



Traffic Control Plans Design Manual

12th Edition, May 2016

Chapter 1 General Standards and Practices

Table of Contents

CHAPTER 1 GENERAL STANDARDS AND PRACTICES	3
1.0 – KEY POINTS OF THIS CHAPTER	3
1.1 – WORK ZONE GUIDING PRINCIPLE AND DECISION TREE	3
1.1.1 – GUIDING PRINCIPLE DECISION TREE APPLICATION	5
1.2 – SAFETY – A PRIMARY FUNCTION	5
1.2.1 – SAFETY IN TCP DESIGN	5
1.2.2 – ENGINEERING JUDGMENT	7
1.3 – TCP STANDARDS	7
1.3.1 - MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)	7
1.3.2 - OAR & ORS	8
1.3.3 – ADDITIONAL STANDARDS & REFERENCES	8
1.4 – TRANSPORTATION MANAGEMENT PLAN (TMP)	9
1.4.1 – TRANSPORTATION MANAGEMENT PLAN DOCUMENT	10
1.5 – TRAFFIC CONTROL PLAN STRUCTURE	11
1.5.1 - WORK ZONE LIMITS & COMPONENTS	11
1.5.2 - TRAFFIC CONTROL PLAN DESIGN FORM	14
1.5.3 - STANDARD SPECIFICATIONS & SPECIAL PROVISIONS	14
1.5.4 - STANDARD DRAWINGS	15
1.5.5 - PROJECT-SPECIFIC CONSTRUCTION STAGING PLAN SHEETS	16
1.6 – TRAFFIC CONTROL PLAN DESIGN	16
1.6.1 – DESIGN CONSIDERATIONS	16
1.6.2 – TRAFFIC CONTROL MEASURES	17
1.6.3 – PRIMARY DESIGN POLICIES	17
1.7 – WORK ZONE INTELLIGENT TRANSPORTATION SYSTEMS	18
1.7.1 - SMART WORK ZONE SYSTEMS	18
1.8 – TRAFFIC CONTROL DEVICES (TCD)	19
1.8.1 - USING TCD TO CREATE A SAFE WORK ZONE	19
1.8.2 - TCD PRINCIPLES	19
1.8.3 TCD CRASH TESTING	19
1.8.4 – TCD CRASH TESTING CATEGORIES	20
1.8.5 - THE QUALIFIED PRODUCTS LIST (QPL)	20
1.9 – MOBILITY	21
1.9.1 – MOBILITY PROCEDURES MANUAL	21
1.9.2 – COORDINATING TRAVEL DELAY ESTIMATES	21
1.10 – DESIGNER RESOURCES & WEB LINKS	22
1.10.1 - TCP DESIGNER WEB LINKS	22
1.10.2 – TRAFFIC CONTROL PLAN CHECKLIST	22

CHAPTER 1 GENERAL STANDARDS AND PRACTICES

Chapter

1

1.0 – KEY POINTS OF THIS CHAPTER

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

1.1 – WORK ZONE GUIDING PRINCIPLE AND DECISION TREE

Working with the Director’s Work Zone Safety Executive Steering Committee, the agency has developed and is implementing the *Work Zone Guiding Principle*:

Mission: ODOT’s mission is to provide a safe, efficient transportation system that supports economic opportunity and livable communities.

Goal: Our work zone safety goal is zero fatalities and injuries, including ODOT employees, contractors, public safety professionals and the traveling public while efficiently moving people and goods.

Guiding Principle: The best work zone design and management plan will maintain safety and mobility, a balance that shall be analyzed continuously throughout the lifecycle of the facility.

Directive/Strategy: To accomplish this goal, project design teams shall consider the full range of options including, but not limited to, separation of the traveling public from workers and work areas, speed reductions, law enforcement, enhanced traffic control devices and signage, and overall roadway and work zone design.

Effective communication with travelers is essential to establish reasonable expectations and minimize unsafe driver behavior. While there is no single solution that is appropriate for all roadway designs and work zones, whenever practicable workers should be separated from traffic.

Resources:

- Mobility Committee
 - ODOT’s Mobility Committee is a resource that can provide necessary balanced guidance.
 - Work through your mobility coordinator and the mobility committee to reach resolution.
 - Bring issues forward early in the scoping and design stage to avoid surprises and keep everyone in the problem solving mode.
- *Guiding Principle Decision Tree Form* (see *Chapter 3*, and *Appendix C - Forms* for details)
 - The *Guiding Principle Decision Tree* will help us identify separation options available per work zone.
 - Impacts to safety, mobility, scope, schedule, budget, delay, driver convenience, and ‘other’ impacts shall be identified when assessing separation options.
 - To help guide us through our decision making, the Decision Tree is intended to provide new tools and approaches.



Decision Tree

Evaluate Separation Opportunities, Other WZ Concepts, WZ Devices

Print Form

I-5: That Big Interchange Reconstruction Sec. (Unit 6)
 Project Name (Section) CON05555
Contract No.

I-5 (Pacific Highway)
 Highway 12345
Key No.

Buddy Stillhere
 Project Leader / Project Manager Region 1
Region

I. M. Incharge
 Agency Project Manager

Instructions: For each phase, work through each opportunity on this "decision tree." Add other project-specific decisions as needed. (Add more instructions as needed.)

Will B. Ontimeandunderbudget
 Contractor

Phase: Scoping Project Initiation to DAP DAP to Advance Plans Construction

Opportunities to Evaluate	Possible	Impacts	Stakeholders	Decision
Full road closure	With Governor approval	A very, very long list.	Half the State of Oregon, and the OTA, too.	Not recommend pursuing further
Partial road closure	Some ramps. Do you mean part of a road (e.g. lane?), or part of a lane? Or, one direction at a time?			
Full detour				
Partial detour	Again, one direction at a time? "Directional Detour"?			
Cross-overs	Need to add "On-site Diversion" - in case we want to build a temporary road to the right and not cross over the median.			
Temporary barrier				
Increased clear space				
Decrease exposure time				
Accelerate/time incentives				
Law enforcement OT hours				
Construction Speed Zone Reduction				
Use drums and cones to close lane				
Use automated flagging station				
Use temporary transverse RS upstream of flagging station				
Use additional PCMS upstream to communicate with drivers				
Other:				
ADD ANOTHER ITEM				

734-decision_tree-d (2-11-2016)

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

1 of 1

1.1.1 – GUIDING PRINCIPLE DECISION TREE APPLICATION

The *Guiding Principle* emphasizes ODOT highway work zones are to be managed through the life of a project – from initial scoping, during project development, and throughout construction. Safety for workers and public traffic must be an integral part of the traffic control plan design. That level of safety must be managed throughout the life of the project. Traffic mobility must also be designed into each project and managed through the life of the contract.

The expectation for design teams is to apply the *e Work Zone Guiding Principle* and the *Guiding Principle Decision Tree* at key milestones throughout the course of the project – starting with Project Scoping.

Transportation Management Plan

As part of the commitment to safety and project integrity, ODOT makes the Transportation Management Plan (TMP) a *required* portion of all ODOT highway construction contracts, ODOT maintenance operations and permitted work (e.g. utility work) within State highway right of way. See *Section 1.4*, below, for more information about the TMP, its development and minimum required contents.

1.2 – SAFETY – A PRIMARY FUNCTION

1.2.1 – SAFETY IN TCP DESIGN

Safety is primary in TCP Design. Chapter 6 of the [MUTCD](#) repeatedly emphasizes safety management. ODOT’s perspective regarding the function of a TCP coincides with the fundamental principles, guidance and standards within the [MUTCD](#). If designed with these ideas in mind, the TCP will minimize inconveniences to traffic during construction, minimize the number and severity of traffic crashes, and optimize safety and efficiency for highway workers.

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

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

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

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

ODOT, in accordance with the [MUTCD](#), works to emphasize the purpose and function of a Traffic Control Plan and develop consistent, safe and effective TCP designs.

[MUTCD](#) DEFINITION OF A “TRAFFIC CONTROL PLAN” – Chapter 6A

From Chapter 6 of the [MUTCD](#), the following excerpts discuss the definition and function of a temporary traffic control plan.

At the Planning level:

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

For worker safety:

“Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway. At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.”

The overall picture:

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

THE TRAFFIC CONTROL PLAN

When conducting road work or working within the public right of way in Oregon, a traffic control plan is required. For ODOT highway construction contracts, the traffic control plan must include, as a *minimum*:

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

Project-specific traffic control plan sheets are recommended or required when projects include:

- Complex scopes of work – including multiple shifts in traffic, or where describing the activities in the Special Provisions would be impractical
- Full or partial facility closures – including motor vehicle, bicycle and pedestrian facilities – where a detour is included to reroute roadway users
- Challenging site locations or conditions

Where additional details are needed to add clarity to improve the constructability of the project, development of project-specific plan sheets is encouraged. Include diagrams and engineered drawings to help convey the intended use and placement of traffic control measures and devices. The development of site-specific drawings may not be required for all projects or work activities; but, drawings should be considered for activities or locations where the additional detail would enhance the overall safety for the work area and increase the ease in which the plan is implemented in the field.

Typical Applications from Chapter 6 of the MUTCD, *Typical Application Diagrams* from Chapter 5 of the Oregon Temporary Traffic Control Handbook (OTTCH), and ODOT Traffic Control Standard Drawings (TM800 Series) are intended to provide generic temporary traffic control layouts for a variety of work zone conditions and roadway environments.

1.2.2 – ENGINEERING JUDGMENT

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

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

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

* While being founded on baseline principals or thresholds, some additions or modifications to the TCP may be based largely on an Engineer’s individual experiences and not be previously documented. If invoking engineering judgment to make additions to the TCP, the engineer’s decision process and final recommendation or solution should be well-documented including relevant assumptions. See *Transportation Management Plans* in Section 1.4, below.

1.3 – TCP STANDARDS

1.3.1 - MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES ([MUTCD](#))

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

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

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

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

1.3.2 - OAR & ORS

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

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

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

1.3.3 – ADDITIONAL STANDARDS & REFERENCES

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

- FHWA *Standard Highway Signs (SHS) manual and SHS Supplement* – Includes sign designs for regulatory, warning, guidance and service signing regularly used in TCPs.
- FHWA *Applying the Americans with Disabilities Act in Work Zones: A Practitioner Guide* – Includes overview of requirements and guidance within 1990 ADA, the Proposed Right of Way Accessibility Guidelines (PROWAG), and MUTCD regarding accommodation, protection and mobility of ADA and pedestrians within a work zone.
- AASHTO *Roadside Design Guide* – Includes concepts and general discussions about “clear zone”, longitudinal barrier systems, impact attenuators and other safety hardware devices.
- ODOT *Sign Policy & Guidelines* – Includes designs and functions for regulatory, warning, guidance and service signs specific to Oregon – modifying or supplementing MUTCD and SHS.
- ODOT *Temporary Traffic Control Handbook for Operations of Three Days or Less (OTTCH)* – While not intended for long-duration roadwork activities, the OTTCH is based on the fundamental principles and standards within the MUTCD as well as Oregon-specific traffic control measures. The OTTCH is intended for work zone activities lasting less than three consecutive days – including mobile operations – for both freeways and non-freeway facilities.
- ODOT *Portable Changeable Message Sign (PCMS) Handbook* – Includes useful information regarding the function, application and proper operation of this valuable traffic control device.
- ODOT *Highway Design Manual (HDM)* – While primarily used for the design of permanent roadway facilities, the HDM includes valuable information in the design of temporary roadway alignments and other features.
- ODOT *Transportation Management Plan (TMP) Project-Level Guidance Manual* – Includes information useful in developing the TMP, and documenting project design and work zone safety enhancement decisions.

1.4 – TRANSPORTATION MANAGEMENT PLAN (TMP)

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

Published on September 9, 2004, the Federal Highway Administration released updates to the work zone safety regulations under 23 CFR 630 Subpart J – referred to now as the, “Final Rule on Work Zone Safety and Mobility.” The complete Rule is available on the FHWA web site under the, “Resources” web page of the “Work Zone” section. Search for, “Work Zone Safety and Mobility” or, “[23 CFR 630 Subpart J](#)”.

The Rule updates and broadens the former regulation at 23 CFR 630 Subpart J to address more of the current issues affecting work zone safety and mobility. The changes to the regulation encourage the broader consideration of the safety and mobility impacts of work zones across project development and the implementation of strategies that help manage these impacts during project delivery.

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

A key requirement in the Rule is the development and inclusion of a *Transportation Management Plan (TMP)* as part of the project development and contract administration processes. The FHWA has identified two different categories for a TMP.

Within the New Rule language, a “*Significant Project*” is one that meets the following criteria:

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

ODOT added a third criterion that would identify a project as being a, “*Significant Project*”:

- All projects with a construction budget of \$5 million or more.

As a “*Significant Project*,” the TMP must include all of the following:

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

For a project that does not qualify as a “*Significant Project*,” the FHWA still recommends agencies consider including both TO and SI strategies in their TMPs, when practical. Documentation should still be kept for all design decisions that affect the TCP and construction schedule.

1.4.1 – TRANSPORTATION MANAGEMENT PLAN DOCUMENT

The TMP should be considered as the “project diary” – used by the agency to document and track critical design and implementation decisions made over the course of project development and throughout the implementation of the TCP. TMP development should begin as early as the Project Scoping phase.

The *Transportation Management Plan (TMP)*, and the amount of detail within it, is relative to a project’s scope of work – the more complex the project, the more details and information should be included in the TMP.

The [ODOT Transportation Management Plan Project-Level Guidance Manual](#) is available on ODOT’s Traffic Control Plans Unit website under the “[TCP Resources](#)” link. The *TMP Guidance Manual* should be used as a template to develop the TMP for an ODOT highway construction project.

ODOT TMP MINIMUM REQUIREMENTS

For any ODOT project – identified as a “Significant project” or not - at a minimum, TMPs must include the following:

- A traffic control plan
- A narrative explaining the Scope of Work, work location and duration details; how selected traffic control measures and devices are being used to protect workers and road users.
- A delay estimate for all projects on State Highways with delay thresholds
- An evaluation of the delay impacts, including a discussion of the impact differences between the different options explored
- Copies of the Guiding Principle Decision Tree for each project development milestone:
 - Scoping
 - Project Initiation
 - DAP
 - Advance Plans
 - Plans, Specifications & Estimates (PS&E)
- Copies of the Guiding Principle Decision Tree during Construction, as developed

The *Guiding Principle Decision Tree* is used to document positive separation and safety enhancement alternatives explored, reasons for rejection/advancement, and final decisions made regarding:

- Construction Staging alternatives
- Positive Separation opportunities
- Traffic Control Measures

However, the TMP should also include discussion of other temporary traffic control plan related topics, including:

- Specific materials, equipment needs, or construction techniques
- Sensitive timeframes, critical project components, or other scheduling constraints
- Stakeholder agreements
- Constructability concerns
- Budgetary compromises
- Project site conditions/restrictions

For “Significant Projects”, the Public Information and Traffic Operations and demand management strategies would also be included as part of the TMP document.

Because the TMP is considered a ‘living document’, it will continue to grow and evolve throughout the life of the project development process. Therefore, as the project design evolves, the TMP should be regularly updated with new information that could affect the final design or the implementation of the Traffic Control Plan during constructions.

The documented information within the TMP – including decisions included in the *Guiding Principle Decision Tree*, stakeholder partnership agreements, traffic control measures, and staging options – can be recalled, as needed, once construction has begun. If a proposal is made to modify the TCP, staging or construction schedule, TMP contents can be used to support documented design decisions, protect the integrity of the TCP, project schedule, and stakeholder agreements. TMP contents are ultimately used to minimize traffic delays and provide a safe, efficient work zone for road users and construction workers.

Upon completion of the design – during the “Plans, Specs & Estimate” (PS&E) phase - the TMP should be distributed to Project Team members (including Consultant staff) and the agency’s Construction Project Manager or Coordinator.

ODOT intends to include the TMP in the bidding documents. A copy of the completed TMP will be included in the Bid Documents, and a copy distributed to the ODOT Project Manager.

1.5 – TRAFFIC CONTROL PLAN STRUCTURE

1.5.1 - WORK ZONE LIMITS & COMPONENTS

Work Zone Limits

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

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

“...from the **first warning sign** or high-intensity rotating, flashing, or strobe lights on a vehicle to the **‘END ROAD WORK’ sign or the last** (traffic control) **device.**”

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

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

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

WORK ZONE COMPONENTS

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

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

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

Transition Area – Where road users are directed out of the normal travel path through signing and the placement of traffic control (channelizing) devices on the roadway. The Transition Area requires road users to maneuver in some manner before reaching the work area. Transitions often occur as a lane or shoulder/bike lane closure, lane shift, or a new (temporary) alignment via crossover or on-site diversion. Some Transition Areas may also include shifts in bicycle and/or pedestrian facilities into or adjacent to motor vehicle pathways.

Proper merging and shifting taper lengths; and, inclusion of appropriate channelizing or barrier systems will provide a satisfactory degree of safety and predictability for road users within the Transition Area.

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

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

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

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

OTHER WORK ZONE COMPONENTS

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

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

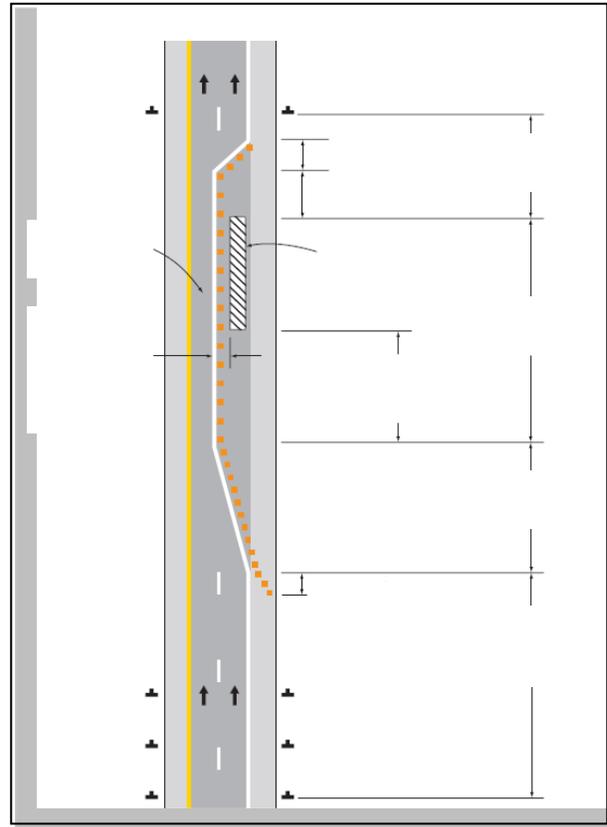


FIGURE 1-1

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

- **Merging Taper** – Used to merge two traffic lanes into one lane. The length of a Merging Taper is equal to “L”. Being based on the pre-construction posted speed, the taper allows drivers to merge safely. For freeways, the Merging Taper length “L” is fixed at 1000 feet.
- **Shifting Taper** – Used to shift traffic laterally. A Shifting Taper length is equal to $\frac{1}{2}$ “L”. Shifting Tapers may be longer – up to “L”, but should not be less than $\frac{1}{2}$ “L” as the taper angle can be too abrupt for drivers and can lead to panicked maneuvers and loss of control of their vehicle.
- **Shoulder (Closure) Taper** – Used to close the shoulder of a roadway. The length of a shoulder closure taper is equal to $\frac{1}{3}$ “L”.
- **One-Lane, Two-Way Traffic (Flagger) Taper** – Set up between the activity area and a flagger station, the Flagger and the taper are used to guide traffic into the two-way, one-lane portion of the roadway within the work area. The length of a One-lane, Two-way taper ranges from 50 – 100 feet.
- **Downstream (Termination) Taper** – Provides a visual cue to traffic that they have passed the work area and are to returning to the original roadway configuration. The length of a Downstream Taper ranges from 50 – 100 feet.

Successive or Multiple Tapers – When designing the TCP, separate successive tapers by a reasonable distance to allow drivers to accomplish one maneuver at a time and readjust their speed. A number of ODOT Standard Drawings suggest distances varying from $2“A”$ to $2“L”$ between the two tapers.

DETOURS and DIVERSIONS – At times, it may be necessary to more aggressively separate traffic from the work area. In this case, there are two common traffic control measures available:

- A *Detour* is used when closing a roadway and traffic is moved from the existing facility to an alternate existing facility – often outside the project limits.
- An *On-site Diversion* is used to move traffic out of its original alignment and onto another part of the existing roadway; or, onto a temporary surface constructed within the project right-of-way or easement (*Figure 1-2*). Traffic is diverted around the work area often using a combination of signing, channelizing devices, barrier, and pavement markings. On-site Diversions can be configured to accommodate all existing traffic lanes, a reduced number of lanes; or, a single, reversible lane controlled by a temporary traffic signal or flagging operations.

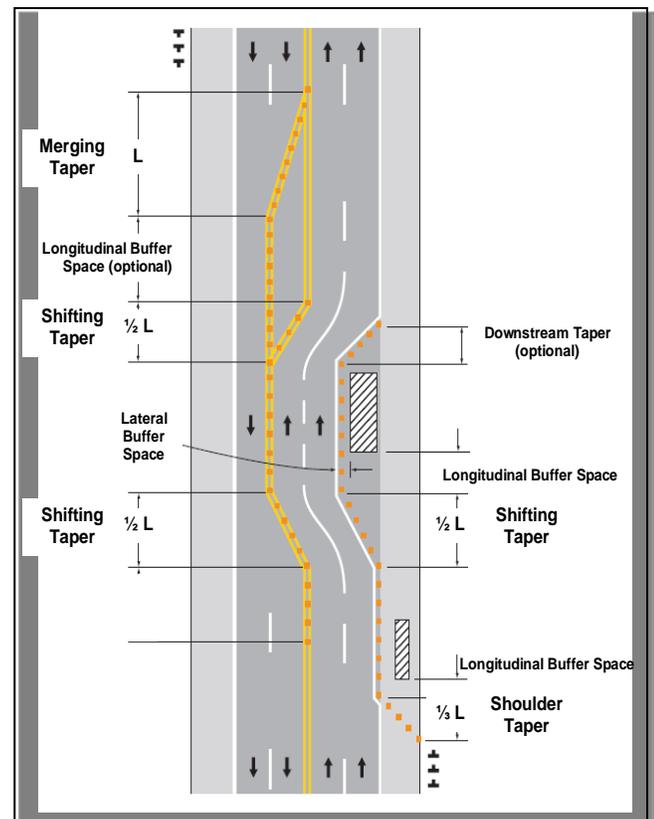


FIGURE 1-2

1.5.2 - TRAFFIC CONTROL PLAN DESIGN FORM

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

A “Written” TCP includes project-specific Special Provisions and applicable [Standard Drawings](#). Written TCPs are common for projects with the following attributes:

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

Examples of projects that greatly benefit from project-specific TCP plan sheets include:

- Bridge replacements or culvert installations, in-kind
- Interchange modifications, signalized intersection/ramp terminal reconstructions
- Full-depth roadway rebuilds, or realignments
- Full roadway closures with detour routes
- Intersection rebuilds or new signal installations that include impacts to pedestrian mobility

See the sections below for more specific information regarding Specifications, [Standard Drawings](#), and TCP plan sheets.

1.5.3 - STANDARD SPECIFICATIONS & SPECIAL PROVISIONS

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

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

STANDARD SPECIFICATIONS

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

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

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

SPECIAL PROVISION “BOILERPLATES”

On the Specification Unit website, there are links to documents known as, Special Provision “Boilerplates.” [Special Provision “Boilerplates”](#) have been developed to accomplish the following:

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

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

“UNIQUE” SPECIAL PROVISIONS

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

“Unique” Special Provisions are on the ODOT Specifications Unit website under the [“Unique Specifications”](#) link. Temporary Traffic Control “Uniques” are located under the “Part 00200” link.

CUSTOM PROJECT-SPECIFIC SPECIAL PROVISIONS

Custom Special Provisions include language drafted from scratch to address project-specific needs or unique features not otherwise addressed by Standard Specifications or other “Unique” Special Provisions available on-line. Custom Special Provisions are not very common – largely because language within the Standard Specifications, Boilerplates, or other “Uniques” can be modified to suit project needs.

1.5.4 - STANDARD DRAWINGS

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

1.5.5 - PROJECT-SPECIFIC CONSTRUCTION STAGING PLAN SHEETS

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

Plan sheets are used to describe how the existing roadway area is divided up between live traffic and the construction site. Plan sheets also identify the type, quantity and location for temporary traffic control devices. See *Chapter 5* for additional temporary traffic control plan sheet information.

1.6 – TRAFFIC CONTROL PLAN DESIGN

1.6.1 – DESIGN CONSIDERATIONS

Chapter 3 – *Traffic Control Measures* provides greater detail regarding the wide variety of issues, factors and details a Designer should consider before beginning their TCP design. Information in this Chapter can be used to focus a Designer’s attention on the critical questions – What, Where, When, How and Why - helping them develop a safe, effective, efficient, biddable TCP.

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

- **SITE INVESTIGATION**

Take the opportunity to learn as much as practical about the exiting features and operations of the project site. Site investigations are invaluable to the designer to get firsthand knowledge of the project site and create accurate traffic control plans. Site investigations should be completed for all projects.

- **SCOPE of WORK**

Understanding the goal of the project, the finished products and any constructability issues associated with completing the project on-time and on-budget.

Chapter 3 includes a number of specific Scope of Work examples and questions the Designer should be asking as they start developing their TCP.

Once the Designer has a confident understanding of both the project site and the scope of work, the Designer can begin looking at the various opportunities for safely managing road users through or around the work zone; and, optimizing the safety and efficiency for the workers.

GUIDING PRINCIPLE DECISION TREE

Designers should begin with the *Guiding Principle Decision Tree* as part of their design documentation process and safety enhancement opportunity analyses identified in the ODOT *TMP Guidance Document*. The *Guiding Principle Decision Tree* allows Designers to systematically step through a variety of traffic control measures, evaluate each option under a number of conditions and determine the feasibility of each option; and, document decisions made regarding the selection or rejection of each option, and reasons supporting those decisions. Chapter 3 includes additional information regarding the *Guiding Principle Decision Tree*. See *Appendix C* for a copy of the form.

Both the [ODOT TMP Project-Level Guidance Manual](#) and the *Guiding Principle Decision Tree* form are available on the ODOT Traffic Control Plans Unit website under the “[TCP Resources](#)” link.

1.6.2 – TRAFFIC CONTROL MEASURES

In developing a TCP, there are several tools and strategies the Designer may employ to optimize the safety and effectiveness of the work zone for both road users and highway workers. Commonly referred to as “Traffic Control Measures” (TCM), they can range from using a single type of traffic control device, to deploying a complex variety or sequence of devices.

EXAMPLES:

- During a paving operation, a Designer may select temporary flexible pavement markers as the TCM to effectively delineate the traffic lanes until permanent pavement markings can be applied.
- For a bridge replacement project, a Designer may use a limited-duration full road closure and a short detour as the TCM to manage traffic and work zone safety.
- Another bridge project may stage the construction of the bridge in two halves and accommodate traffic movement through the work area on a two-way, one-lane roadway. The single, alternating lane paired with a portable traffic signal may be the TCM selected for this project.

Chapter 3 discusses Traffic Control Measures at length and provides a number of other examples of effective strategies a Designer can use to develop a safe, effective TCP.

1.6.3 – PRIMARY DESIGN POLICIES

The design of a temporary traffic control plan requires engineering experience and judgment when determining the use or application of a given safety measure or construction strategy. Design standards and practices must also be applied to ensure consistency, and optimize safety and mobility within the work zone. This manual identifies these standards to emphasize the need for regular and consistent use in TCP design.

The following Design Policies are used to produce safe, consistent and efficient work zones for all road users and construction contractors. See *Chapter 3* for design policy application details and examples.

GUIDING PRINCIPLE and DECISION TREE

The goal and objectives of the *ODOT Guiding Principle* is to be applied throughout the life of the project’s development and construction. The *Guiding Principle Decision Tree* is to be used for each project, and addressed at each of the project’s key milestones to identify and document safety enhancement opportunities.

DESIGN SPEED

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

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

SIGN and DEVICE SPACING

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

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

For temporary signing, spacing is speed-dependent as well. Spacing dimensions, “A”, “B”, and “C”, as shown in the [MUTCD](#) and on Oregon [Standard Drawings](#), are defined in Oregon as:

SPEED (mph)	A (ft.)	B (ft.)	C (ft.)
20 – 30	100	100	100
35 – 40	350	350	350
45 – 55	500	500	500
60 – 70	700	700	700
55 – 70(Freeways)	1000	1500	2640

For additional device spacing information, see the, “*Traffic Control Devices Spacing Table*” shown on TM800 in the Temporary Traffic Control [Standard Drawings](#).

FREIGHT MOBILITY

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

BICYCLE, PEDESTRIAN and ADA ACCOMMODATION

As part of a comprehensive TCP, the design must incorporate mobility and safety needs for all road users – including bicycles, pedestrians and ADA users. TCP designs must include features, alignments, guidance, surfaces and safety appurtenances for bicyclists, pedestrians and ADA users. To optimize its TCP designs, ODOT uses this manual, current Standard Drawings and guidance from FHWA sources – including the FHWA *Applying the Americans with Disabilities Act in Work Zones: A Practitioner Guide* – available in *Appendix E* and on ODOT Traffic Control Plans Unit website.

1.7 –WORK ZONE INTELLIGENT TRANSPORTATION SYSTEMS**1.7.1 - SMART WORK ZONE SYSTEMS**

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

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

ODOT is adapting these permanent technologies for use in its temporary highway construction work zones. Using Portable Changeable Message Signs (PCMS), portable traffic sensors and other system

components, ODOT aims to provide real-time alerts, travel time data, and detailed work zone information to approaching motorists. ODOT has defined these new temporary work zone systems as, “Smart Work Zone Systems” (SWZS).

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

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

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

1.8 – TRAFFIC CONTROL DEVICES (TCD)

1.8.1 - USING TCD TO CREATE A SAFE WORK ZONE

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

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

1.8.2 - TCD PRINCIPLES

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

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

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

1.8.3 TCD CRASH TESTING

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

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

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

- National Cooperative Highway Research Program ([NCHRP Report 350](#)) for devices tested prior to January 1, 2010
- Manual for Assessing Safety Hardware ([MASH](#)) for new or modified devices tested after January 1, 2010
- "[Eligibility for Federal Aid Reimbursement](#)" Process
- [FHWA Work Zone Device Crash Testing](#) – Self-Certifying Process (See Appendix A)

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

1.8.4 – TCD CRASH TESTING CATEGORIES

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

- Category 1** – Low-mass devices. Devices typically [self-certified](#) for crashworthiness.
- Category 2** – Devices with higher mass. Frequently crash tested. Examples include signs/supports, small portable (balloon) lighting,
- Category 3** – Much higher mass and requires correct installation and protection. Mandatory crash-testing. Examples include concrete barrier,
- Category 4** – Devices posing the greatest risk to motorists – Examples include trailer-mounted devices (PCMS, portable signals, Arrow boards, large portable light plants). FHWA crash-testing pending.

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

1.8.5 - THE QUALIFIED PRODUCTS LIST (QPL)

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

NOTE: All TCD moved onto the [QPL](#) can be considered as, "crashworthy". Therefore, a device chosen from the [QPL](#) requires no further proof of crashworthiness. It should also be noted that the FHWA requirement for Category 4 device crash testing is pending. ODOT has a long, successful

record in using these devices within public right-of-way. Further, current ODOT standards and best practices call for additional delineation for these devices when in use, and have specific requirements for removing the devices from the roadway when not in use.

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

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

1.9 – MOBILITY

1.9.1 – MOBILITY PROCEDURES MANUAL

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

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

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

See the [Mobility Procedures Manual](#) for additional information regarding work zone mobility analyses and over-dimensional freight accommodation strategies.

1.9.2 – COORDINATING TRAVEL DELAY ESTIMATES

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

1.10 – DESIGNER RESOURCES & WEB LINKS

1.10.1 - TCP DESIGNER WEB LINKS

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

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

1.10.2 – TRAFFIC CONTROL PLAN CHECKLIST

Appendix D contains a *Traffic Control Plan Checklist* that can be used by Designers as a comprehensive list of temporary traffic control items and measures that might be used within a project. Designers should compare this Checklist with the *Guiding Principle Decision Tree* form found in *Appendix C* to confirm all reasonable positive separation and work zone safety enhancement opportunities have been explored and documented.