should receive a "Support" Letter. This letter is ***NOT*** the Speed Zone Reduction Order! The intent of the letter is to notify the Designer that they may proceed with their TCP design and anticipate the incorporation of a Speed Zone reduction.
- Designer should add a quantity of Temporary Signs in their estimate that would cover the needed signs for the Speed Zone reduction. Contact Jan Gipson for additional information.
- ***DO NOT*** draw the specific signs into your plan sheets!
- At some point following the Plans-in-Hand meeting, a signed speed zone order will be issued. The order will establish the final placement and duration of the signs.
- The order will be released to the awarded Contractor at the Preconstruction Conference.

Once a TCP Designer has received the "Support Letter" from the State Traffic Engineer, the Designer should remember to include the language from the Unique Special Provision, "*00225 – Temporary Speed Zone Reduction*" into the project Special Provisions.

SPEED ZONE REDUCTION ALTERNATIVES

As an alternative, *or supplement*, to a formal Speed Zone Reduction order, the TCP Designer may add Advisory Speed (W13-1) plaques to any advance warning sign to indicate the advisory speed for a given condition – for example: "*(Reversing) Curve*" signs, "*LANE(S) SHIFT(S) AHEAD*", etc.

Advisory Speed plaques shall only be used where an engineering study determines the need to advise drivers of an advisory speed for a condition and approved by ODOT. Advisory Speed plaques shall be Type "O4" and shall be in 5 mph increments.

The "*ROAD WORK XX MPH*" (CW20-1a) sign may also be used as an alternative to or to supplement a Speed Zone reduction. Again the speed displayed on the sign should be determined through engineering judgment and have ODOT approval.

It is recommended to avoid creating a temporary situation that would require an Advisory Speed more than 20 mph below the pre-construction posted speed.

IMPORTANT NOTES

- The "*CONSTRUCTION SPEED XX*" sign has been ***deleted*** from the ODOT Sign Policy and may ***no longer*** be included in a Traffic Control Plan.
- Reducing the posted speed of a facility through a Temporary Speed Zone reduction ***DOES <u>NOT</u> constitute a reduction in the DESIGN SPEED*** for the TCP.

VALUE ENGINEERING PROPOSALS

At any point following award of the contract, the contractor may submit a Value Engineering (VE) proposal to modify the Traffic Control Plan. In the proposal, the contractor typically submits changes that attempt to accelerate construction or simply complete a portion of the project using a different technique or practice, or in a different order than that shown in the original TCP.

The VE proposal should meet the following criteria as a minimum:

- Provide a benefit to the public and ODOT, as the Owner of the facility
- Meet all current design and safety standards and practice

The proposal should also satisfy the following processes:

- The TCP Engineer of Record should be afforded the opportunity to review and comment on the Contractor's proposal. If the proposal has identifiable deficiencies, the Engineer of Record may ask to either have the deficiencies corrected or have the proposal rejected. In addition, the Engineer of Record should convey their comments and concerns to the State Traffic Control Plans Engineer.
- If applicable, temporary traffic control devices or materials not already on the ODOT Qualified Products List or Conditional Use list must be submitted to the ODOT QPL Manager, Mike Dunning and the State Traffic Control Plans Engineer for approval.

If the VE proposal is agreed to by all parties, the changes are made through a written Contract Change Order (CCO). The CCO must address three main components:

- <u>Dollar Authority</u> – Concurrence to spend the additional money or receive the amount of savings
- <u>Consistency</u> – Compliance with all relevant design, construction and safety standards and practices
- <u>Engineer of Record concurrence – as stated above</u>

WORK ZONE TRAFFIC ANALYSIS

All construction projects which impact traffic flow on State Highways require Work Zone Traffic Analysis (WZTA) to determine when the existing lanes will exceed their capacity due to construction. Work Zone Analysis is used to identify how many lanes are needed to support current volumes during specific times of day or night, days of the week, or months of the year, while taking into account the multiple factors in a work zone that can create traffic delays or congestion.

Travel Delay Estimates are also generated from Work Zone Traffic Analysis.

When it was discovered that over 400 bridges on the Oregon highway system needed to be repaired or replaced, ODOT worked closely with the Oregon Motor Carrier Transportation Division to restrict the delay that road users would experience during bridge construction.

ODOT's Statewide Mobility Program was created to manage corridor delay and has created delay thresholds for Oregon's major corridor segments. The thresholds are the maximum acceptable delay generated by all construction and maintenance projects on that segment.

When Travel Delay Estimates are generated by the Traffic Analyst, they need to be discussed with the project leader and to ODOT's Region Mobility Liaison whose job it is to coordinate regional travel delay estimates.

Region Traffic Analysts will complete the analysis and return a report stating the necessary number of lanes needed to accommodate the given traffic volumes through the work zone, as well as the times of day when these lanes are needed. The TCP Designer can then modify the Special Provisions subsection 00220.40(e) to reflect the analysis received from the Region Traffic Analyst.

The language in Section 00220.40(e) can be modified depending upon each project's set of circumstances. The TCP Designer should include the edited Lane Restrictions in the Special Provisions and ensure that the wording and intent described by the analyst meets the requirements set forth by the Specifications Unit.

If **all** of the following criteria are met, the only 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 Traffic Control Plans Designer determines there are no complicating factors and construction does not affect the normal flow of traffic.

The current language addressing Lane Restrictions can be found in Section 00220.40 of the Standard Specifications and the Special Provision "boilerplate" under subsection 0022.40(e). Both references can be found on the Specifications Unit website. Look for the link to "*Specifications*" from the *Traffic-Roadway Section* main page.

ODOT has modified the 00220.40(e) subsection for the *2008 Standard Specifications for Construction*. From the *Specifications* web page, see the link to the new 2008 Standard Specifications:

SPECIAL EVENTS

The TCP Designer and the Work Zone Traffic Analyst should work together to determine if there are local events which could seriously impact 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. In conversations with the Chamber of Commerce, learn what you can regarding 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 include additional Lane Restrictions for any relevant special events in the Special Provisions under Section 00220.40(e).

After award of the contract, Lane Restrictions can be modified if it is determined that the original restrictions were excessively conservative. This determination can be made through conversations with Region staff and by making field observations. The request to modify the 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

The following Section attempts to describe a number of commonly used Special Provisions – explaining their intended application and limitations. The particular specifications in this Section have presented challenges in the past and resulted in some inconsistent application. Therefore, we felt additional clarification might be helpful.
Despite the following discussion, it is strongly recommended that a TCP Designer become very familiar with all of the Standard Specifications, Special Provision "boilerplates", and the Unique Special Provisions from Sections 00220 and 00225, as well as other Sections cross-referenced within them.
Much more information and detail on Specifications is presented in Chapter 4.

20-MINUTE STOP OR HOLD

Many years ago, ODOT established a constraint placed on contractors to limit the amount of time traffic is stopped or held at any time within a construction work zone. And, in keeping with ODOT's commitment to mobility and minimizing delay to the traveling public, this bulleted item found in the Standard Specifications under Section 00220.02 should not be deleted through Special Provision language.

***IMPORTANT NOTES*:**

- It is not recommended to modify this Standard Specification language by reducing the 20-minute time limitation. Contractors often rely on the 20-minute time frame to optimize their productivity and complete the project as quickly as possible. Reducing this time frame can have a counter-productive effect on their work schedule.

  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 where a contractor is conducting 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 ODOT does not allow Flaggers to stop or hold traffic on Oregon freeways.
- In the ***2008 Standard Specifications for Construction***, the current 2002 language has been split into two separate bulleted items for clarity. The notes above apply to this new language as well.

In addition, Liquidated Damages (from Section 0022.40(f) of the Special Provisions) may not be applied to any stoppage extending beyond 20 minutes. Currently, under this situation, ODOT notifies the contractor that they are in Breech of Contract and that they must modify their work practices to relieve the excess delay or the contractor will be issued a "Suspend Work" order.

BICYCLES ON ROADWAY

ODOT requires the inclusion of the "Bicycles" symbol sign (#W11-1) and an "ON ROADWAY" rider (#OBW1-5) in the following project types where a *significant number* of bicycles can be expected:

- Urban or bridge projects where existing bicycle facilities (shoulders, Bike Lanes, sidewalks) are removed due to staging and are forced to share a live travel lane
- Rural preservation projects that, again, force cyclists to share a live travel lane
- On any designated "*Bicycle Route*" where the bicycle facility is closed or removed and bicycles must share a live travel lane

See the Unique Special Provision, "*00225 – Bicycles*" for additional information regarding the installation of the sign(s) and special applications based on project type and location.

Designers should also be aware that the Unique Special Provision, "*00220-00225 Emulsified Asphalt Surface Treatment*" modifies the "*Bicycles*" Unique specification.

BUSINESS ACCESSES

This practice is used to help identify and delineate business accesses disrupted by construction staging. Often times, driveway approaches for private businesses along a State highway are 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 a construction project, ODOT employs the use of additional signing and specialized channelization devices to clearly identify temporary business accesses.

A TCP Designer should be familiar with the current Unique Special Provision, "00220-00225 – Business Access".

Due to the specific purpose of the signing, this treatment should not be applied to private residences or public street accesses.

For optimum visibility, ODOT prefers the small "BUSINESS ACCESS" sign (#CG20-11) be mounted on a Single-Post Temporary Sign Support (ODOT Standard Drawing TM775). The TCP Designer may call for this specific installation by adding, "(Mount on Single-Post TSS)" under each sign shown on the plans; or, by adding the specific language in the Special Provisions. The sign may, however, be installed on a Type II barricade, as well. If not specified, the contractor will likely install the sign on the support of their choice.

INCENTIVE / DISINCENTIVE (I/D) CLAUSE

I/D Clauses can be added to a contract to encourage a contractor to accelerate the completion of a particular portion of a contract. The intention is to minimize traffic delays and inconvenience to the public by completing portions of the project that create a width or capacity restriction on traffic. Provided adequate funding is available and a specific task can be identified, Project Teams may choose to use I/D clauses when the following conditions exist:

- High traffic volumes – generally urban areas
- Work which completes a gap in the highway system
- Major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic (i.e. bridges)
- Major bridges out of service
- Projects requiring lengthy detours
- An existing element of the highway system with a significant crash history or other operational deficiency

When project teams decide that I/D clauses will be included in the contract, TCP Designers can assist in writing the special provision language and estimating the I/D dollar amounts. TCP Designers can help with the development of the I/D language by:

- Determining the Lane Restrictions in Section 00220.40(e)
- Assisting with estimating delay costs and impacts to traffic
- Assembling the construction staging plan and working with those responsible for developing the construction schedule

- Assisting with special provision language. The wording for the lane restrictions and staging clauses needs to clearly define when and where a Contractor may work.

When called upon to assist in determining I/D amounts, the TCP Designer may refer to the following documents:

1. *Traffic Control for Streets and Highway Construction and Maintenance Operations*, FHWA, 1978, available from National Transportation Library Reference Service, (*NTIS*).
2. Publication #PB81242554, "*Planning and Scheduling Work Zone Traffic Control*", Report #FHWA IP-81-6, FHWA, October 1981, FHWA – RD 81-049, available through the *NTIS*, Publication # PB80206006.
3. "*A Manual of User Benefit Analysis for Highways*", 2nd Edition. 2003, AASHTO, Washington, D.C.

I/D clauses should be discussed and agreed upon at the Project Team level, including such issues as whether sufficient funding is available to award an incentive to the contractor.

PRESERVATION PROJECTS

INTRODUCTION

Preservation projects make up the majority of the projects completed each year on the Oregon State Highway system. While the larger, more complex freeway modernization or bridge replacement projects tend to get all the limelight, the preservation projects demand a surprising amount of attention to detail regarding the temporary traffic control. Preservations projects have the potential of creating much more delay to the traveling public due to the nature of the work; the two-way, one-lane operations; and, their presence predominantly on the dozens of low-volume, rural highways.

PRESERVATION PROJECT TYPES

There are three primary types of preservation projects and each project has a specific list of criteria (instructional notes to the TCP Designer) as to when the boilerplate should be used:

- Hot Mix Asphalt Concrete (HMAC) Paving:

  (Use this Unique Specification on Level 1, 2, or 3 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***

- Emulsified Asphalt Surface Treatment (EAST) – aka, "Chip Seal":

  (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***

- Cold In-place Recycle (CIR) or Emulsified Asphalt Concrete (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"

For our purposes here, "boilerplates" are prepared documents that can be used much the same way you would use a form letter, or a "template". Boilerplates can be thought of as generic fill-in-the-blanks documents where the TCP Designer will insert additional project-specific information and delete language that is not relevant to their specific project.

Boilerplates typically include general statements, safety warnings, commonly used installation procedures, copyright statements, and responsibility disclaimers.

When beginning any new project, remember to download a ***new copy*** of the Special Provision "boilerplates" for both Sections 00220 and 00225 from the Specifications Unit web site. Boilerplates are updated frequently and the TCP Designer should always use the most recent edition available.

In addition, for Preservation projects, the Designer will need to download a new copy of the appropriate Unique Special Provision that matches the type of pavement preservation method being used on their project – e.g. Chip Seal, EAC, HMAC, etc.

NOTE: If several months pass between the time you first download the boilerplates and the completion of a project, consider downloading another new copy of the boilerplates and updating the Special Provisions for your project.

SIGNS AND STRIPING

Because preservation projects obliterate the existing striping, No Passing and Passing Zones need to be identified using "DO NOT PASS" and "PASS WITH CARE" signs. In addition, the "NO CENTER STRIPE" with "NEXT XX MILES" signs must be used to alert drivers and supplement temporary pavement markings.

From Section 00225.02 of the three Unique Special Provisions for preservation projects, the contractor is given instructions to install these signs to replace the missing centerline pavement markings.

While language in the preservation project specifications also describes minimal temporary pavement markings, these markings are not sufficient enough to rely on them exclusively to convey Passing and No Passing Zone limits.

Other project-specific requirements for striping, signing and traffic control are included in each of the Unique Special Provisions for the various preservation projects. Read through all of the Special Provisions and the Unique Special Provisions very carefully.

Complete all of the missing (blank) information, add any additional project-specific language, delete any irrelevant or unnecessary language and delete all of the instructions to the TCP Designer or Specification Writer shown in ***(parentheses and italicized font)***.

STEEL PLATING

On State Highways with a posted speed greater than 35 mph, the contractor is 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 are currently in the Section 00220 "boilerplate" Special Provision. This language has been incorporated into the 2008 Standard Specifications for Construction.

The language in this specification 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.

A separate Unique Special Provision, "*00220 – Pipe Excavation*", is available to address a number of 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 Provisions.

TRAFFIC CONTROL SUPERVISOR (TCS)

A certified employee of either the prime contractor or subcontractor, the Traffic Control Supervisor (TCS) is responsible for the administration, proper installation, maintenance, layout and overall quality of the Traffic Control Plan and all of the necessary temporary traffic control devices used on the project.

Below are examples of some of the duties of the TCS:

- 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 the Section 00225 Special Provision for additional information regarding the TCS. Traffic Control Supervisor language from the current 00225 Special Provisions has been updated and incorporated into the 2008 Standard Specifications.

WHEN IS A TCS USED?

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 temporary Traffic Control Devices, including significant signing changes – i.e. detours or alternate route signing
- Projects with complex construction staging or complicated temporary alignments for traffic
- Night paving operations – particularly on freeways
- High ADT highways (> 10,000)
- Freeway work
- High profile projects with substantial community or stakeholder involvement

TCS QUANTITIES

The current unit of measure for TCS is “24-hr days”. However, the new 2008 specification unit of measure will be per “shift”. Definitions and limitations are explained in the specifications. Please familiarize yourself with the 2008 Standard Specification language to prepare for the change in September, 2008.

The ***number*** of TCS-days to be included in the contract will depend on the complexity of the project. The TCP Designer should have regular discussions with the Construction Project Manager’s office to help determine an appropriate number of days for the TCS pay item. Adjusting your final estimate by a small percentage for contingencies would be appropriate. Statistically, TCS quantities have ranged from 40-100% of the number of construction days in the contract.

When calculating your quantities, keep in mind the following items that may affect the number of days you include in the contract:

- Scope of work
- Where work is taking place with respect to live traffic
- Facility type
- Site location and roadway geometry
- Permanent lane closures through the use of temporary concrete barrier
- Winter shut-down periods

- Seasonal weather conditions
- Overall physical length of the project

TCS PAYMENT

In the current 2002 specifications, the TCS can be identified in the contract as a separate pay item or paid for within the Temporary Protection & Direction of Traffic (TP&DT) lump sum pay item.

Traditionally, the TCS is included in the pay item schedule as a separate pay item. It is much easier for the Project Manager and the Contractor to track the number of days billed or available for the TCS over the life of the contract if the pay item is separate.

TCS paid for under the TP&DT lump sum item is typically reserved for projects with a small number of TCS days – approx. 50 days or less.

Typically, the TCS is paid for on a 24-hr/day basis, meaning one payment is made for a 24-hour period, regardless of the number of TCS used within that 24-hr timeframe. This is done to account for multiple shifts in one 24-hr period.

If including a TCS in the contract, include all of the relevant Special Provision language written for this pay item.

> If your intention is to pay for the TCS through the ***TP&DT Lump Sum*** pay item, be sure to include the appropriate current Special Provision language from Section 00225.

In either case, discuss with the Project Development Team, particularly the Construction Project Manager, quantities and which payment method is preferred for your project.

CHAPTER 4 – 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 FOR 2008

Highway construction specifications are a standard set of procedures used to execute and manage a legal binding contract. This includes describing scope of work, type of materials, equipment requirements, construction methods, and measurement and payment methods of work related items.

4.1.1 – GENERAL OVERVIEW

Standard specifications are applicable to all highway construction projects within the State. **The 2008 edition of the Oregon Standard Specifications for Construction have been included in most projects beginning with the October 23, 2008 bid opening. (PS&E due date of September 1, 2008 and later).**

The 2008 edition consists of two volumes; Volume 1 contains Part 00100, the General Conditions and Volume 2 contains Parts 00200 through 03000, the Technical Specifications.

Changes to the Specifications

Every five years or so the Specifications, or “Specs”, are updated and rewritten by teams of ODOT technical experts. The “2008 Oregon Standard Specifications for Construction” has just gone through a thorough rewrite and was implemented in the summer of 2008.

Structure & Components - Division Format

The Standard Specifications are divided up into 13 parts, according to function, such as Roadway, and Water Supply Systems. Each part is divided into Sections and Subsections. The Subsections are organized under up to 10 divisions. Usually not all Subsection divisions are used in each Section.

The Standard Specs for Temporary Traffic Control Plans are found in 00220.00 and 00225.00.

The section divisions are the same for the Standard Specs, Special Provisions, and Unique Specs as follows:

Description	**(.01 - .09)**	A statement of the work to be done.
Materials	**(.10 - .19)**	Cross references to the material specifications contained in Materials, Part 02000 and Part 03000.
Equipment	**(.20 - .29)**	the minimum equipment requirements to accomplish the work.
Labor	**(.30 - .39)**	any unique labor requirements or qualifications required for the project.
Construction	**(.40 - .49)**	the sequence of construction operations and the end product to be obtained.
Temporary	**(.50 - .59)**	any unique temporary measures to be done in order to accomplish the work. It is not meant to supplement work zone traffic control measures.
Maintenance	**(.60 - .69)**	any maintenance, repair or avoidance measures the contractor must follow.
Finishing and Cleaning Up	**(.70 - .79)**	any other related information the contractor must accomplish before the work is accepted.
Measurement	**(.80 - .89)**	the components of the completed work item that are to be measured for payment; the units of measurement, whether measured in original position, in transporting vehicles, or in the completed work.
Payment	**(.90 - .99)**	**T**he units for which payment will be made, identify the bid item for work will be paid for, and define very explicitly the scope of the work covered by the payment.

4.1.2 – 00220.0 SPECS TCP DESIGNERS SHOULD KNOW:

Section 00220

00220.02

Allow emergency vehicles immediate passage at all times. The work zone must allow for the passage of emergency vehicles at all times.

Do not close lanes. Do not impede the flow of traffic or close any lanes of traffic except as listed in 00220.40(e).

20-Minute Stop or Hold. Do not stop or hold vehicles . . . for more than 20 minutes. This spec is still valid, even in light of the new mobility regulations. See section 00220.40 (e) for more information on traffic delay.

Do not block driveways for more than two hours unless otherwise authorized in writing. This spec is new.

Steel Plating. Do not use temporary steel plating within the roadway or shoulder having a pre-construction posted speed zone greater than 35 mph.

00220.03 - New Notifications

Over-Dimensional Vehicle Restrictions & Motor Carrier Transportation Division

MCTD must be notified at least 28 calendar days before the project restricts the width, length, height, or weight of vehicles. Any changes in the roadway width or height must be reported.

Closures – Submit to the engineer, in writing, for approval, all proposed closure schedules:

Lanes – A minimum of 7 calendar days before the lane closure begins

Roads – A minimum of 14 calendar days before closures. Also notify in writing all affected emergency services, school districts and US Postal Service, a minimum of 14 days before any closure.

Bicycle and Pedestrian Facilities – a minimum of 14 calendar days before a bike lane, sidewalk and multi-use path closure. After receiving written approval, provide 48 hour public notification before the closure.

4.1.3 – 00225.0 SPECS TCP DESIGNERS SHOULD KNOW:

Section 00225

00225.02 – General Requirements

Standard Signing – Contains placement, location and size requirements for these signs:

TRUCKS with a 500 FEET rider

TRUCKS LEAVING HIGHWAY 1500 FT.

ROAD WORK AHEAD

GROOVED PAVEMENT & BUMP signs used when cold planed pavement surface is used by traffic.

Contractor Activities

Contractor Access –

Do not allow construction vehicles to accelerate or decelerate in a travel lane open to traffic on a freeway or multi-lane facility.

Do not use a flagger to allow construction vehicles to access an open traffic lane on a freeway or a multilane facility.

Abrupt Edges – When paving operations create an abrupt edge, protect traffic by installing signing according the "2-Lane, 2-Way Roadway Overlay Area" detail shown on the standard drawings.

Extended Traffic Queues for Advanced Flagging Operations – During flagging operations, monitor the length of traffic queues and when extended traffic queues develop, protect traffic by providing advance flagger(s) . . . as shown on the standard drawings detail.

00225.02 – 00225.17 – Traffic Control Materials

Evaluate all TCD to be used; only use new or acceptable TCD from the QPL. After installation inspect and maintain TCD during project.

The following specifications for temporary sign materials, posts, and supports, are in this section.

Folding or Turning signs

Roll-up signs

Sign posts and support requirements are listed in this section.

Wood Sign Posts,

Portable Sign Supports

Concrete Barrier Sign Support

Temporary Sign Supports

Square Tube Sign Support

00225.28 to 00225.32 - Traffic Control Supervisor (TCS)

Outlines the needed TCS equipment

Lists the duties of a TCS and specifies how and when a TCS is to report to the job site during non-working on-call hours.

00225.88 and 00225.98 TCS New measurement and payment

Designates the TCS bid item as "each shift" and outlines the TCS shift parameters.

00225.41 (f) Inconsistent Temporary Signs

Emphasis on consistency - All temporary signs will be properly used [see 00225.41 (a) - (e)] and will be consistent with work zone activity.

When signs and/or sign boards are no longer needed ***remove, cover or turn them,*** remove or cover sign flag boards, and turn off amber flashers.

For example; unless active flagging is being done, remove, cover or turn all flagger signs.

00225.47 (b) – Flagger Station Lighting

States that the flagger station lighting will be continuous for nighttime flagging, describes the location and angle of the light equipment and lists the wattage parameters.

00225.87 (b) Flagger Station Lighting Pay Item

Specifies that this item will either be listed by the “unit” (per each) basis or by the number of hours of use.

4.2 – SPECIAL PROVISIONS

ALL PROJECTS REQUIRE SPECIAL PROVISIONS.

Special Provisions - commonly called “the Boilerplate”, are revisions to the standard specifications that modify, add to and/or replace them. The Boilerplate contains special instructions, provisions, and requirements specific to an individual project.

The TCP Designer includes all of the Special Provision in Sections 00220 and 00225 and uses “Track Changes” to strike through those that do not directly apply to their project. The document appears in “Track Change” format only for internal reviewers, such as spec. writers at Advance Plans, and PS&E. The final hard copy version appears in “normal text” format with the edits “Accepted”.

Note: Always download a new version of the Boilerplate when starting a project. Special Provisions are updated and changed often. It is also a good idea to download a new version of the Boilerplate if your project is lengthy and you began working on the Special Provisions several months previously.

Special Provisions can be found on the ODOT web site, in the Highway Section, Engineering Services pages.

4.2.1 – 00220 BOILERPLATE

Special Provisions TCP Designers should know:

00220.40(e) Lane Restrictions & Work Zone Traffic Analysis

During construction there will be a need to close traffic lanes so that roadway work may be done. The results of Work Zone Traffic Analysis tells the contractors when traffic is light enough to safely close lanes, while maintaining stable and efficient traffic operations. This analysis is critical because lane closure restrictions can preserve highway safety, alleviate expensive staging and reduce lengthy travel delays.

There is further discussion on Work Zone Traffic Analysis in Chapter 5.

0020.40(f) Bridge Work

This section gives instructions on Bridge Work including:

- Instructions that bridge work should begin after all equipment, labor and materials are on hand so that the work may be completed efficiently and quickly.
- Information on road closures for bridge work includes:
  - **signing** for bridge work road closures,
  - 20 minute "**stop and hold**" guidelines, and
  - the **Rolling Slowdown** Method.

4.2.2 – 00225 BOILERPLATE

Special Provisions TCP Designers should know:

00225.02 General Requirements –

- Project Signing - How and where to place "ROAD WORK AHEAD", "FINES DOUBLE" and "END ROAD WORK" SIGNS
- Horizontal and vertical clearance sign placement
- A new PROJECT IDENTIFICATION sign, CG208-48, has been developed and is approved for use on ALL ODOT projects.

00225.11 Signs are to meet the "Acceptable" category shown in the American Traffic Safety Service Association (ATSSA) "Quality Standards for Work Zone Traffic Control Devices".

00225.17 Flagger Station Lighting – these specs were developed based on a recent OSU study. At the time of this writing flagger station lightning equipment is being researched to augment those on the QPL.

4.3 – UNIQUE SPECIAL PROVISIONS

Unique Specifications modify the Standard Specifications and/or Special Provisions, are narrow in scope and are used on projects on an "as needed" basis. Therefore, not all projects will include Unique Specs.

Must Unique Specs add text; however, Unique Specs can replace Standard Specs and/or Special Provisions. Look through the Unique Specs to become familiar with the areas to which they apply and how they are used.

4.4 – HIERARCHY OF DOCUMENTS

There are various documents that go into a TCP and there may be contradictory information among them. The Oregon Standard Specifications for Construction lists a hierarchy for the documents – "Order of Precedence" in section 00150.10 (a).

4.5 – STANDARD DRAWINGS

General Information is given on how to set up work zones in the TM7400 series of ODOT's Standard Drawings.

These drawings show general information:

- They are not intended to substitute for complex, multi-stage TCP.
- These drawings are complete as shown and are not to be cut, pasted or edited.
- When choosing Standard Drawings you will select those drawings which match the scope of the work for your project.

Note – the Standard Drawings that are chosen for your project need to line up with the Special Provisions and Unique Provisions that are written for the project. All of these also need to line up with the Cost Estimate, which will be discussed later.

The Standard Drawings can be found on the ODOT web site, in the Highway Section, Engineering Services pages. The TCP Standard Drawings are found among the Traffic Drawings:

TM700 - Tables, Abrupt Edge, and PCMS Details

- These important tables will be referred to often on other drawings – they include:
  - The Barrier Flare Rate,
  - Taper & Buffer Lengths,
  - And the Spacing Table For Traffic Control Devices.
- The Drawing also shows
  - The Abrupt Edge Detail,
  - Portable Changeable Message Sign (PCMS) Installation Detail,
  - The Typical Excavation Abrupt Edge Signing Detail and
  - General Notes For All TCP Drawings:

TM705 - Intersection Work Zone Details show closure diagrams for

- 2-Lane, 2-Way streets for One Lane Closures and Shoulder Closures,
- 4-Lane, 2-Way streets for Right Side, Near Side, Far Side Closures and Left Lane Closure, Far Side and
- 2-Lane, 1-way streets for Right Lane Closure.

TM710 - 2 Lane, 2 Way Roadways has diagrams for:

- Loose Gravel in Roadway,
- Overlay Areas,

- Extended Traffic Queues for Advance Flagging,
- One Lane Closures.

TM715 - Non-Freeway Multi-lane Sections shows work zones set ups for

- 4-Lane, 2-Way Roadway Interior Lane Closures, Exterior Lane Closures and Shoulder Closures.
- 4-Lane, 1-Way Non-Freeway Closures for Two Lanes

TM717 - Non-Freeway Multi-lane Sections shows work zones for

- 3-Lane, 2-Way Roadway with a One Lane Closure using a Crossover.
- 4-Lane, 2-Way Roadway with a Left Turn Median. It shows how to set up closures for Two Lanes and a closure for the Median.

TM720 - Freeway Sections shows work zone set ups for

- Divided Freeway with One Lane Closed and with a Shoulder Closure
- Shows how to stage and close sections for On-Ramp and Off-Ramp work

TM725 - Freeway Sections, includes how to set up a Divided Freeway for Overlay Work with a One Lane Closure including the signing detail.

TM730 - Freeway Section drawing shows how to set up work zones for a Divided Freeway for a Two Lane Closure, including a signing detail.

TM735 - Bridge Construction drawing shows 2-Lane, 2-Way Bridge with a One-Lane Closure using Signals and shows another closure using Flaggers.

TM740 - Blasting Zones

- shows a TCP design for a Blasting Zone near a 2-Lane, 2-Way roadway and
- a Blasting Zone near a 4-Lane, 2-Way non-freeway roadway.

TM745 - Temporary Concrete Barrier Details shows concrete barrier restraining and pinning details

TM747 - Temporary Reflective Pavement Markers - has layouts for

- temporary reflective pavement markers supplement
- 4” wide stripes double solid lines; one detail with 4” spacing and one detail with 12” spacing

- 4” wide stripe solid line
- 10” x 4” stripes skip lines
- temporary reflective pavement markers simulate
- skip lines and solid lines

TM750 - Traffic Control Plans - Temporary Barricades shows

- Barricade rail layout and placement and
- Slope diagram for barricade markings.

TM755 - Temporary Impact Attenuators indicates typical installation and zero offset installation for single concrete barrier run at various roadway speeds.

TM760 - Temporary Impact Attenuators shows typical installation for a double concrete barrier run at various roadway speeds.

TM770 - Signalized Intersection Details has diagrams for 2-Lane, 2-Way Roadway with Left Turn Median

- Left Turn Median Closure
- Right Lane Closure, Near Side
- Right Lane Closure, Far Side

TM770 - Multi-lane Intersection Details shows closure details for 4-Lane, 2-Way Roadways with Left Turn Medians

- Right Lane Closure
- Left Turn Median Closure
- Left Turn Median and Left Lane Closure
- Left Turn Median and Left Lane Closure Far Side.

TM775 – Temporary Sign Supports shows sign support details for:

- Double Post Sign Supports
- Single Post Sign Supports
- Concrete Barrier Sign Support

TM780 Closure Details for typical:

- Road closure with Detour

- Partial Street Closure
- Full Street Closure
- Sidewalk Closure
- Trailer Blazer Assembly

4.6 – STANDARD DETAILS

Standard Details are similar to Unique Specifications; they are intended to give additional information for a narrow, specific subject. Currently there are two Standard Details for Temporary Traffic Control.

- DET4700 – Automated Flagger Assistance Device (AFAD) Red/Yellow Lens AFAD.
- DET4710 – Transverse Rumble Strips
- DET4720 – Diversions and Crossovers
- DET 4730 – Removal of Existing Rumble Strips

CHAPTER 5 – TRAFFIC CONTROL PLANS DESIGN

Chapter 5

5.0 – KEY POINTS OF THIS CHAPTER

- Traffic Control Plans Function
- Plan Sheet Order
- Typical Sections
- Plan Sheet Development
- Freeway Bridge Overlay
- Traffic Control Measures
- Typical Applications
- Barrier Warrants
- Temporary Signs & GuidSIGN
- Drafting Standards

5.1 – TRAFFIC CONTROL PLANS FUNCTION

TCP is a written and drawn plan for handling traffic on a specific roadway through a work zone. The primary function of a TCP is to provide for the reasonably safe and expeditious movement of traffic through a work zone while protecting on-site workers, responders to incidents, and equipment. 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.

The TCP four primary functions are:

1) Efficient Traffic Flow
2) Enhanced Safety
3) Minimize Inconvenience
4) Maintain Mobility

5.2 – PLAN SHEET ORDER

Plan sheets are prepared for a specific project based on the complexity of the project. When the scope of the project is limited then it may be possible to suspend the development of plan sheets by utilizing standard drawings and specifications.

For more complex projects plan sheets are necessary to develop a comprehensive staging plan. The staging plan will clearly depict a construction sequence for the project and will illustrate what portion of the roadway is dedicated to traffic.

Plans are incorporated into a set by an established order. The TCP sheets should follow the Roadway plans.

The TCP sheet order is as follows:

- ✓ Details – Specific information about items the contractor will need to provide for the project.
- ✓ Detours – A reroute of traffic around any portion of the construction. Closures may need additional time constraints
- ✓ Plans – Staged construction showing the roadway alignments. Dedicating portions of the roadway to traffic and construction. Shows the location and type of TCD required to sustain the safe flow of traffic through the work zone.

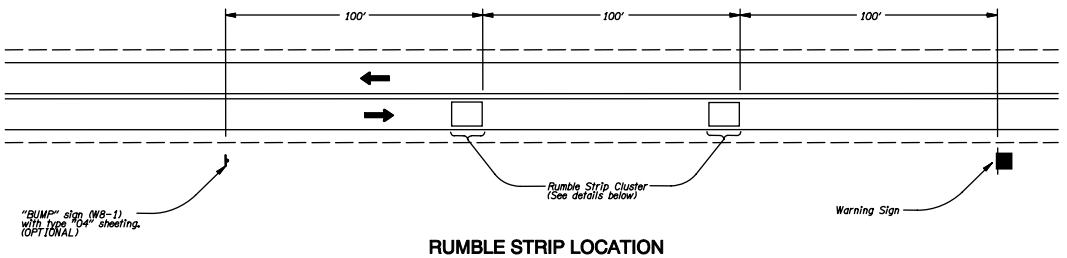
The TCP should be started early in the planning process especially when a significant project is planned. Considerations will be given for various staging proposals throughout the design process. The design principles for permanent roadways should be used to develop the TCP.

Typical factors that influence the TCP are as follows:

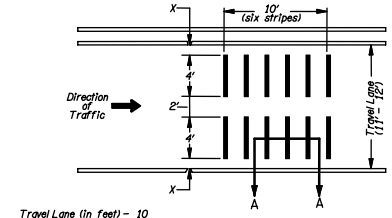
- ✓ Traffic – Volumes, Capacity, Speed, % Trucks
- ✓ Roadway – Alignment, Width, Number of Lanes, Intersections
- ✓ Appurtenances - Signage, Signals, Barriers, TCD
- ✓ Construction – Materials, Excavation, Duration, Separation, Access

A stage will entail the construction required to complete the work on one side of the centerline, and the second stage will complete the work on the opposite side. Succeeding stages may be developed as needed for additional alignments. A phase is a smaller, but distinct portion of an individual stage. During phase construction the mainline alignments do not change to accommodate the work.

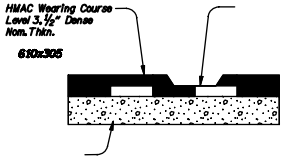
D E T A I L S



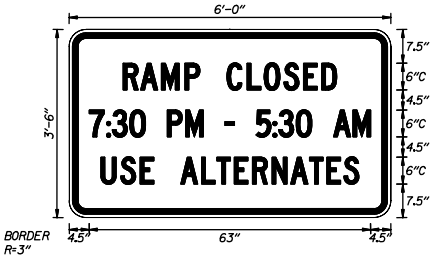
RUMBLE STRIP LOCATION



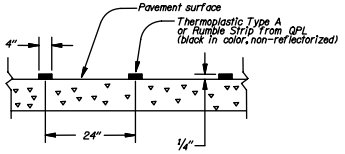
RUMBLE STRIP CLUSTER



TEMPORARY SURFACING



TEMPORARY SIGN



SECTION A-A

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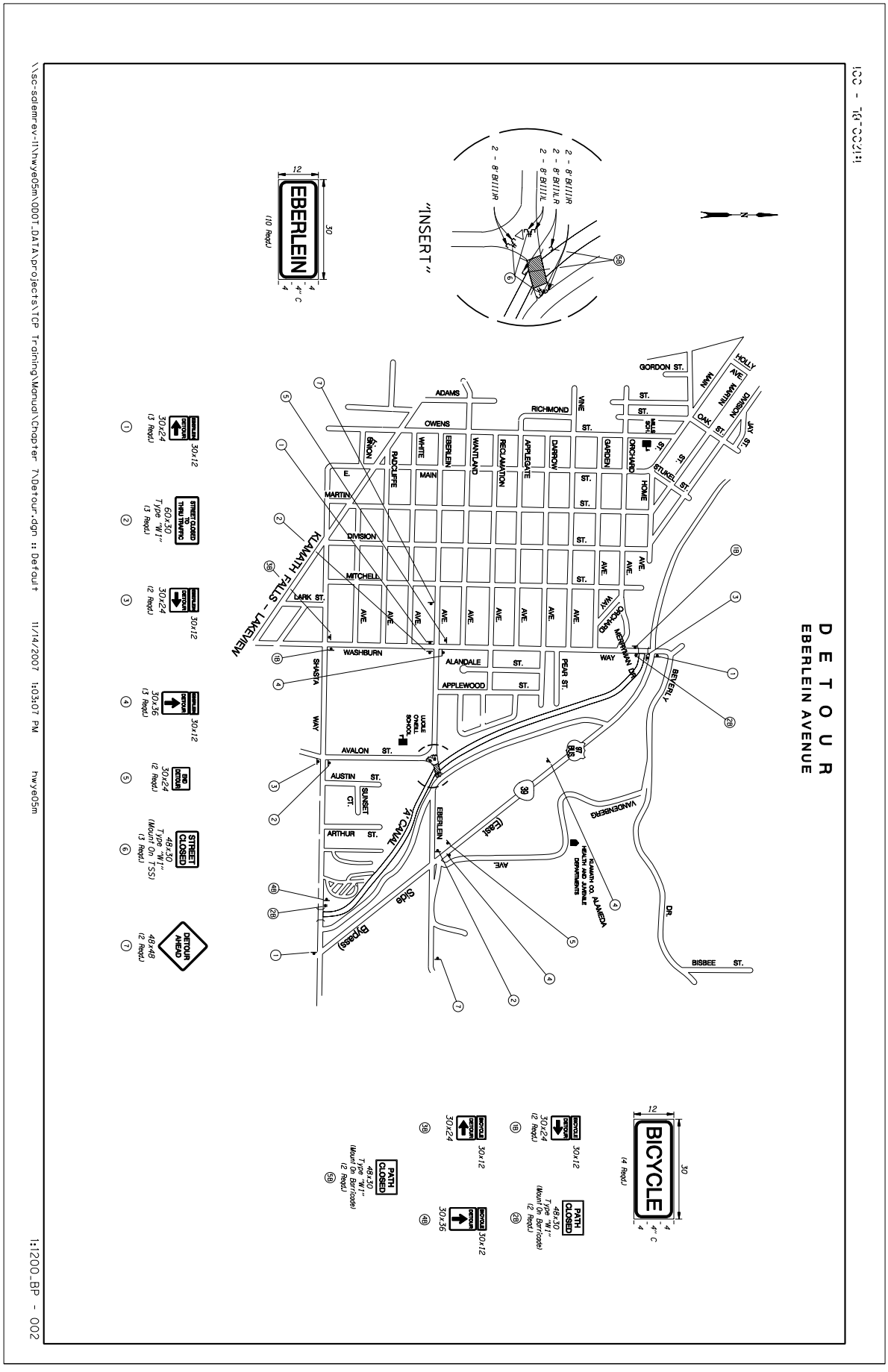
D E T O U R
EBERLEIN AVENUE
"INSERT"
EBERLEIN
BICYCLE
(4 Req'd.)
(10 Req'd.)
2 - 8' B/I1/R
2 - 8' B/I1/R
2 - 8' B/I1/L
GORDON ST.
ADAMS
OWENS
RICHMOND
VINE
MAIN
ORCHARD
HOME
GARDEN
DARROW
APPLEGATE
RECLAMATION
WANTLAND
EBERLEIN
WHITE
MAIN
RADCLIFFE
E. MARTIN
DIVISION
MITCHELL
LARK ST.
KLAMATH FALLS - LAKEVIEW
WASHBURN
SHASTA WAY
ALANDALE ST.
APPLEWOOD ST.
PEAR ST.
MERRIMAN DR
BEVERLY
AVALON ST.
AUSTIN ST.
SUNSET CT.
ARTHUR ST.
A CANAL
Bypass
EBERLEIN
East
AVE.
VANDENBERG
DR.
BISBEE ST.
LUCILE O'NEILL SCHOOL
KLAMATH CO. HEALTH AND JUVENILE DEPARTMENTS
ALAMEDA
PATH CLOSED
48x30
Type "W1"
(Mount On Barricade)
(2 Req'd.)
30x24
(2 Req'd.)
30x36
(3 Req'd.)
30x12
STREET CLOSED
48x30
Type "W1"
(Mount On TSS)
(3 Req'd.)
DETOUR AHEAD
48x48
(2 Req'd.)
STREET CLOSED THRU TRAFFIC
60x30
Type "W1"
(3 Req'd.)
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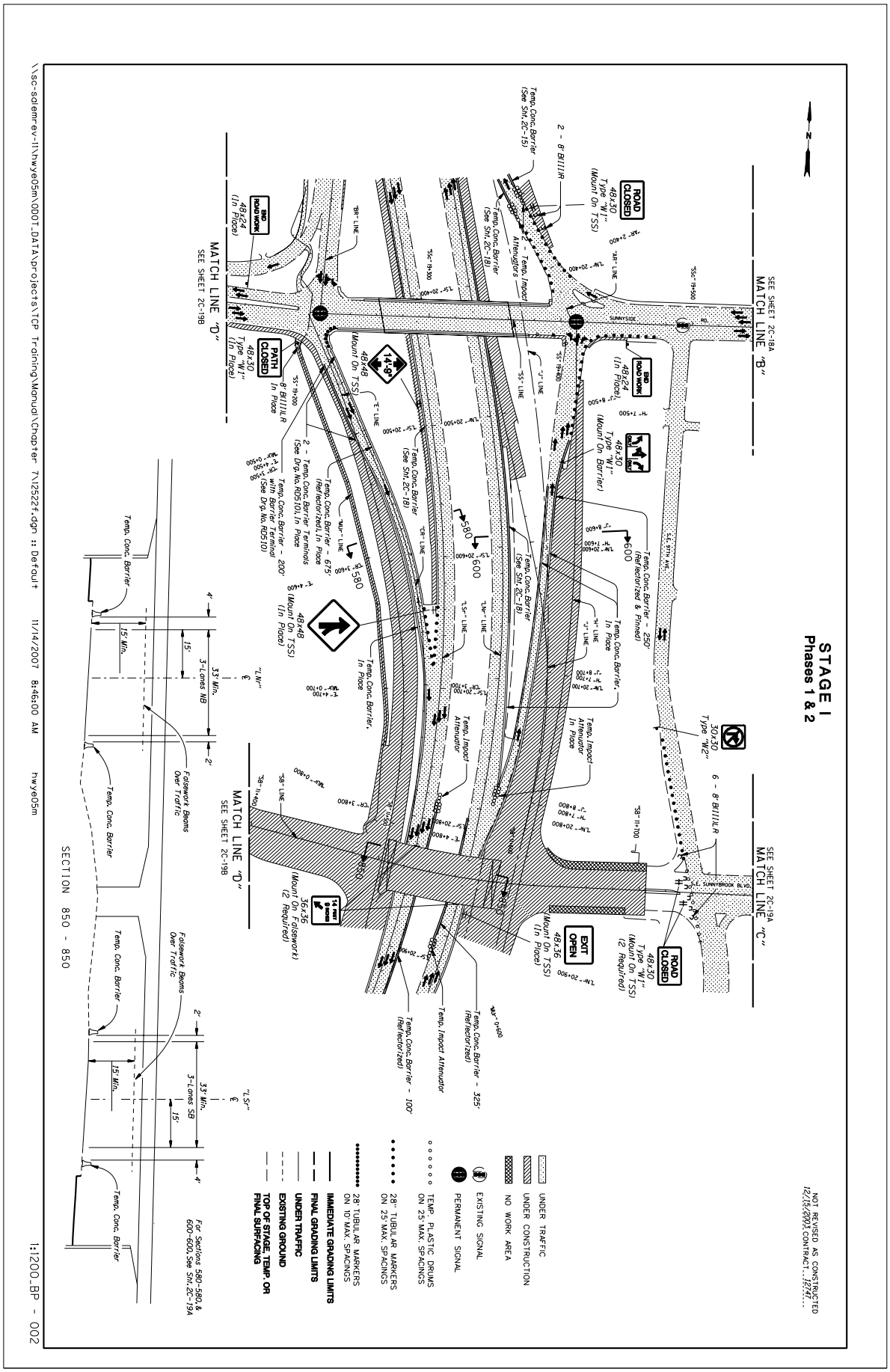
STAGE I
Phase 1 & 2
SEE SHEET 2C-18A
MATCH LINE "B"
SEE SHEET 2C-19A
MATCH LINE "C"
MATCH LINE "D"
SEE SHEET 2C-19B
SUNNYSIDE RD.
E. SUNNYBROOK BLVD.
ROAD CLOSED
48"x30" Type "W1" (Mount On TSS)
END ROAD WORK
48"x24" (In Place)
PATH CLOSED
48"x30" Type "W1" (In Place)
48"x48" (Mount On TSS)
30"x30" Type "W2"
EXIT OPEN
48"x36" (Mount On TSS)
36"x36" (Mount On Falsework) (2 Required)
2 - 8' BILLIAR
6 - 8' BILLIAR
Temp. Conc. Barrier (See Sht. 2C-15)
Temp. Impact Attenuators
Temp. Conc. Barrier (See Sht. 2C-18)
Temp. Conc. Barrier - 250' (Reflectorized & Pinned)
Temp. Conc. Barrier, In Place
Temp. Impact Attenuator In Place
Temp. Conc. Barrier - 325' (Reflectorized)
Temp. Impact Attenuator
Temp. Conc. Barrier - 100' (Reflectorized)
2 - Temp. Conc. Barrier Terminals (Reflectorized), In Place
Temp. Conc. Barrier - 675'
Temp. Conc. Barrier - 200' with Barrier Terminal (See Drg. No. RD510)
8' BILLIAR In Place
Falsework Beams Over Traffic
Temp. Conc. Barrier
33' Min.
3-Lanes NB
3-Lanes SB
15' Min.
15'
4'
2'
SECTION 850 - 850
For Sections 580-580, & 600-600, See Sht. 2C-19A
UNDER TRAFFIC
UNDER CONSTRUCTION
NO WORK AREA
EXISTING SIGNAL
PERMANENT SIGNAL
TEMP. PLASTIC DRUMS ON 25' MAX. SPACINGS
28" TUBULAR MARKERS ON 25' MAX. SPACINGS
28 TUBULAR MARKERS ON 10' MAX. SPACINGS
IMMEDIATE GRADING LIMITS
FINAL GRADING LIMITS
UNDER TRAFFIC
EXISTING GROUND
TOP OF STAGE, TEMP. OR FINAL SURFACING
NOT REVISED AS CONSTRUCTED
12/15/2003 CONTRACT...12747...
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5.3 – TYPICAL SECTIONS

Typical Sections – Typical sections are developed and included within the roadway portion of the plan set. The typical sections are a graphical representation of the work within the project limits by station parameters. This provides a detailed illustration of the construction components that are to be incorporated into the project.

The typical sections will include the following:

- Centerline and Median
- Travel Way and Shoulder
- Cut or Fill Slope
- Base and Wearing Course
- Subbase and Subgrade
- Permanent Appurtenances

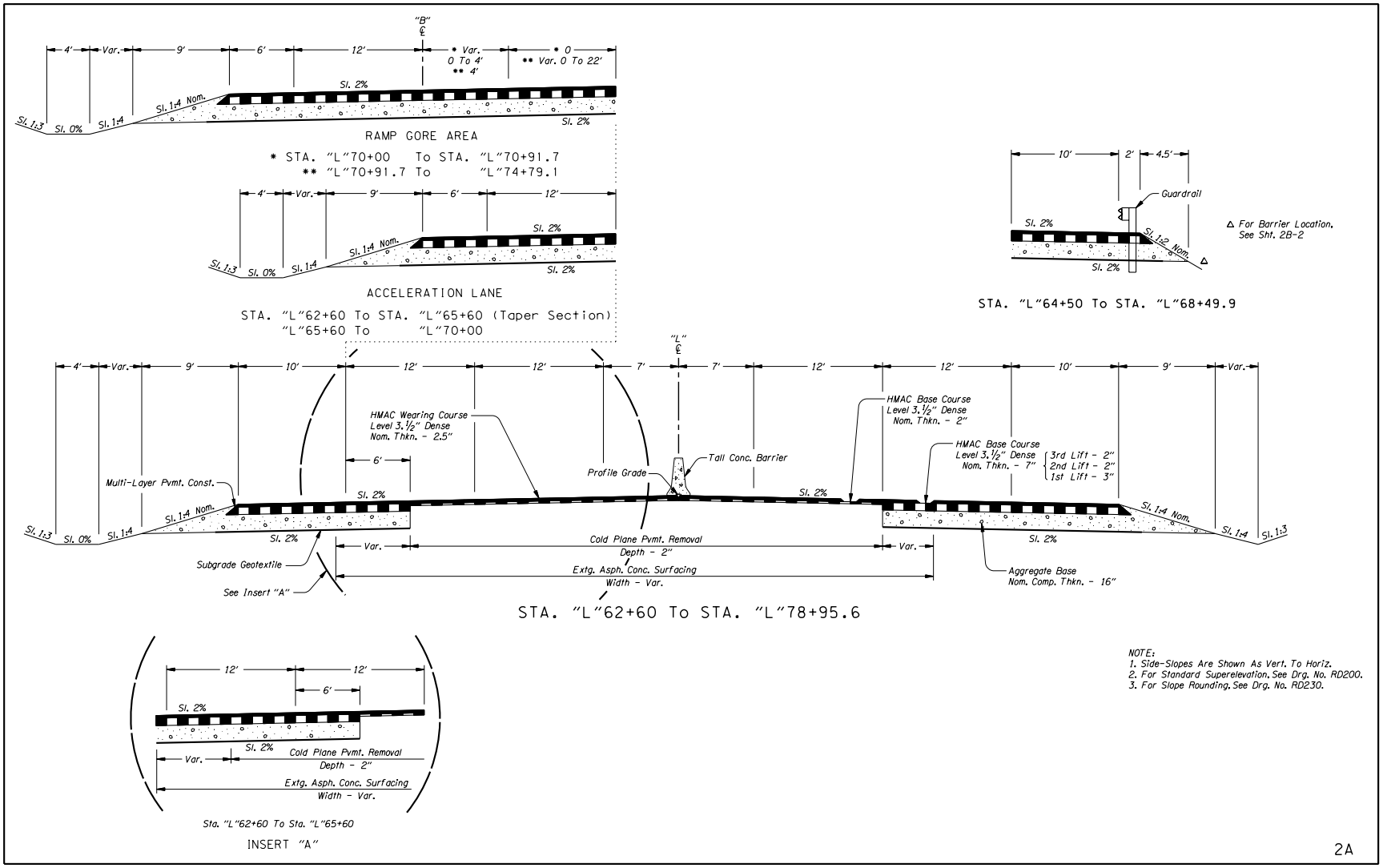
The required TCP for the project is dependant upon the degree of complexity illustrated on the typical sections. The greater number of typical sections shown in the plans is an indication of how complex a project may become for traffic control. Different typical sections are necessary to show the various roadways and ramp alignments.

TCP complexity is also a derivative of the roadway surface design for the project. The typical sections show each pavement course and define the type of material. The required TCD will vary depending upon extent of the construction and the impacts upon traffic.

Different surface types require varying durations for placement and curing of the paving materials. Placing Portland Cement Concrete will usually require considerable more staging effort than paving with asphalt concrete. The typical section will depict the surfacing depth from subgrade to wearing course.

Permanent appurtenances will be shown on the typical section. When permanent concrete barrier is shown the use of temporary concrete barrier may be used to separate opposing directions of travel. Use of barrier is a primary consideration for freeway applications and is common to protect traffic from excavation areas and to provide a positive separation of the work area from traffic.

The timing of when to install the permanent appurtenances becomes intrinsic to the staging plan. The type and amount of TCD required can be dependant upon when the permanent devices are installed. Permanent traffic devices are usually installed at the final location shown on the typical, but they can be installed in a temporary location and then moved into the final position.


"B"
℄
4′ Var. 9′ 6′ 12′ * Var. 0 To 4′ ** 4′ * 0 ** Var. 0 To 22′
Sl. 2%
Sl. 1:4 Nom.
Sl. 1:3 Sl. 0% Sl. 1:4
Sl. 2%
RAMP GORE AREA
* STA. "L"70+00 To STA. "L"70+91.7
** "L"70+91.7 To "L"74+79.1
4′ Var. 9′ 6′ 12′
Sl. 2%
Sl. 1:4 Nom.
Sl. 1:3 Sl. 0% Sl. 1:4
Sl. 2%
ACCELERATION LANE
STA. "L"62+60 To STA. "L"65+60 (Taper Section)
"L"65+60 To "L"70+00
10′ 2′ 4.5′
Guardrail
Sl. 2%
Sl. 1:2 Nom.
Sl. 2%
△ For Barrier Location, See Sht. 2B-2
STA. "L"64+50 To STA. "L"68+49.9
"L"
℄
4′ Var. 9′ 10′ 12′ 12′ 7′ 7′ 12′ 12′ 10′ 9′ Var.
HMAC Wearing Course Level 3.½" Dense Nom. Thkn. - 2.5"
6′
Multi-Layer Pvmt. Const.
Profile Grade
Tall Conc. Barrier
HMAC Base Course Level 3.½" Dense Nom. Thkn. - 7"
3rd Lift - 2"
2nd Lift - 2"
1st Lift - 3"
HMAC Base Course Level 3.½" Dense Nom. Thkn. - 2"
Sl. 2%
Sl. 1:4 Nom.
Sl. 1:3 Sl. 0% Sl. 1:4
Sl. 2%
Sl. 2%
Sl. 1:4 Nom.
Sl. 1:4 Sl. 1:3
Sl. 2%
Var.
Cold Plane Pvmt. Removal Depth - 2"
Var.
Subgrade Geotextile
Extg. Asph. Conc. Surfacing Width - Var.
See Insert "A"
Aggregate Base Nom. Comp. Thkn. - 16"
STA. "L"62+60 To STA. "L"78+95.6
12′ 12′
6′
Sl. 2%
Sl. 2%
Var.
Cold Plane Pvmt. Removal Depth - 2"
Extg. Asph. Conc. Surfacing Width - Var.
Sta. "L"62+60 To Sta. "L"65+60
INSERT "A"
NOTE:
1. Side-Slopes Are Shown As Vert. To Horiz.
2. For Standard Superelevation, See Drg. No. RD200.
3. For Slope Rounding, See Drg. No. RD230.
2A
\\sc-salemrev-11\hwye05m\ODOT_DATA\projects\TCP Training\14291typical.dgn :: Default 11/15/2007 10:41:42 AM hwye05m
1:1200_BP - 010

5.4 – PLAN SHEET DEVELOPMENT

Base Sheets – Preparation of TCP base sheets will provide the basic premise for the number of stages and phases included in the project. The TCP base map uses the existing roadway plan sheets. The typical TCP plan scale is 1”=200’, which is one half the scale of the roadway plan at 1”=100’. The following features are represented:

- Alignments & Center Line
- Existing Edge of Pavement
- Stationing & Labeling
- Existing Appurtenances

Cross Sections – The development of cross sections are a representation of the typical sections associated to a particular stage at a given station. Cross sections are an integral component of the plans. Once it is determined where a representative section is taken that particular section should be shown for every stage throughout the plans. This determines how the entire roadway will be constructed by showing each stage at that location. A unique line style is shown for each surfacing component as follows:

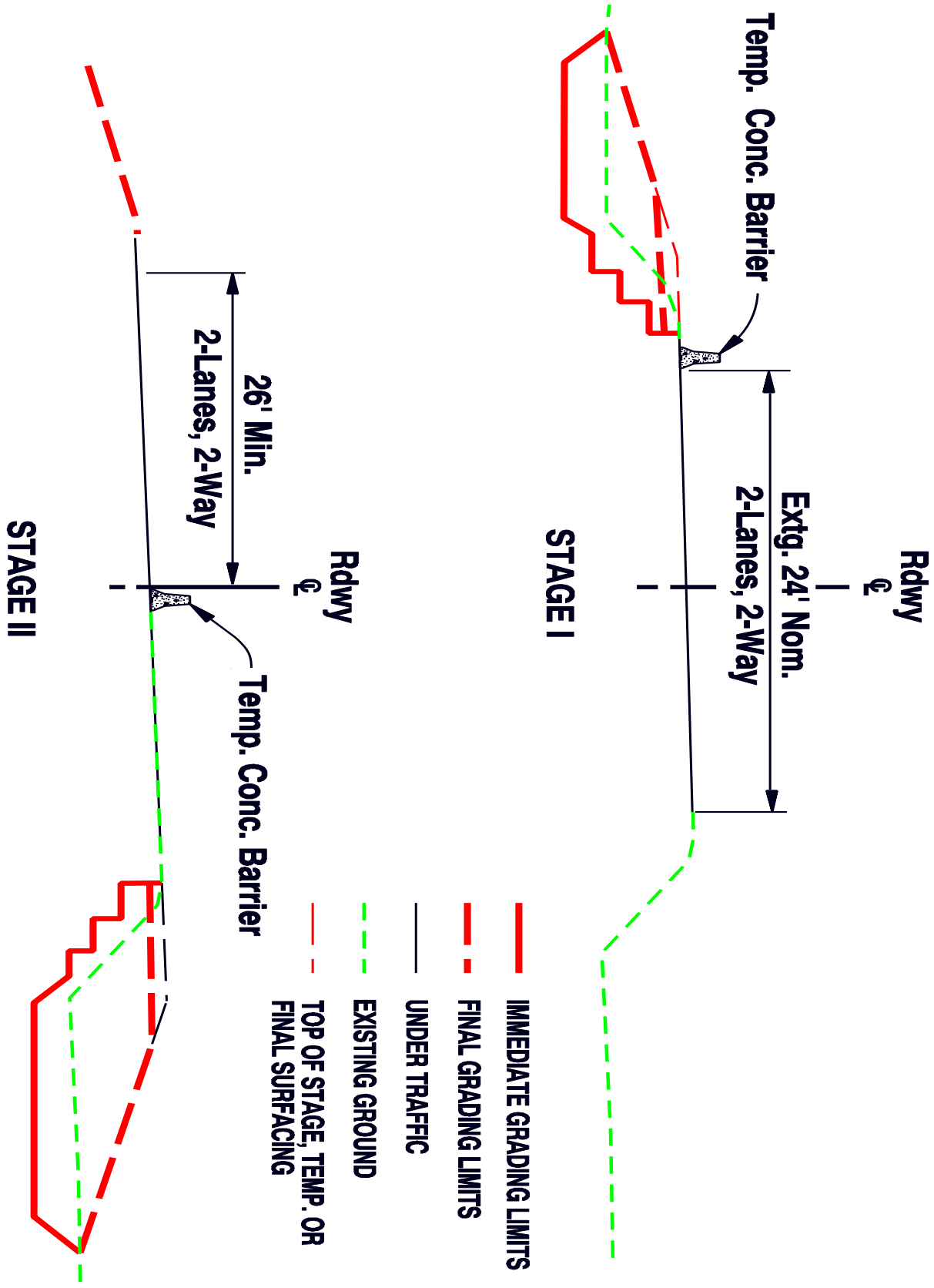
- Immediate Grading Limits
- Final Grading Limits
- Under Traffic
- Existing Ground
- Top of Stage (Temporary or Final Surfacing)

Dimensions will show the width available for traffic. Also, the TCD separating the work area from the under traffic area will be shown. The available width for the area under traffic is determined by evaluating the scope of construction, TCD, and staging requirements during each stage.

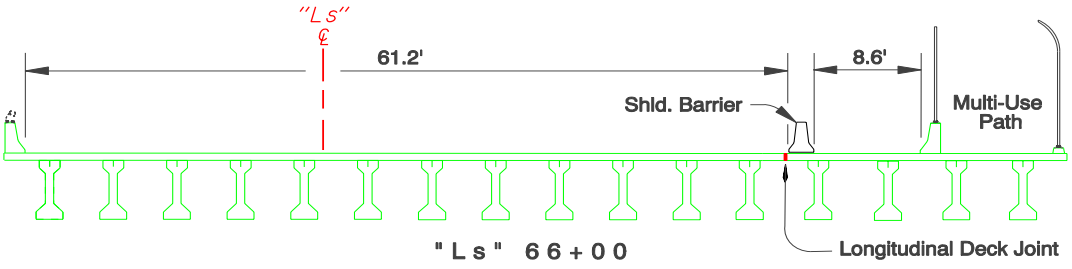
The cross section should be scaled at 4 to 5 times the size of the plan scale. The cross section scale would be 1”=50’ or 1”=40’. The section can be placed on the plan sheet where it is located, or on the separate sheet. For clarity a separate sheet may be preferred when multiple sections are shown.

Through comprehensive evaluation it can be determined if the lane width achieves the desirables. When the available lane width is less than desirable construction alternatives are considered. It may become necessary to construct temporary surfacing, limit duration of work, utilize different TCD, manipulate staging, or develop a comprehensive mitigation strategy.

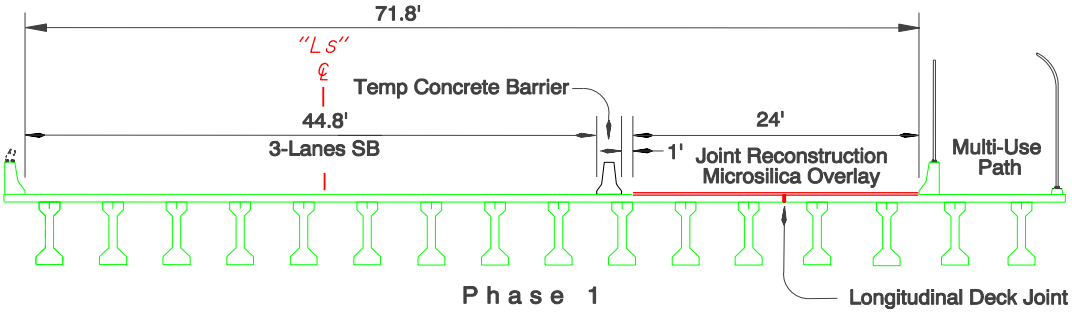
Plan Sheets – Utilizing the preceding data the TCP designer incorporates into the TCP design the desired staging and phasing. The designer defines the work area by placing the stippling and hatching. Then designer finishes developing the plan by including the required TCD for each stage and phase.


Temp. Conc. Barrier
Extg. 24' Nom.
2-Lanes, 2-Way
Rdwy
℄
STAGE I
26' Min.
2-Lanes, 2-Way
Rdwy
℄
Temp. Conc. Barrier
STAGE II
IMMEDIATE GRADING LIMITS
FINAL GRADING LIMITS
UNDER TRAFFIC
EXISTING GROUND
TOP OF STAGE, TEMP. OR
FINAL SURFACING

5.5 – 6-LANE, 2-WAY FREEWAY BRIDGE OVERLAY

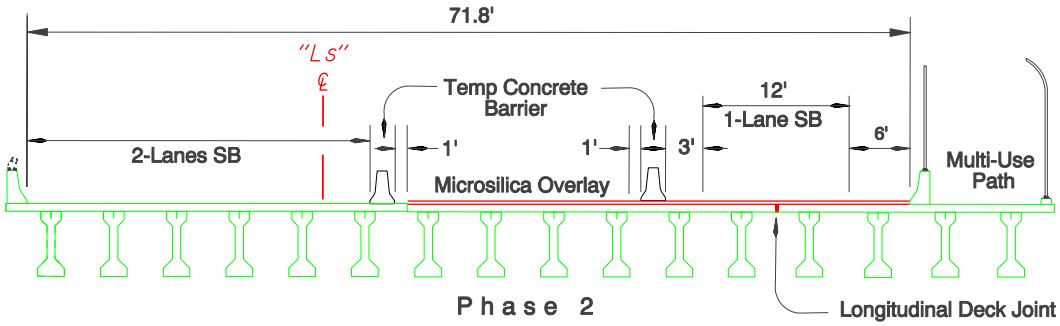


Freeway bridge overlay with microsilica concrete requires a long-term staging plan method. This example will demonstrate the process of developing a cut section for each phase of construction. Freeway traffic will have positive separation from the work area to provide safety for both the contractor and traffic. The key to this process is to maintain all of the existing lanes in the staged configuration. During off-peak hours the contractor can accelerate the construction by electing to close lanes for ingress and egress of equipment and materials. Work has to opportunity to continue 24/7 without being overly concerned about traffic. Notice that the existing structure has a total width of 71.8'. This entire width can become available for staging purposes once the longitudinal joint is repaired.



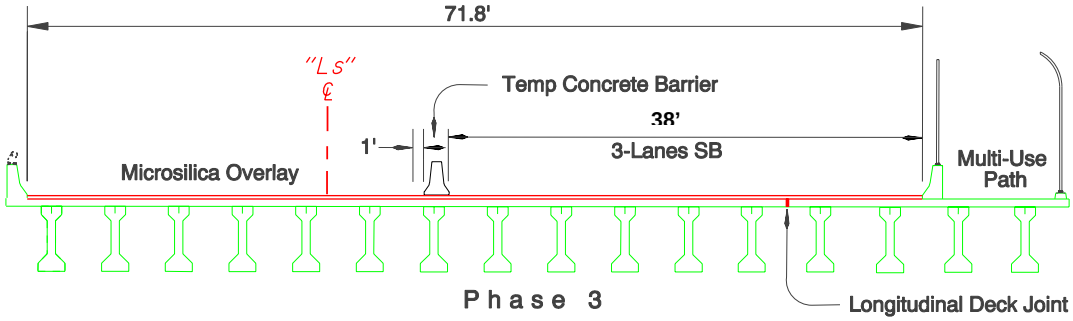
Under Phase 1 the 3-lanes of freeway traffic are shifted to the inside shoulder and the work area is located to the outside shoulder. To maintain the freeway speed a full "L" taper is recommended. During Phase 1 the contractor will repair the longitudinal joint, end panels, and microsilica overlay during the same phase. Temporary concrete barrier is installed adjacent to the work area to protect traffic through the diversion. There is a 1' lateral buffer space from the work area side of the barrier to the microsilica deck pour. This space provides room for the concrete paver and personnel to complete the deck pour.

Consideration is given for the width of the travel lanes and shoulders. Since this structure is in the proximity of an interchange consideration is given for access to the freeway ramps. Proper advance warning of any ramp closures or lane dedications is an important factor to maintain the continuity of the work zone.



Under Phase 2 the contractor will have to establish a center work island to complete the middle portion. Freeway traffic lanes will be split with 2-lanes to the inside and 1-lane to the outside. Truck mobility is maintained by providing a lane with shoulders totaling a 21' clear distance between barriers. Advance warning of freeway lane configuration will be critical to maintain safety and traffic flow. The two runs of barrier will be flared together on the leading end and protected with a double barrier impact attenuator. This configuration establishes a temporary gore situation in the freeway travel lanes, which traffic needs to be adequately warned of. Again, lane dedication for ramp connections is important.

Delivery and placement of materials can become a milestone event and requires proper planning. Heavy equipment working in close proximity to the roadway will affect traffic flow.



Under Phase 3 the median side is completed. With proper planning we have developed adequate width to provide for 3-lanes of traffic. When shifting traffic onto the either shoulder, an evaluation determines if the shoulder has sufficient structural integrity prior to shifting traffic. Since the overall width is only 38' by engineering judgment a decision is made on the width of travel lanes and shoulders.

Temporary concrete barrier provides a secure work area for the contractor. The leading end of the barrier is flared onto the inside shoulder and protected by an impact attenuator. Consideration for truck ingress and egress is evaluated. When shifting traffic back to mainline an evaluation will consider the proximity of the interchange off-ramp. If necessary, temporary paving can be constructed in the ramp gore to provide additional surfacing for the termination area.

5.6 – TRAFFIC CONTROL MEASURES

Traffic Control Measures (TCM) are elements of the Traffic Control Plan including, but not limited to, Traffic Control Devices, personnel, materials and equipment used to control traffic through the work zone. Various strategies are employed to provide for the safe and expeditious movement of traffic through the work zone.

Examples of the common TCM are:

- √ Pilot Car
- √ Detour
- √ Diversion
- √ Closures

Pilot car - can be employed to safely lead a queue of traffic through a 1-lane, 2-way operation. The pilot car can facilitate the traffic movement through the work zone and is coordinated with flagging control at each end of the one lane section.

Detour - is a rerouting of vehicles onto another existing facility to direct traffic around the work zone. All vehicles or selected oversized vehicles can be instructed to utilize the detour.

Diversion - is similar to a detour, but uses a temporary roadway or alignment to provide a route for vehicles to travel through the work zone. The diversion will generally be constructed within the existing right of way and will usually be removed once traffic is placed back onto the existing roadway.

Closure - is a viable option when the benefit to the public exceeds the risk of staging. The public can benefit from a closure, when the overall construction duration can be significantly reduced. Usually the contractor can expedited the work when full access is granted. Considerations can be given for applying an incentive/disincentive clause to the duration of the closure. This technique will usually further prioritize the contactor's efforts to complete this portion of work in a timely manner.

The possible advantages of a closure are:

- Shorter construction duration
- Improved safety
- Higher workmanship quality
- Improved public relations
- Lower traffic control cost

5.7 – TYPICAL APPLICATIONS

While preparing a TCP the designer will include the appropriate standard drawings to provide additional guidance to the contractor. The following work zone conditions will be evaluated to select the proper drawings to include for the construction situations consistent with the project scope.

The work zone conditions are:

- ✓ Type of Roadway
- ✓ Proximity of Work
- ✓ Type of Work
- ✓ Duration of Work
- ✓ Roadway Capacity/Traffic Volumes
- ✓ Posted Speed

5.7.1 – 2-LANE, 2-WAY RURAL HIGHWAY USING FLAGGERS

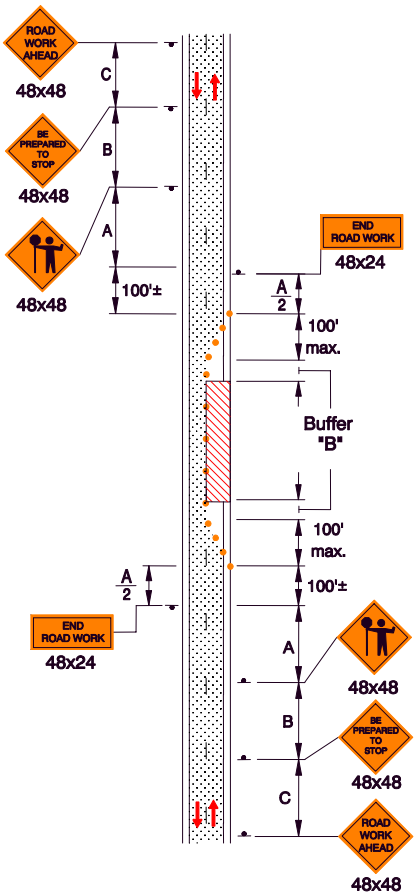
Flagging is a dynamic occurrence, which would be difficult to depict on plan sheets. When flaggers are used occasionally, this drawing would provide adequate direction about the operation. This type of short term traffic control measures are usually not shown to the TCP. Preference is delegated to more stationary long term TCP applications for plan sheets.

Flaggers are used to control traffic in short term and intermediate term work. A “BE PREPARED TO STOP” sign is installed prior to the “FLAGGER” sign.

Monitor length of queues, when necessary install “Extended Traffic Queues” signing. Flagger station shall be illuminated at night. When flaggers are no longer present remove signing in opposite order of how installed.

When using pilot cars in addition to flaggers for paving operations increase Tubular Marker spacing along centerline to 200 feet within work zone.

Flagger station is located at the start of the taper and the taper shall not exceed a Maximum distance of 100 feet.



5.8 – BARRIER WARRANTS

One of the most commonly asked question of a TCP designer is: "When should temporary concrete barrier be used?" An assessment of risk will be evaluated by using engineering judgment. If the resulting occurrence of a vehicle striking a fixed obstacle or runoff the road is greater than striking the barrier then generally it is warranted. By weighing the effect of each of the following factors one develops a subjective method for warrant justification:

✓	Type of Obstacle	✓	Clear Zone
✓	Can Obstacle be Moved	✓	Type of Facility
✓	Cut & Fill Slopes	✓	Duration
✓	Height of Embankment	✓	Type of Work

Generally, when traffic is routed adjacent to a fill or cut section with a descending slope and is not operating under flagger control an evaluation of the slope vs. height will determine barrier warrants. Barrier warrants are achieved when the following slope/height criteria are exceeded:

SLOPE ≥	HEIGHT >
2 ½ : 1	8 ft.
2 : 1	5.5 ft.
1 ½ : 1	3 ft.

Two work zone applications where barrier warrants are achieved are as follows:

- Bridge rail replacement
- Freeway median barrier replacement

Select one of the following three options when determining how to protect a roadside hazard:

- Leave the hazard unprotected
- Remove or reduce the hazard
- Install the appropriate barrier

5.9 – TEMORARY SIGNS & GUIDSIGN

Temporary Signs - TCP Designers should exhaust the following resources when determining the text, configuration, sizing, color, usage and placement for Temporary Signs:

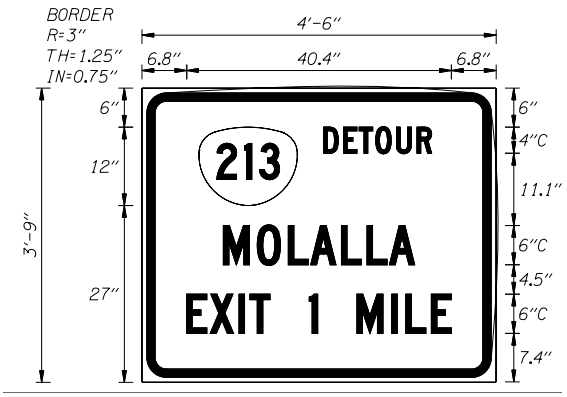
- ODOT "Sign Policy & Guidelines for State Highway Signs"
- "Standard Highway Signs", published and maintained by FHWA
- Manual on Uniform Traffic Control Devices

Guidsign - For the design of highway signs ODOT utilizes a software program called Guidsign. This program runs within the microstation environment. It is also available in AutoCAD and Windows versions.

The program has features for creating many panel styles derived from the MUTCD sign standards. Select the desired parameter category to make adjustments.

The categories are:

- Panel
- Border
- Margins
- Spacing
- Text
- Symbols

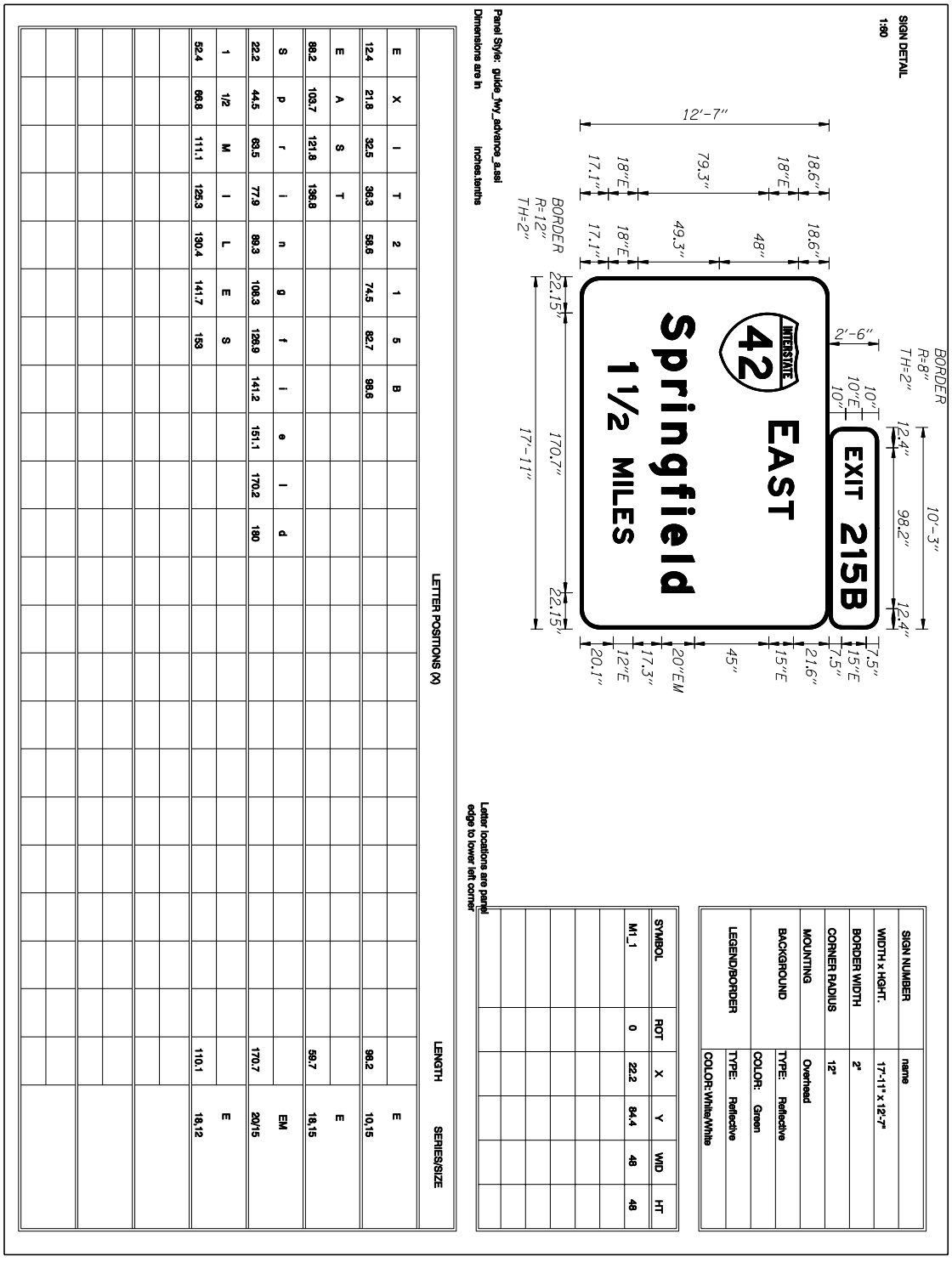


The desired settings should be used to prepare temporary TCP signs:

Sign Size	Border Radius	Border Thickness	Border Inset
≤ 24x24	1 1/2	5/8	3/8
30x30	1 7/8	3/4	1/2
36x36	2 1/4	7/8	5/8
48x48	3	1 1/4	3/4
60x72	3	1 1/4	3/4
72x120	0.125 x Min Dim.	1 3/4	1 1/4
72x120 >	0.125 x Min Dim.	2 1/2	2

The sign is prepared by adding Text. Various text fonts, height, and spacing are chosen for letters, numbers, and fractions, which can be added. Others objects like arrows and symbols can be selected from the menu. There is a feature to place exit panels above or within the sign. There are editing functions for modifying the sign and for moving and aligning objects and text. Once the sign is prepared panel dimensions can be added.

A reporting function can be utilized to prepare a detailed report. The report provides detailed information about the sign. The sign vendor uses this data to manufacture the sign. Below is a finished example:

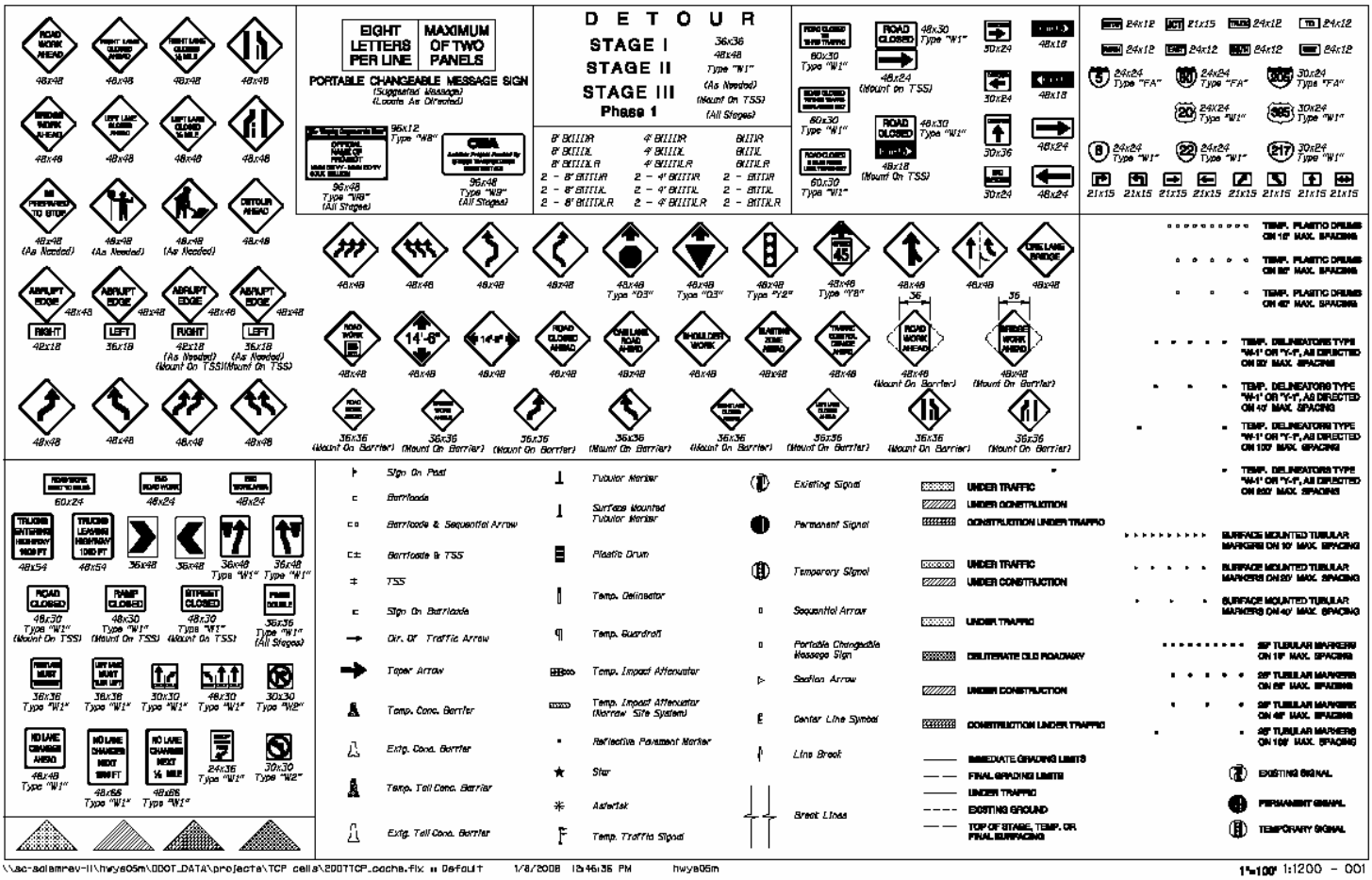


5.10 – DRAFTING STANDARDS

Contract Plans Development Guide (CPDG) - TCP Designers should utilize the CPDG in preparing the plans. Guidance is provided for labeling, patterning, borders, and conditional formatting.

Cell Libraries – The TCP cell library is entitled TCPE.cel and is located in the ODOT CAD workspace. The cell library can be used to quickly place TCP related signs, devices, and symbols on the plans.

TCP Cache – The TCP cache is another resource to utilize during plans development. Once the cache file is attached the elements can be copied into the plans.



CHAPTER 6 – TRAFFIC CONTROL COST ESTIMATE

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 – PAY ITEM COST ESTIMATES

Use the Excel spreadsheet to prepare your Traffic Control Plan cost estimates. A copy of the Cost Estimator is available on the TCP web site.

The TCP Cost Estimator has been designed to calculate TCP Pay Items in English units. Metric units are no longer being supported within ODOT.

The Cost Estimator is divided into easy tabbed sheets that should help you systematically calculate your pay item quantities to ensure that all of your appropriate pay items have been accounted for.

While the Cost Estimator is thorough, there are limitations. For ***very*** complex staging, it may be necessary to run through the process more than once to calculate quantities for a particular Pay Item. Remember, too, that most quantities are rounded to the nearest whole unit. Some Pay Item quantities include a percentage for replacement of damaged devices, while others require the TCP Designer to determine a percentage of replacement devices.

NOTE: The first sheet of the Cost Estimator is titled, "***INSTRUCTIONS – Read Me First***." We strongly recommend you do this first. If you have any questions or find any errors within the Cost Estimator, we encourage you to contact the Central Traffic Control Plans Unit at your earliest convenience.

The following excerpt from the Cost Estimator lists some of the Pay Items included in a typical TCP Cost Estimate Pay Item Quantities.

TEMPORARY SIGN QUANTITIES

Project:	0			**County:**	0
Prepared By:	0	**Date:**	01/00/00	**KEY #**	0

NOTE: *Text in* **ALL CAPS** *is actual sign legend. All Other Signs are Symbol Signs, as indicated*
See the FHWA "Standard Highway Signs," or the ODOT "Sign Policy & Guidelines" for additional sign detail

SIGN NAME / LEGEND	Width in.	Height in.	Size ft^2	Quantity	Area	NOTES
Project Identification	96	48	32		-	
KEEPING OREGON ON THE MOVE (Rider)	96	12	8		-	
OTIA Project	96	48	32		-	
ROAD (**BRIDGE**) **WORK AHEAD**	48	48	16		-	
ROAD (**BRIDGE**) **WORK AHEAD** - *(Smaller)*	36	36	9		-	
ROAD WORK NEXT XX MILES	60	24	10		-	
FINES DOUBLE (Rider)	36	27	7		-	
~~TRAFFIC FINES DOUBLE IN WORK ZONES~~	~~65~~	~~45~~	~~20~~		-	
END ROAD WORK	48	24	8		-	
Workers (Symbol)	48	48	16		-	
Flagger (Symbol Sign)	48	48	16		-	
BE PREPARED TO STOP	48	48	16		-	
SHOULDER WORK	48	48	16		-	
SHOULDER WORK *(Smaller)*	36	36	9		-	
SHOULDER CLOSED	48	48	16		-	
SHOULDER CLOSED *(Smaller)*	36	36	9		-	
Right Lane Drop (Symbol)	48	48	16		-	
Right Lane Drop (Symbol - *Smaller*)	36	36	9		-	
RIGHT LANE CLOSED AHEAD	48	48	16		-	
RIGHT LANE CLOSED AHEAD *(Smaller)*	36	36	9		-	
RIGHT LANE CLOSED 1/2 MILE	48	48	16		-	
RIGHT LANE CLOSED 1/2 MILE *(Smaller)*	36	36	9		-	
Left Lane Drop (Symbol)	48	48	16		-	
Left Lane Drop (Symbol - *Smaller*)	36	36	9		-	
LEFT LANE CLOSED AHEAD	48	48	16		-	
LEFT LANE CLOSED AHEAD *(Smaller)*	36	36	9		-	
LEFT LANE CLOSED 1/2 MILE	48	48	16		-	
LEFT LANE CLOSED 1/2 MILE *(Smaller)*	36	36	9		-	
LEFT TURN LANE CLOSED	48	48	16		-	
LEFT TURN LANE CLOSED AHEAD	48	48	16		-	
Curve (Symbol)	48	48	16		-	
Reversing Curve (Symbol)	48	48	16		-	
XX MPH (Rider)	24	24	4		-	
Arrow (Rectangular Symbol)	48	24	8		-	
Chevrons (Use in Groups of 3 Min.)	36	48	12		-	
Lanes Merge (Symbol)	48	48	16		-	
Added Lane (Symbol)	48	48	16		-	
LANE(**S**) **NARROW**(**S**)	48	48	16		-	
Two-Way Traffic (Symbol)	48	48	16		-	
NO LANE CHANGES NEXT X/X MILE	48	66	22		-	
NO LANE CHANGES NEXT XXXX FT	48	66	22		-	
STAY IN LANE	36	54	14		-	
DO NOT PASS	48	60	20		-	
PASS WITH CARE	48	60	20		-	

Remember, all of the fields in ***yellow*** are TCP Designer entry fields and require input from the Designer for the quantities to be correctly calculated.

Please go through each item on this sheet very carefully. Calculations for some of the pay items are very straightforward. Others, however, involve some complex forethought as you work through the various Stages and Phases of your project.

In particular, you will notice that **Concrete Barrier & Attenuator** deals specifically with the quantities for Temporary Concrete Barrier and Concrete Barrier Moves. If you are dealing with a complex, multi-stage project with a large quantity of temporary barrier, we encourage you to work through this sheet very carefully.

6.2 – TEMPORARY PROTECTION & DIRECTION OF TRAFFIC – LUMP SUM ITEM

The TP&DT Lump Sum item (often misconstrued as being synonymous with the Traffic Control Plan) is actually a single Pay Item comprised of several individual Traffic Control items that do not otherwise have their own Pay Item category in the TCP Cost Estimate.

As described in the Specs, there are several devices and labor-related items that are covered under this lump sum item.

Below 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:

TP & DT - Lump Sum Pay Item					
Project:	0	County:	0		
Prepared By:	0	Date:	1/0/1900	KEY #	0
ITEM	Unit	Quantity	Unit Cost	Total	
Tubular/Conical Markers (See Worksheet Below)	Each	0	$27.50	$0.00	
Tubular/Conical Marker MOVES	Each	0	$0.50	$0.00	
Temp. Concrete Barrier To & From Stockpile	ft	0	$5.00	$0.00	
Remove Temp. Concrete Barrier	ft	0	$5.00	$0.00	
Move Concrete ("Zipper") Barrier Laterally	Each	0	$300.00	$0.00	
Move "Zipper" Machine To/From Storage {Min}	Lump Sum	0	$1,000.00	$0.00	
Guard Rail, Anchor Type 1	Each	0	$450.00	$0.00	
Guard Rail, Anchor Type 1 Modify	Each	0	$350.00	$0.00	
Guard Rail, Transition 2-Sides	Each	0	$3,000.00	$0.00	
Pole Base Excavation Covers	Each	0	$200.00	$0.00	
Pedestrian Work Zone Delineation Fence (Orange)	ft	0	$3.00	$0.00	
Temporary Chain Link Fence	ft	0	$7.50	$0.00	
Traffic Control Supervisor - ONLY if NOT already included on "TCP COST ESTIMATE" sheet!!	Lump Sum	0	$0	$0	
Falsework Illumination	ft	0	$3.50	$0.00	
Incidental Flagging Hours	Hour	0	$25.00	$0.00	
		0	$0.00	$0.00	
Blue Tubular Markers	each	0	$30.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
		0	$0.00	$0.00	
	SUBTOTAL =			$0	
TP&DT Calculated From 1% of Project Budget:			x 1.0% =	$0	
			COMPARED TO:		
TP&DT Calculated from Above {$5000 Minimum} =				$5,000	
** TP&DT TOTAL =					

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 this number handy as you will be asked to enter it into the spreadsheet. The percentage amount will then be compared to the calculated Lump Sum amount. The larger of the two amounts will be used and carried forward into your Total TCP Cost Estimate.

6.3 – TEMPORARY SIGN QUANTITIES

One of the more significant TCP Pay Items is the Temporary Signing. On some projects, you will find Temporary Signing to be your largest Pay Item quantity and cost. **Sign Quantities** of the Cost Estimator will help you keep an inventory of your temporary signs as well as calculate total quantities and costs.

- Important to remember when calculating sign quantities:
  In multi-lane sections, two signs, one on each side of the road way, are needed for each direction.

- Sign supports are included in the square-foot cost of the signs.

- Route Shields are measured separately, even if installed on the face of another temporary sign.

- Pay close attention to TCP Staging. You may be able to reuse a sign(s), rather than adding an additional one.

- An additional 5% is automatically added to your Sign quantity at the end of the calculations.

6.4 – TCP COST ESTIMATE

Once you have completed the tabbed sheets there are a small number of fields that may require inputs directly from the TCP Designer:

- If Tall “F” Concrete Barrier is used in your project, you may calculate the quantities and enter the amounts by hand.

- Quantities for Temporary Delineators can be calculated and entered by hand.

- Quantity for Overheight Vehicle Warning Systems (OVWS) should be entered by hand. These devices are rare and will most likely be no more than two on any project.

- Quantities for Temporary Traffic Signals will come from the development of the project and staging; however, costs for the signal(s) should come from the Traffic Section.

- Quantities for Traffic Control Supervisor (TCS) should come following discussions with Region Construction staff and Project Team members.

- Quantities for Flaggers, Pilot Cars and Tow Trucks should come from Region Cost Estimating staff who, having reviewed the scope of work and the staging plans, will be able to provide reasonable amounts of time for these pay items.

- Due to the wide range of devices available, the cost for Truck-Mounted Impact Attenuator Repair should be entered by the TCP Designer following conversations with Region Construction staff. They should be able to provide reasonable costs for this item based on past experiences.

- When submitting your TCP Cost Estimate to the Specification Writer, “TCP COST ESTIMATE” is needed. Keep a copy of the entire workbook in both your electronic and paper 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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
Environmental Classes	(1) 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. (2) 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. (3) 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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 $\leq$ 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.

TERM	DEFINITION
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	(1) 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. (2) 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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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)	(1) Any sign, signal, marking, or device placed, operated or erected for the purpose of guiding, directing, warning or regulating traffic. (2) Any device that remotely controls another traffic control device by electrical, electronic, sound or light signal. (3) 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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 Chapter 2.

APPENDIX C – FORMS

Use the following INTEROFFICE MEMO (which is also available from ODOT's Traffic Engineering & Operations Section) to request **Speed Zone Reductions**:

STATE OF OREGON
Department of Transportation

INTEROFFICE MEMO
Traffic Engineering & Operations

Worksheet for Determining the Need for a Reduced Speed Zone for Work Zones
The presence of one or more factors does not require a reduced speed, but an assessment by traffic engineering staff should be made to determine from review of the plans and/or operation if a speed reduction is needed. It is assumed for all of the factors that they are present for a continuous length of 1/4 mile or more. Shorter travel restrictions should be appropriately signed with advance warning and warning signs.

PROJECT: _____

Requested By: _____ **Date:** _____

1. Table of Factors

WORK TYPE	ACTIVITY AREA	4	FACTORS FOR REDUCED SPEED for >1/4 mile (0.4 km)
Roadside Activity	Activities that are more than 10 ft. (3.05 m) from the edge of the traveled way	μ	None
Shoulder Activity	Activities that encroach on the area closer than 10 ft. (3.05 m) but not closer than 2 ft. (0.06 m) to the edge of the traveled way	μ μ	• Workers present for extended periods within 10 ft. (3.05 m) of traveled way unprotected by barriers • Horizontal curvature with a safe speed of 10 mph (16.1 km/hr) or more less than the posted speed
Lane encroachment	Activities that encroach in the area from the edge of the traveled way to 2 ft. (0.06 m) from the edge of the traveled way	μ μ μ	• Workers present for extended periods within 2 ft (0.06 m) of traveled way unprotected by barrier • Horizontal curvature with a safe speed of 10 mph (16.1 km/hr) or more less than the posted speed • Barrier or pavement edge drop-off within 2 ft (0.06 m) of traveled way
Moving operation, shoulder	Activities that require an intermittent or moving operation on the shoulder	μ	None
Lane closure	Activities that encroach on the	μ	• Workers present for extended periods in the closed lane

(1 or more) **Design speed ___MPH**	area between the centerline and the edge of traveled way	μ μ μ μ	unprotected by barrier • Lane width reduction of 1 ft. (0.03 m) or more with a resulting lane width of 10 ft. (3.05 m) or less • A series of traffic control devices encroaching on a lane open to traffic or within a closed lane but within 2 ft (0.06 m) of the edge of the open lane that can't be moved to a safer location • Barrier or pavement edge drop-off within 2 ft (0.06 m) of traveled way for >1/4 mile (0.4 km) • Horizontal curvature with a safe speed of 10 mph (16.1 km/hr) or more less than the posted speed
Temporary detour **Design speed ___MPH**	Activities requiring the diversion of traffic to a temporary detour, either over existing roads or temporary road	μ μ μ	• Lane widths on the detour of 10 ft (3.05 m) or less • Speed reduction of 10 mph (16.1 km/hr) or more on transition with less than 1/4 mile (0.4 km) length between transitions • Significant increase in traffic volumes for the detour facility sufficient to cause continuous, unusual congestion
Centerline or lane line encroachment **Design speed ___MPH**	Activities that encroach upon the area on both sides of the centerline of a roadway or lane line of a multi-lane highway	μ μ μ μ μ	• Workers present for extended periods in the closed lane unprotected by barrier • Lane width reduction of 1 ft. (0.03 m) or more with a resulting lane width of 10 ft. (3.05 m) or less • A series of traffic control devices encroaching on a lane open to traffic or within a closed lane but within 2 ft (0.06 m) of the edge of the open lane that can't be moved to a safer location • Barrier or pavement edge drop-off within 2 ft (0.06 m) of traveled way for >1/4 mile (0.4 km) • Horizontal curvature with a safe speed of 10 mph (16.1 km/hr) or more less than the posted speed

2. Detail work zone areas where above restrictions apply (include begin and end milepoints/stations):

3. Detail how work zone changes (phasing, moving of work areas, etc.) affect the above restrictions:

4. Any other information unique to this work or location which affects your decision to request a lowered speed:

SUPPORTING SIGNATURES

Work Zone Traffic Control Design (plans): _____

Traffic Control Plans Designer

Region Traffic (active project): _____

Region Traffic Manager:

Project Manager (active project): _____

Crew No.:

BORDERING STATE PROJECTS LETTER

Oregon
John A. Kitzhaber, M.D., Governor

Department of Transportation
{Address}
{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

PRINT RESET SAVE

Under provisions of OAR 734-020-0430 and the delegated authority, the State Traffic Engineer must approval 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:	**Email:**	
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:	

TRAFFIC SIGNAL APPROVAL REQUEST FORM.doc Revision 12/14/04

APPENDIX D - TRAFFIC CONTROL PLANS CHECKLIST

Traffic Control Task/Item	Yes	No	N/A	In Plans
Has traffic analysis been requested?	☐	☐	☐	☐
Have local events been looked at?	☐	☐	☐	☐
Holidays and weekends considered?	☐	☐	☐	☐
Speed Zone Reduction Request	☐	☐	☐	☐
Temp. Traffic Signal Request	☐	☐	☐	☐
Vert./Horiz. Clearances checked	☐	☐	☐	☐
Has MCTD been notified?	☐	☐	☐	☐

Work Zone Types:	Yes	No	N/A	In Plans
Beyond Roadway	☐	☐	☐	☐
Shoulder Closure	☐	☐	☐	☐
Lane Constriction	☐	☐	☐	☐
Lane Closure	☐	☐	☐	☐
Two-lane, two-way operation	☐	☐	☐	☐
Four-lane, two-way operation	☐	☐	☐	☐
Intermittent Closure(s)	☐	☐	☐	☐
Crossover(s)	☐	☐	☐	☐
Controlled Delay (“Rolling Stop”)	☐	☐	☐	☐
Two (Multi) Lane closure	☐	☐	☐	☐
Detour	☐	☐	☐	☐
Self-regulating Diversion	☐	☐	☐	☐
Flagger-regulated Diversion	☐	☐	☐	☐
Signal-regulated Diversion	☐	☐	☐	☐
Extended Traffic Queues	☐	☐	☐	☐
Overlay, Inlay/Overlay	☐	☐	☐	☐
On/Off Ramp	☐	☐	☐	☐
Blasting Zone	☐	☐	☐	☐

TP&DT	Yes	No	N/A	In Plans
Tubular Markers	☐	☐	☐	☐
Tubular Marker Moves	☐	☐	☐	☐
Guard Rail Anchors	☐	☐	☐	☐
Guard Rail End Pieces/Transitions	☐	☐	☐	☐
Pole Base/Inlet Covers	☐	☐	☐	☐
Work Zone Delineation Fencing	☐	☐	☐	☐
Temp. Chain Link Fencing	☐	☐	☐	☐

Signs:	Yes	No	N/A	In Plans
Temporary Delineators	☐	☐	☐	☐
Incidental Flagging Hours	☐	☐	☐	☐
Falsework Illumination	☐	☐	☐	☐

Signs:	Yes	No	N/A	In Plans
ROADWORK AHEAD	☐	☐	☐	☐
ROADWORK NEXT XX MILES	☐	☐	☐	☐
END ROAD WORK	☐	☐	☐	☐
FLAGGER (SYMBOL)	☐	☐	☐	☐
BE PREPARED TO STOP	☐	☐	☐	☐
PROJECT INFO SIGNS	☐	☐	☐	☐
TRAFFIC FINES DOUBLE	☐	☐	☐	☐
HZ/VERT CLEARANCE	☐	☐	☐	☐
TRUCKS	☐	☐	☐	☐
500 FT	☐	☐	☐	☐
SHOULDER WORK	☐	☐	☐	☐
SHOULDER CLOSED	☐	☐	☐	☐
LANE DROP (SYMBOL)	☐	☐	☐	☐
RIGHT LANE CLOSED AHEAD	☐	☐	☐	☐
LEFT LANE CLOSED AHEAD	☐	☐	☐	☐
CURVE (SYMBOL)	☐	☐	☐	☐
XX MPH (RIDER)	☐	☐	☐	☐
ARROW (SYMBOL)	☐	☐	☐	☐
GROOVED PAVEMENT	☐	☐	☐	☐
BUMP	☐	☐	☐	☐
NO CENTER STRIPE	☐	☐	☐	☐
NEXT XX MILES	☐	☐	☐	☐
LOOSE GRAVEL	☐	☐	☐	☐
DO NOT PASS	☐	☐	☐	☐
PASS WITH CARE	☐	☐	☐	☐
ABRUPT EDGE	☐	☐	☐	☐
CENTER	☐	☐	☐	☐
RIGHT	☐	☐	☐	☐
LEFT	☐	☐	☐	☐
REDUCE SPEED	☐	☐	☐	☐
SPEED ZONE AHEAD	☐	☐	☐	☐
SPEED XX	☐	☐	☐	☐
DO NOT PASS {ONE LANE DETOUR}	☐	☐	☐	☐

	Yes	No	N/A	In Plans
PASS WITH CARE {1-LANE DETOUR}	☐	☐	☐	☐
ONE LANE ROAD AHEAD	☐	☐	☐	☐
YIELD AHEAD	☐	☐	☐	☐
YIELD	☐	☐	☐	☐
TO ONCOMING TRAFFIC (RIDER)	☐	☐	☐	☐
SIGNAL (SYMBOL)	☐	☐	☐	☐
STOP HERE ON RED	☐	☐	☐	☐
END 25 MPH SPEED ZONE	☐	☐	☐	☐
BLASTING ZONE AHEAD	☐	☐	☐	☐
TURN OFF 2-WAY RADIOS & CELL PHONES	☐	☐	☐	☐
CHEVRONS	☐	☐	☐	☐
MEDIAN CLOSED	☐	☐	☐	☐
RAMP NARROWS	☐	☐	☐	☐
EXIT OPEN	☐	☐	☐	☐
JCT	☐	☐	☐	☐
STREET CLOSED TO THRU TRAFFIC	☐	☐	☐	☐
ROAD/STREET CLOSED	☐	☐	☐	☐
KEEP (ARROW) LEFT/RIGHT	☐	☐	☐	☐
ONE WAY (ARROW)	☐	☐	☐	☐
DETOUR AHEAD	☐	☐	☐	☐
DETOUR 1000 FT	☐	☐	☐	☐
DETOUR 500 FT	☐	☐	☐	☐
DETOUR (ON ARROW)	☐	☐	☐	☐
DETOUR (DIAMOND SHAPE)	☐	☐	☐	☐
DETOUR	☐	☐	☐	☐
DETOUR (W/ARROW L/R)	☐	☐	☐	☐
DETOUR (W/ARROW UP/ANGLE)	☐	☐	☐	☐
END DETOUR	☐	☐	☐	☐
NORTH/SOUTH/EAST/WEST/TO	☐	☐	☐	☐
ROUTE SHIELDS	☐	☐	☐	☐
DIRECTIONAL ARROWS (SYMBOLS)	☐	☐	☐	☐
SIDEWALK CLOSED	☐	☐	☐	☐
BICYCLE (SYMBOL)	☐	☐	☐	☐
ON ROADWAY	☐	☐	☐	☐

Quantities (not lump sum):	Yes	No	N/A	In Plans
Concrete barrier (Std, “Tall”, “Zipper”)	☐	☐	☐	☐
Concrete barrier moves	☐	☐	☐	☐
Concrete barrier removal	☐	☐	☐	☐

	Yes	No	N/A	In Plans
Barrier machine (For "Zipper")	☐	☐	☐	☐
Temporary guard rail	☐	☐	☐	☐
Temporary barricades – Type III	☐	☐	☐	☐
Temporary barricades – Type II	☐	☐	☐	☐
Truck Mounted Impact Attenuator	☐	☐	☐	☐
Temporary Plastic Drums	☐	☐	☐	☐
Surface Mounted Tubular Markers	☐	☐	☐	☐
Temp. Tape Removable/Non-Removable	☐	☐	☐	☐
Temp. Flexible Pavement Markers	☐	☐	☐	☐
Temporary Striping	☐	☐	☐	☐
Temporary Stripe Removal	☐	☐	☐	☐
Durable Stripe Removal	☐	☐	☐	☐
Sequential Arrow Sign	☐	☐	☐	☐
Portable Changeable Message Sign	☐	☐	☐	☐
Traffic Control Supervisor	☐	☐	☐	☐
Flagging Hours (From Cost Est. Unit)	☐	☐	☐	☐
Pilot Car Hours (From Cost Est. Unit)	☐	☐	☐	☐

DETOURS:	Yes	No	N/A	In Plans
Weight Restrictions				
Vertical & Horizontal Clearances				
Trail Blazers (Detour guide signs)				
Geometrics (turning radii, etc.)				
Bridge weight restrictions				
Notify local governments				
Local Business Access				
Local Residence Access				
Detour Striping				
Pedestrian/Bike detour provisions				
Emergency vehicle impacts				
Public transit impacts				
School bus impacts				
US Mail Services				
Pavement Section – adequate depth?				
Reconnaissance of the route				
Street Parking along the detour				

APPENDIX E - DESIGN CONVERSION CHARTS

METRIC ⟷ ENGLISH

Appendix E – Design Conversion Charts

METRIC AND ENGLISH UNITS

Sizing Increments	
English (Inches)	**Metric (mm)**
3	76
6	152

Sign Letter Heights	
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	
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*".
- Delivers ODOT's 3-day TCP Design Course.
- Participates in 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

- **Provides Training -** Researches, develops, and implements training material and provide training for Traffic Control Plans Designers and Work Zone Traffic Analysts. Training given includes both internal and external staff. External staff includes city, county, contractor, manufacturer, and consulting staff. Coach and mentor design personnel in the development of Traffic Control Plans and Work Zone Traffic Analysis and provide technical assistance to designers and consultants statewide.
- **Performs "Other Duties as Assigned"** Completes special assignment at the direction of the State Traffic Engineer, the Technical Services Managing Engineer, or the Traffic Standards Engineer. Perform miscellaneous assignment and provides technical advice to the State Traffic Engineer regarding work zone traffic control as directed by supervisors. For example, this has included the development of the Oregon Temporary Traffic Control Handbook ("*Short Term Traffic Control Handbook for Operations of 3 Days or Less*").
- **Reviews plans**, specifications and engineering estimates prepared by Region Technical Centers, consultants and local agencies as part of Quality Assurance Program reviews. Reviews completed plans for conformity with design standards, safety features and funding limitations. Develop and implement Quality Assurance Plan to maintain and improve quality of plans specifications and estimates. Answer questions and provide statewide expertise on design criteria and standards.
- **Helps with research, development, and implementation of standards, specifications** and procedures related to work zone TCP design statewide. Reviews and makes recommendations on exceptions to design standards, specifications and procedures. Identifies new product of device needs, develop research needs and conducts product research. Identify new product device needs, help with research needs and conduct product research.
- **A TCP Team Member -** Participates as a member of the crew (work) team as outlined by their team agreements. Duties of a team member may include preparing for meetings, preparing, presenting, and sponsoring action items and crew team proposals; implementing approved team proposals; and giving honest feedback during critiques.

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 ODOT Traffic Control Plans Unit meetings. Meetings may be held on a quarterly basis. Meetings will be used to maintain statewide consistency and uniformity of Traffic Control Plan design techniques, 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

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