Traffic Control Plans Design Manual

12th Edition, May 2016

Chapter 3
Traffic Control Measures (TCM)

CHAPTER
3

CHAPTER 3 – TRAFFIC CONTROL MEASURES (TCM)

3.0 – KEY POINTS COVERED IN THIS CHAPTER

- ✓ The concept of a Traffic Control Measures (TCM)
- ✓ The broad array of Design Considerations in developing a TCP
- ✓ The variety of TCP Design Standards, Practices and Policies
- ✓ Specifications directly related to TCP Design

3.1 – TRAFFIC CONTROL MEASURES (TCM)

A Traffic Control Measure (TCM) can be best described as the combination of a work zone traffic control strategy with the temporary traffic control devices needed to implement a temporary traffic control plan. TCM are used to optimize safety and efficiency of road user movements and the operations of highway workers.

The style and quantity of TCM selected and implemented in a work zone are often proportional to the scope and complexity of the work. TCM can range from one or more simple devices, to an extremely complex system of devices, technologies and human resources. For example, TCM used for a short-duration utility operation may utilize a few temporary signs, whereas a larger, year-long construction project might incorporate multiple traffic control measures, flaggers and numerous devices.

Examples of commonly used TCM include:

- PCMS – For road condition information
- Flagging for 2-way, 1-lane work areas
- Temporary Portable Traffic Signals
- Sidewalk Closure with Pedestrian Detour
- BCD for temporary Bike Lane
- Lane Closures – For needed work space
- Temporary Median Crossovers
- On-Site Diversions
- Rolling Slowdown Procedures
- Advance Flaggers for Extended Traffic Queues
- Temporary Concrete or Steel Barrier
- Smart Work Zone Systems (see “*SWZS”*)
- Limited Duration Full Road Closure with Detour

3.2 – DESIGN CONSIDERATIONS

Due to the unique nature of each work zone, Designers are presented with a broad range of design challenges. This chapter focuses on common considerations the Designer should explore in putting together a TCP and the traffic control measures best suited for their project.

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

GUIDING PRINCIPLE DECISION TREE

To aid in evaluating and documenting the variety of traffic control measures and staging alternatives, Designers should use the *Guiding Principle Decision Tree* form. See *Appendix F* and the ODOT Traffic Control Plans Unit website – under the "TCP Publications" link, for a fillable PDF of the *Decision Tree* form. See *Chapter 1* for additional details regarding the *Guiding Principle* and the *Guiding Principle Decision Tree*.

From the earliest stages of project development (e.g. Scoping), Designers should begin documenting their decision-making processes while evaluating applicable traffic control measures and devices best suited for the project.

The *Guiding Principle Decision Tree* form is a tool TCP Designers can use to help them document the many evaluations and decisions made over the course of the TCP design, as well as, provide a critical component within the *Transportation Management Plan (TMP)* during implementation of the TCP during construction.

As the project design evolves – changes in scope, new site restrictions, modified staging strategies, stakeholder feedback, budgetary shortfalls, constructability issues, etc. may require the TCP Designer to update the TMP with the new information. In these cases, the Designer should revisit the *Guiding Principle Decision Tree* and look for any needed changes to preferred TCM or TCP enhancements. Both the TMP and the *Guiding Principle Decision Tree* will be updated at key milestones during project development to capture new information; and, to reassess and ensure the selected traffic control measures and devices are providing optimal protection for public road users and highway workers.

Designers should complete the form with sufficient detail so as to provide a clear record of what TCM and TCD were evaluated, which were advanced, which were discarded, including the reasons for each; and, the final decision(s) made that have resulted in the design of the TCP.

DESIGN CONSIDERATIONS

A Designer must explore and address the wide variety of considerations that will result in the development of a safe, effective, efficient and buildable traffic control plan. Many of the following considerations can impact the format and content of the TCP, but can also affect issue related to the staging, constructability, duration and cost of the project:

- Scope of Work
- Project complexity
- Staging sequence and durations
- Facility Type, geometry, cross section
- Existing road side features, accesses
- Existing traffic speeds and operations
- Traffic characteristics and behaviors
- Location, topography, climate features
- Positive protection options or opportunities to mitigate worker exposure to traffic
- Construction Schedule and constraints
- Environmental constraints
- Alternative/Accelerated contracting options
- Interagency/Stakeholder impacts

3.2.1 - SITE INVESTIGATION

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

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

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

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

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

DRIVER EXPECTANCY

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

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

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

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

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

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

PROJECT LOCATION and SITE TOPOGRAPHY

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

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

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

ACCESS MANAGEMENT

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

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

3.2.2 - PROJECT SCOPE

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

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

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

Designers should also be looking for opportunities to provide positive protection to separate workers from traffic – or for staging options that might enhance the ability to provide positive protection. The more details you know about your project, the more potential strategies you can develop, the more applicable and effective your traffic control measures will be. Again, use the *Guiding Principle Decision Tree* to document TCM evaluations and design decisions – including positive protection opportunities and other TCM used to optimize public traffic and worker safety.

In reviewing the Scope of Work, the TCP Designer should gather answers to a number of scope-related questions to maximize the design and strengthen the integrity of the TCP. Below, are some example lists of questions for a given scope of work.

- ***BRIDGE REPAIR or BRIDGE REPLACEMENT***
  - Building a new bridge, or repairing an existing bridge?
    - If new, is the bridge being built in a different location, or same location?
    - Are there plans for demolition and removal of the existing bridge?
  - How is the existing bridge configured?
    - Would the structural configuration allow the bridge to be partitioned to allow for staging traffic on a portion of the bridge?
  - Are there in-water work limitations?

- Can traffic capacity on the bridge be reduced during construction?
- Can the road be closed (long or short-term), and traffic detoured?
    - Are practical alternate routes available as detours?
- Is the construction schedule being accelerated? If not, can it be?
    - Is the project critical enough to warrant incentives for early completion?
- Are there geometric, topographical or other environmental constraints?

Similar to bridge projects, answers to several questions should be collected for projects involving pavement reconstruction or preservation, as well as "Modernization" projects that construct or rebuild larger highway segments or facilities:

- ***PAVEMENT PRESERVATION***
    - What is the roadway type – freeway, high-speed, urban, mountainous, etc.?
    - What is the extent of the work – overlay, grinding, and full-depth reconstruction?
    - What type of material is being used to repair/replace the existing pavement?
    - Can multiple lanes be closed to accelerate the work?
    - Can the road be closed completely (long or short-term)?
    - How extensive is the access control within the project limits?
    - Should the project be accelerated?
- ***NEW ROAD CONSTRUCTION or MODERNIZATION***
    - Are geometric changes being made to the alignment?
    - Is capacity being added to the new facility – widening, etc.?
    - Is the control of traffic being changed - adding, removing a traffic signal(s)?
    - Are local public services (transit, mail, schools, police/fire) being affected?

LEVEL OF COMPLEXITY

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

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

3.2.2 - PROJECT DURATION

Many traffic control measures depend on the duration of the project – translating as the duration traffic may be exposed to a potential hazard. Managing this risk, as well as the construction schedule – in whole or in part – has a key role in the final content and configuration of the TCP.

Work zone hazards present for short durations (3 days or less), are often mitigated using measures that may differ from those used to address more complex conditions that are in place for much longer. For example, using portable signing and an increased spacing of channelizing devices for the purpose of minimizing worker direct exposure to live traffic might be used for operations of one day or less. Longer, stationary projects may include post-mounted signs, PCMS, temporary traffic signals, concrete barrier and other features to establish the presence of a work zone that could be in place for days, weeks or years.

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

- Facility type and Location (urban, rural)
- Traffic volumes
- Posted speeds, Running speeds
- Crash history, Known safety issues (e.g. ODOT “SPIS” site information)
- Worker exposure to live traffic, Positive protection options
- Availability and practicality of a full road closure with a detour

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

- 24-hour Flagging operations vs. a Temporary Traffic Signal
- Temporary concrete barrier vs. Channelizing devices (cones, tubular markers, drums)
- Temporary pavement markings vs. Channelizing devices
- On-site Diversion vs. Full Road Closure with detour vs. In-place staging plan
- Static, rigid, post-mounted temporary signs vs. Roll-up signs on portable sign supports

DEVICE QUANTITIES

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

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

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

- Channelizing devices: Consider +10-20% depending on proximity to live traffic
- Pavement markings (paint stripe): Consider a second application for temp. stripes
- Pavement markers (reflective, flexible): Consider replacement amount for high traffic areas
- Temporary signs: Not typically adjusted for winter shutdowns

3.2.3 - PROJECT SCHEDULES

Be aware of projects with "accelerated" construction schedules, or projects with time-critical components that must be completed within a specific timeframe. Examples include projects with detours, bridges on critical highways or freight routes; or, routes with high traffic volumes and a high level of importance to the region or local infrastructure.

Projects with an aggressive completion schedule, or time-critical components, may include unique construction materials or equipment that might require additional TCM and project-specific specifications to accommodate the construction schedule. Communicate regularly with the Project Manager's office and Project Development teams, watching for atypical construction strategies that would trigger the need for special traffic control measures within the TCP.

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

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

3.2.4 - COMMUNICATION AND INTERACTION

Maintain frequent communication with the Project Leader and other members of your Project Development Team regarding relevant details that may affect the TCP. The Project Leader should also be able to update Designers with stakeholder inquiries or comments; or, agreements made between the agency and stakeholder groups.

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

Communicate regularly with appropriate technical discipline representatives within your agency – Bridge, Roadway, Environmental, and Right-of-way Sections, etc. Technical groups often provide important data Designers may use to simplify or streamline the TCP by eliminating impractical or unfeasible staging concepts.

CONSTRUCTABILITY REVIEW

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

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

3.2.5 - TRAFFIC CONTROL PLAN FORM

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

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

- ***"WRITTEN" TCP***

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

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

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

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

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

- ***TCP with PLAN SHEETS***

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

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

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

3.3 – TCP DESIGN POLICIES & PRACTICES

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

3.3.1 – POSITIVE PROTECTION

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

Project-specific engineering studies and agency guidelines typically consider expected work zone conditions along with the function and advantages/limitations of various measures and devices that may be included in the TCP.

The AASHTO Roadside Design Guide (RDG) states, "…the design and selection of work zone safety features should be based on expected operating speeds and proximity of vehicles to workers and pedestrians."

GUIDING PRINCIPLE DECISION TREE

In the early development of the TCP, Designers should use the *Guiding Principle Decision Tree* form to evaluate different opportunities for positive protection, and document decisions made regarding the selection of traffic control measures and devices needed to best provide the desired level of positive protection.

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

POSITIVE PROTECTION DEVICES

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

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

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

Steel Barrier – While not widely used in Oregon and currently on the ODOT's Conditional Use List, steel barrier is gaining ground in its consideration as an effective positive protection device. Steel barrier has several advantages over concrete barrier, including:

- Low transportation costs
- High length/hour installation rates
- Durability
- Ease of on-site portability
- Low weight/foot dead load for bridge applications

Steel barrier can be as effective as concrete barrier in providing a safe and effective positive protection device with minimal deflection, when properly secured to the pavement surface.

- ***Other Considerations*** – To minimize the deflection of steel barrier, it must be secured to the pavement per manufacturer installation instructions. "Unsecured" steel barrier, however, can deflect between 6-13 feet when impacted by a full-size pickup truck at an angle of 25^0, at a speed of 100 km/h (62.1 mph) [per MASH crash testing].

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

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

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

A TMA should be placed in advance of the object or workers being protected, as shown in Table 3.1, below, or as approved by the Project Manager (Engineer). A TMA is _not_ intended for long-term protection in a single location, and should be limited to a single location for three consecutive days or less.

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

TRUCK-MOUNTED IMPACT ATTENUATOR (TMA) PLACEMENT (*feet*)

		TMA Support Vehicle Weight	
		9,900 - 22,000 lb	> 22,000 lb
STATIONARY OPERATIONS[1] (Barrier Vehicles)		(For TL-2 rated TMA)	(For TL-3 rated TMA)
Posted Speed:[3] (mph)	≤ 45	100	75
	50 - 55	*	100
	> 55	*	150

		TMA Support Vehicle Weight	
		9,900 - 22,000 lb	> 22,000 lb
MOBILE OPERATIONS[2] (Shadow Vehicles)		(For TL-2 rated TMA)	(For TL-3 rated TMA)
Posted Speed:[3] (mph)	≤ 45	100	100
	50 - 55	*	150
	> 55	*	175

* TL-2 rated TMA is not suitable for these speeds. Use a TL-3 rated TMA.

1 - Distances shown are between front of the TMA support vehicle and beginning of the area or equipment being shielded by the TMA.

2 - Distances shown for mobile operations are appropriate for support vehicle speeds up to 15.5 mph.

3 - Posted Speed refers to the pre-construction posted speed of the facility on which the TMA is being used.

TMA PLACEMENT – Table 3.1

POSITIVE PROTECTION CONSIDERATIONS

Effective as of December 4, 2008, the FHWA published the Temporary Traffic Control Devices Rule (_23 CFR 630, Subpart K_) that provides additional information and emphasizes the need to appropriately consider and manage worker and road user safety as part of the project development process. The Rule provides guidance on key factors to consider in reducing worker exposure and risk from motorized traffic. It also requires highway agencies to consider positive protection where such devices offer the highest benefits to worker safety, such as situations where workers may be at increased risk of serious injury from exposure to traffic.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

As examples:

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

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

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

POSITIVE PROTECTION DEVICE SUPPORT TOOL

From the *ATSSA Guidelines on the Use of Positive Protection in Temporary Traffic Control Zones*, the "*Decision Support Tool for Selecting Various Positive Protection Devices"* table (*Table 3.2*) gives Designers guidance on the variety of devices available and an equally variable set of conditions where applicability, benefits, costs and other factors can be compared, evaluated and used to select the protection device best for their project.

Table 3.2 – Positive Protection Device Selection Decision Support

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

3.3.2 – TCP DESIGN EXCEPTION PROCESS

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

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

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

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

3.3.3 – ABRUPT EDGES

Abrupt edges result from a variety of highway construction activities:

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

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

PAVING OPERATIONS

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

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

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

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

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

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

COLD PLANE PAVEMENT REMOVAL ("GRINDING")

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

EXCAVATIONS OR TRENCHING

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

3.3.4 – BICYCLE AND PEDESTRIAN ACCOMMODATION

As part of ODOT's commitment to bicycle and pedestrian transportation, considerations should be made during the development of the TCP to provide safe, efficient and accessible facilities for bicyclists and pedestrians.

Pedestrian accommodation requirements are described in the Public Right-of-Way Accessibility Guidelines (PROWAG), section R205: "*When a pedestrian circulation path is temporarily closed by construction, alterations, maintenance operations, or other conditions, an alternate pedestrian access route complying with sections 6D.01, 6D.02, and 6G.05 of the MUTCD shall be provided. Where provided, pedestrian barricades and channelizing devices shall comply with sections 6F.63, 6F.68, and 6F.71 of the MUTCD*"

A pedestrian circulation path may or may not include a sidewalk. When no sidewalk exists within the project limits, but pedestrians and bicyclists use the shoulder, a temporary circulation path shall be made available that matches the level of accessibility that existed before per 3.3.5.

When existing sidewalks and/or bicycle facilities exist within or adjacent to project limits, and facilities are affected by construction or construction staging, adequate temporary facilities, and access to them, ***shall*** be provided as part of the TCP, and shall meet all applicable ADA standards.

Where it becomes impractical to provide a temporary facility – due to space limitations or other physical site constraints – alternative measures should be developed and implemented to accommodate these road users, including strategies such as:

- Detour routes using adjacent existing facilities that minimize out-of-direction travel
- Partnerships with local transit providers (e.g. Tri-Met, Cherriots, LTD) to provide discounted or complimentary passes
- Shuttle services provided by private transportation vendors

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

SPECIAL DESIGN ENVIRONMENTS

The following represent design environments that Designers should be aware of as they begin their designs for bicycle and pedestrian accommodation. Each traffic control measure or work zone condition must accommodate bicycles and pedestrians, or at least identify an alternative means to do so:

- **Temporary and Portable Signals**: Design may require pre-emptive push-buttons and associated signal timing. If a crosswalk is closed at a signalized intersection, each applicable Pedestrian Crossing Signal Head should be covered, the existing push-buttons disabled, and the crossing itself should be signed and include detectable barricades.
- **Closure of Shoulders, Sidewalks, Bike Lanes or Multi-Use Paths**: Provide equal or better facilities to allow safe, efficiently travel through or around the work zone. Note that two-way, one-lane work zones often provide minimal operational widths for vehicles, and may omit a standard shoulder normally used by bicycles, pedestrians or other road users.

- **Urban/Suburban Intersections**: Scope of work often includes work on all four corners of an intersection(s). In some urban/suburban environments, viable detours, or the location for adequate temporary facilities, may be limited. Consider the use of construction easements to provide the additional space needed to include a temporary pedestrian facility adjacent to the work area – one that would minimize out-of-direction travel and encourage pedestrian use.
- **Construction Details and Staging Considerations**: TCPs must provide enough detail to allow for the construction of the project, but also accommodate bicycles and pedestrians. For intersection projects, in particular, the TCP must break up intersection work into enough Stages that would minimize out-of-direction pedestrian travel. To meet this goal, one corner of an intersection should be affected at a time.

  Plan sheets developed specifically for pedestrian accommodation should be drafted at a larger scale (e.g. 1”=50’) and should include details for:

  - Intersection curb ramps
  - Closure points
  - Detour routes
  - Surfacing design/designation
  - ADA-specific accommodations.

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

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

3.3.5 – PEDESTRIAN ACCOMMODATION DESIGN

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

The principles discussed in the *standards* in the MUTCD, Sections 6C, 6D (.01, .02), 6F (.63, .68, .71) and 6G (.05); and, the ODOT/APWA Standard Specifications and ODOT Standard Drawings address minimal requirements needed to accommodate pedestrians in work zones. .

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

NOTE**:** Schools, shopping malls, theatres, arenas and similar pedestrian volume generators will result in sudden, large volumes of pedestrians in a concentrated area or section of the work zone. Carefully consider the location and length of needed temporary pathways to safely and effectively guide pedestrians through or around work zones in these areas.

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

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

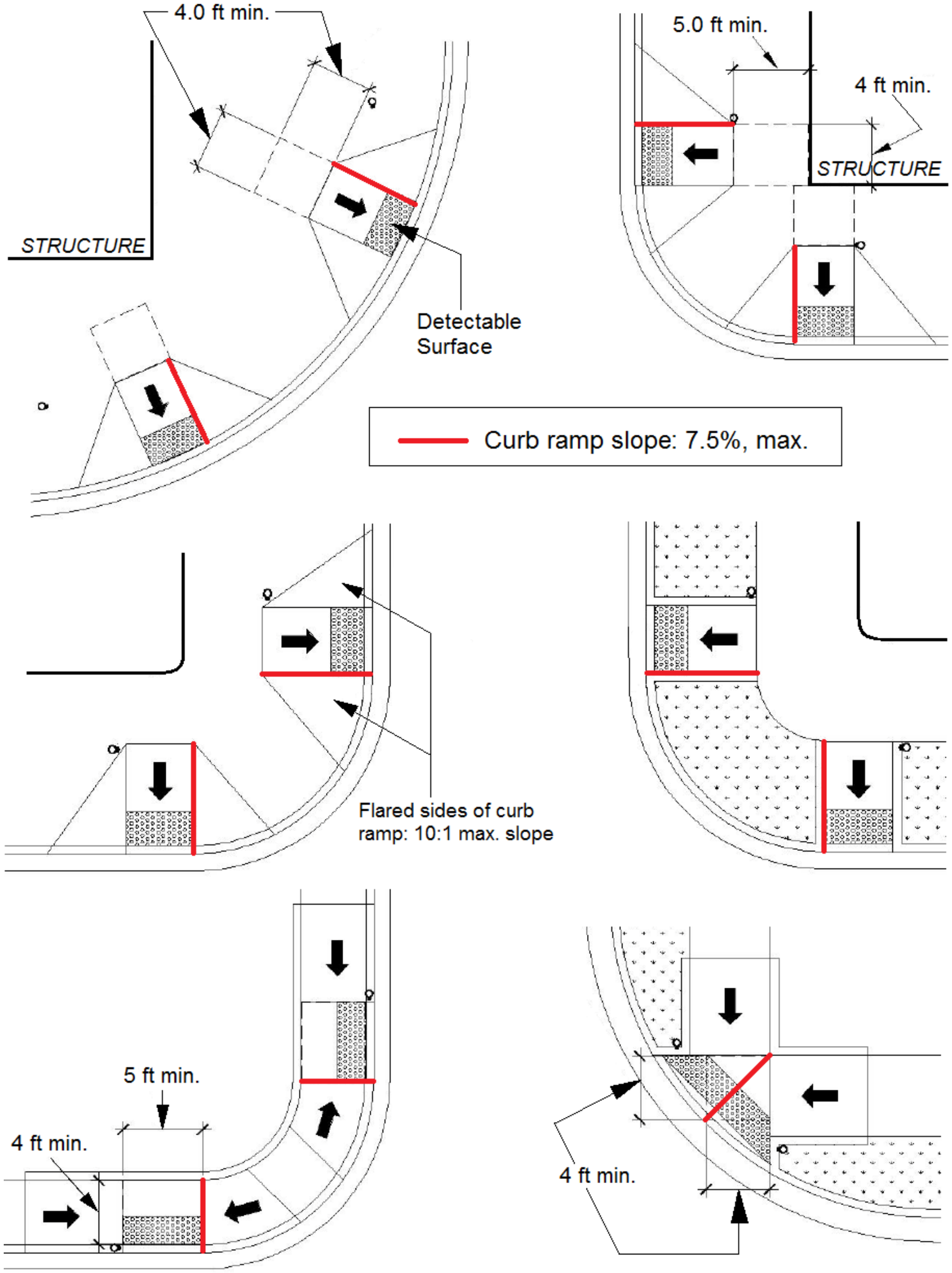
PEDESTRIAN ACCOMMODATION PRINCIPLES

When accommodating pedestrians in highway construction work zones and developing a pedestrian-specific temporary traffic control plan, address the following:

- Do not lead pedestrians into conflicts with public traffic, construction vehicles, equipment, or operations; or, hazardous materials
- Where practical, when directing pedestrians across a roadway, use existing intersection corners and crosswalks – marked or unmarked. For route continuity and to meet pedestrian expectancy, avoid developing temporary mid-block crossings. An existing marked mid-block crossing may be used to shorten pedestrian routes.
- Provide a convenient, contiguous and accessible path that equals or exceeds, as practical, the existing pedestrian facilities.
- Minimize out-of-direction travel for pedestrians, and
- If closing a pedestrian route, sign the closure in *advance* at the nearest crossing or diversion point. Avoid having a pedestrian route double-back on itself. Pedestrians are not likely to walk one block beyond the closure to the next crossing and then walk one block back on the other side of the road. They will likely either cross before the work zone impact (if visible), or cross mid-block, which may be unsafe or leave the pedestrian within the work area.
- Designers should confirm if visually impaired pedestrians can be expected in the work zone by a number of means, including:
    - Personal investigations and/or collecting manual counts
    - Contact local agency/organization sources
    - Contact the Oregon Commission for the Blind – (888) 202-5463; ocb.mail@state.or.us; or, www.oregon.gov/blind
- Provide temporary facilities that meet ODOT Standards and ADA-compliant technical requirements, including the following:
    - Maximum design running slope of 7.5% (as constructed for crosswalk curb ramps (see *Figure 3.1*, below)
    - Maximum design cross slop of 1.5% (as constructed) on sidewalks, curb ramps and landings
    - 60-in. sidewalk widths; or, 48-in. widths with 60-in. x 60-in. level landings (max. 2% slope) every 200-ft
    - Continuous and detectable surfaces with no vertical drops or edges

- See ODOT Roadway Standard Drawings related to *Curbs, Islands, Sidewalks and Driveways* (RD700 series) for details specific to sidewalk curb ramps, sidewalk grades and cross-slopes, etc. Temporary pedestrian facilities are to be equal to or improve upon existing facilities. These details should be referenced or incorporated into the TCP to meet this requirement.
- Coordinate with local agencies, as necessary, if alternate pedestrian routes would utilize their facilities. Ensure pedestrian access and TCD placement on their facilities are approved prior to your project being released for advertisement.

CURB RAMP DETAILS –Figure 3.1



PEDESTRIAN CHANNELIZING DEVICES – SELECTION & PLACEMENT

Providing a well-delineated, ADA-compliant pathway is critical in safely and effectively guiding pedestrians through or around the work zone. In determining a suitable system for separating and guiding pedestrians through or around construction work areas, *Table 3.3*, below, may be used:

PEDESTRIAN ACCOMMODATION DEVICE SELECTION – Table 3.3

POSTED SPEED (mph)	PEDESTRIANS ANTICIPATED		PEDESTRIANS NOT ANTICIPATED [(4)]	
	Between Traffic & Pedestrians [(1)]	Between Work Area & Pedestrians	Between Traffic & Pedestrian Space	Between Work Area & Pedestrian Space
≤ 35	Rigid barrier system (steel, concrete, or plastic)	PCD [(2)]	Channelizing devices[(3)]	Channelizing devices, chain link fence, barrier systems
≥ 40	Pedestrian detour, barrier, or separate temp. pedestrian facility		Channelizing devices[(3)]	Channelizing devices, chain link fence, barrier systems

(1) Assumes pedestrians share same surface as the traffic lane or shoulder. Blunt ends exposed to vehicular traffic must be protected with proper end treatment. For pedestrian facilities on raised/curbed sidewalks, or separated from roadway, channelizing treatment is optional.

(2) Chain link fence with inserts, barrier, or other rigid screening system may be used to control debris or “gawking”; however, PCD or other ADA-compliant system must be placed in front of rigid system to provide detectable pathway for pedestrians.

(3) Cones, tubular markers, plastic drums, or PCD may be used. 10-20 ft device spacing preferred. Do not use chain link fence.

(4) Designers should confirm a lack of: Existing pedestrian facilities, Indications of pedestrian traffic, Pedestrian generators immediately adjacent to the work zone. Local sources can also help to confirm unanticipated or no pedestrian volumes.

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

TEMPORARY PATHWAY ALIGNMENTS

Where a temporary pedestrian pathway alignment is highly varied, or differs dramatically from the original facility, use PCD on *both* sides of a temporary pathway. Where the pathway parallels existing facility, and only beginning and ending pathway alignments vary, PCD may be limited to beginning and end portions, and along non-traffic side of pathway.

Use *Table 3.3* as initial guidance in determining the appropriate channelizing device for pedestrian work zone accommodation. Suggestions are based on posted speeds and anticipated pedestrian traffic volumes. Use the following additional factors in determining final device selection:

- **Project Duration** – Longer projects can warrant placement and cost of more substantial pedestrian control measures.
- **Facility Type & Traffic Volumes** – Divided highways, arterials and other high-volume facilities often attract transit services and higher pedestrian volumes; and thus more likely warranting ADA-compliant devices for pedestrian management.
- **Alternate Pedestrian Routes** – On-site alternate pedestrian routes can often be preferred due to shorter lengths, consistent terrain, and accessibility. However, where staging impacts on-site routes, local detour routes may be available and can help decrease risks related to exposure to work activities. Both route options must provide for the protection of pedestrians, be properly signed, and accommodate all ADA users.
- **"Outside The Box" Alternatives** – Occasionally, neither on-site pedestrian routes, nor local detours are viable. In these cases, more creative means of pedestrian transport should be considered and weighed against traditional TCM. Partnerships with public transit, taxi and shuttle services may provide acceptable levels of pedestrian mobility.
- **Available ROW Widths** – As with constructability issues, some locations will not have adequate width to provide safe, effective, ADA-compliant pedestrian facilities. Alternative measures should again be explored.

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

DEVICE PLACEMENT

Placement of pedestrian channelizing devices will vary depending on a number of factors, including the location of pedestrians with respect to the hazard(s) – e.g. live traffic, construction activities, surface conditions, work area hazards, etc., as is discussed in *Table 3.3*.

- **Between Pedestrians and Traffic** – In cases where the project impacts the existing pedestrian facility and pedestrians may be forced to share the same roadway surface as motor vehicles (e.g. a closed lane or shoulder), the preferred solution is to develop a reasonable-length detour route. However, if the detour route is not practical, consider using a rigid barrier system (concrete, steel or plastic (water-filled)) on the roadway surface to separate vehicles from pedestrians.

  Also, consider developing alternate pedestrian routes

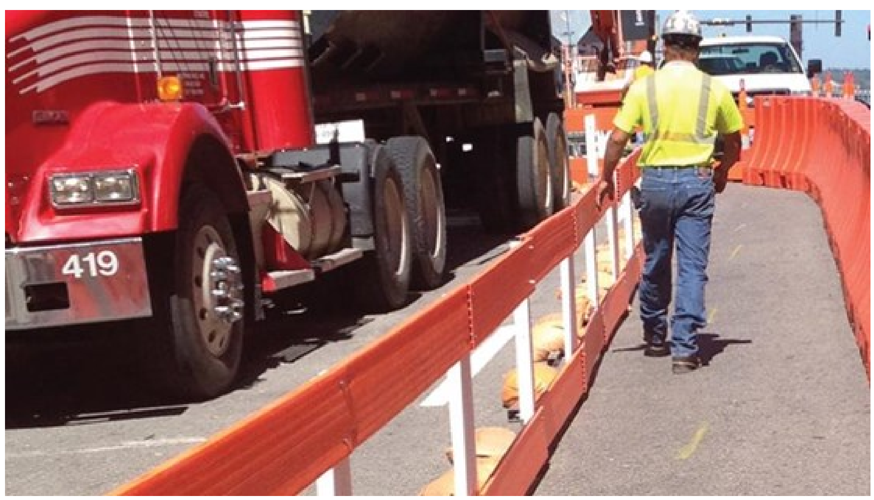
Obsolete **"Work Area Fencing" (Not ADA-compliant)**

Pedestrian Channelization Device (PCD) (ADA-compliant)

through a parking lot or similar areas by means of a construction easement or other agreements with property owners. Use PCD on both sides of the pathway to channelize these temporary pedestrian routes.

Do not specify "Work Area Fencing" to delineate temporary pedestrian routes, or to separate pedestrians from a work area.

- **<u>Pedestrians and The Work Area</u>** – Use PCD between pedestrians and the active construction work area when the following conditions apply:
    - Pedestrian traffic must pass along-side the work area. The "work area" may include active or inactive work, the storage of equipment and materials, or empty space for contractor access/staging purposes.
    - If work area hazards are present on both sides of the pedestrian pathway, PCD should be placed on both sides of the pathway.



COVERED PATHWAYS

Where work activities take place above the pedestrian pathway, or falling debris is a concern, the TCP should include directions to contractors to provide a canopied or covered pedestrian walkway in those areas. Covered walkways should be well-lit for nighttime use.

PATHWAY LIGHTING

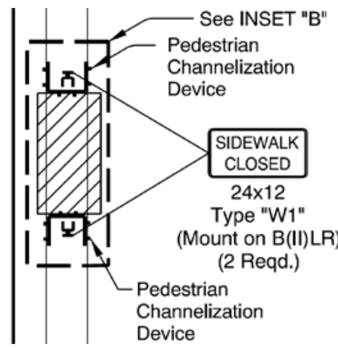
Pedestrian facilities should be adequately lit for nighttime use. Existing lighting may be used, but supplemental lighting may be needed for temporary covered pedestrian pathways.

TEMPORARY SIGNING

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

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

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



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

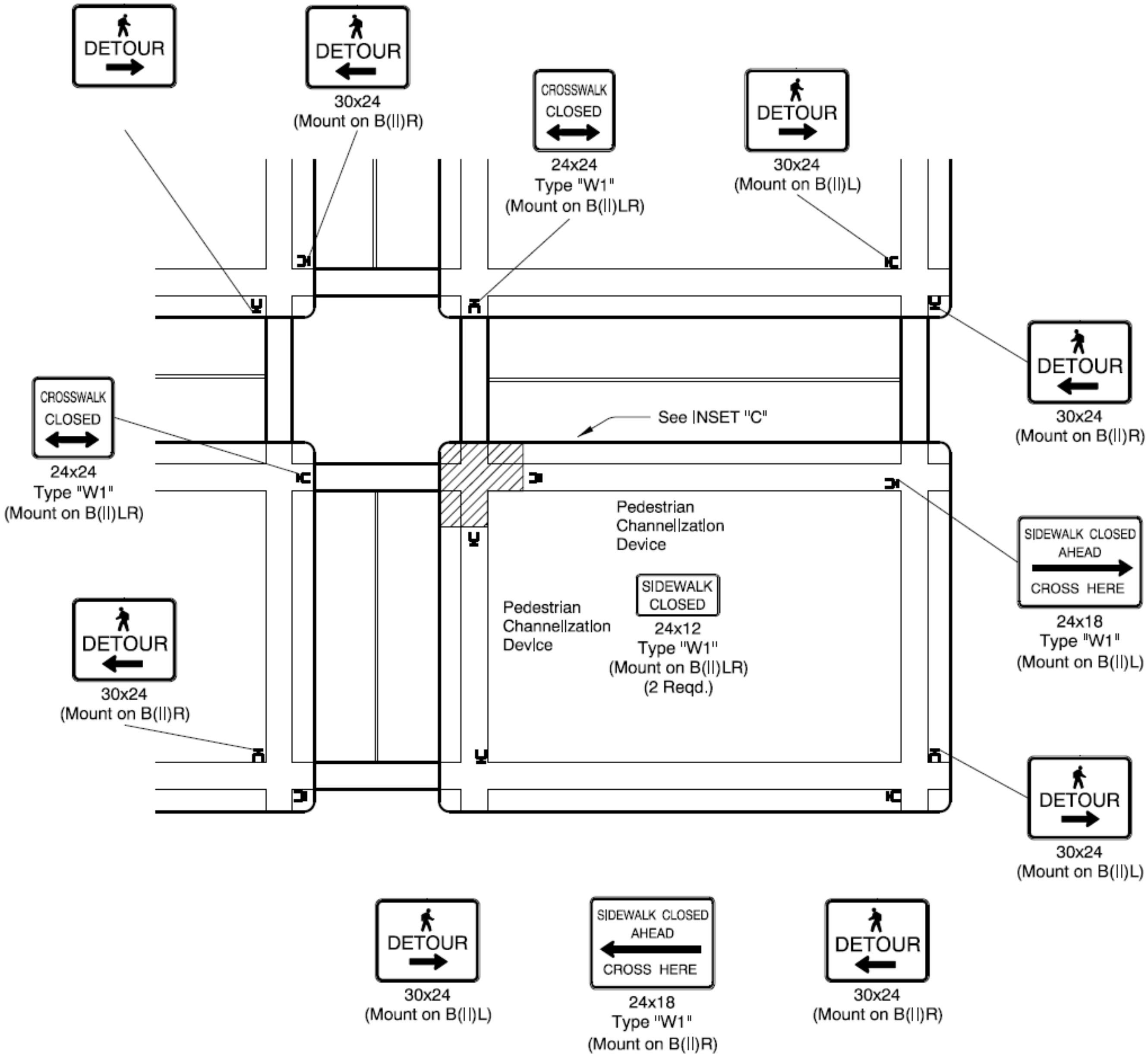
(1) **Closure Points**: PCD are an effective means for keeping pedestrians from venturing beyond the intended point of closure – especially critical where closure points are immediately adjacent to an active work area, or location that could result in significant injury or death for the pedestrian. In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

(2) **Detectable Barrier:** PCD are also effective in providing a detectable barrier – a device designed to be detectable to visually impaired users of long canes having low vision.

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

(4) **Continuous Route Signing**: Adequate, clear signing must be continued at reasonable intervals along the *entire* alternate route, for *both* directions. "Reminder" signing may be needed at each intersection, or at key turns along the route. In some cases, multiple closure points may be necessary to construct a single, desired alternate route for pedestrians. See ODOT Standard Drawing TM844 (excerpt, below) for additional details.

PEDESTRIAN ROUTE SIGNING – TM844 Detail



3.3.6 – BICYCLE ACCOMMODATION DESIGN

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

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

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

BICYCLE ACCOMMODATION ISSUES

- Do not lead bicyclists into conflicts with public traffic, construction vehicles, equipment, operations; or, hazardous materials
- Provide a convenient, contiguous and traversable path with an equal or better degree of accessibility than the existing bicycling route.
- Providing a separate roadway space (e.g. shoulder, bike lane) for bicycles is preferred. Use channelizing devices to separate bicycles from traffic if delineating a temporary pathway/alignment.
- Where roadway width is not available, explore detour routes for bicycles. Develop a thorough signing plan for the detour. Include regulatory bicycle exclusion signs to keep bicycles out of the work area and encourage use of the detour route.
- Coordinate with local agencies, as necessary, if alternate bicycling routes would utilize their facilities. Ensure bicycle traffic and TCD placement on their facilities are approved prior to your project being released for advertisement.
- For pre-construction posted speeds of 35 mph or lower, where neither roadway width, nor alternate routes are available, a "shared roadway" condition could be provided. Designers should apply for a 10 mph temporary Speed Zone Reduction for the section where bicycles will be on the roadway. Include "Bicycles ON ROADWAY" signs for additional mitigation.

"Outside the Box" Alternatives

Occasionally, neither on-site roadway width, nor local detours are available. In these cases, more creative means of transporting bicycles should be considered and weighed against traditional measures. Partnerships with public transit or private shuttle services have been used in the past to maintain acceptable levels of bicycle mobility. Consider temporary bus/shuttle stops, information kiosks, "hotline" phone numbers, etc, to provide an effective transportation means for cyclists.

TEMPORARY SIGNING

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

- A significant number of bicycles can be expected. Local agencies, Chambers of Commerce, and other resources may be helpful in determining likelihood of bicycle presence.
- When an existing bicycle facility (e.g. bike lane, multi-use path) is impacted by construction and cyclists must share a traffic lane, or the shoulder width is narrowed to 3-feet or less.

Include the "Bicycles ON ROADWAY" (CW11-1) sign for the conditions described above, and for locations and situations such as:

"Bicycles ON ROADWAY" (CW11-1)

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

See Chapter 6 of the ODOT Sign Policy & Guidelines for additional sign details. The CW11-1 sign may be fabricated using rigid substrates (plywood, sheet aluminum), or roll-up sheeting.

Temporary signing can also be helpful in identifying the location, or beginning and ending points of a temporary bicycle pathway. While standard sign designs should be considered first, project-specific sign designs may be necessary.

Temporary Bicycle Signing Examples:

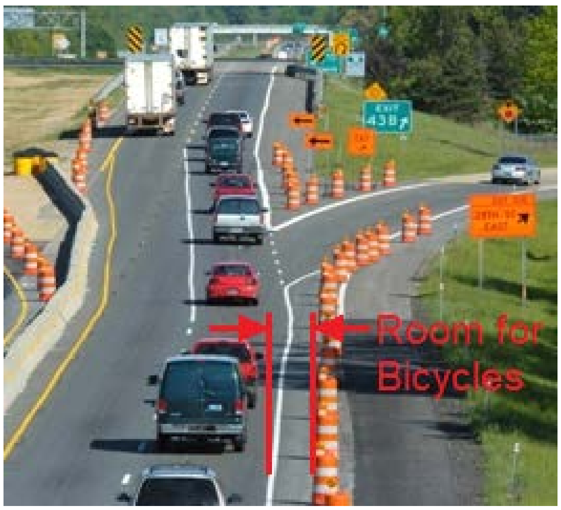
UNIQUE SPECIAL PROVISION

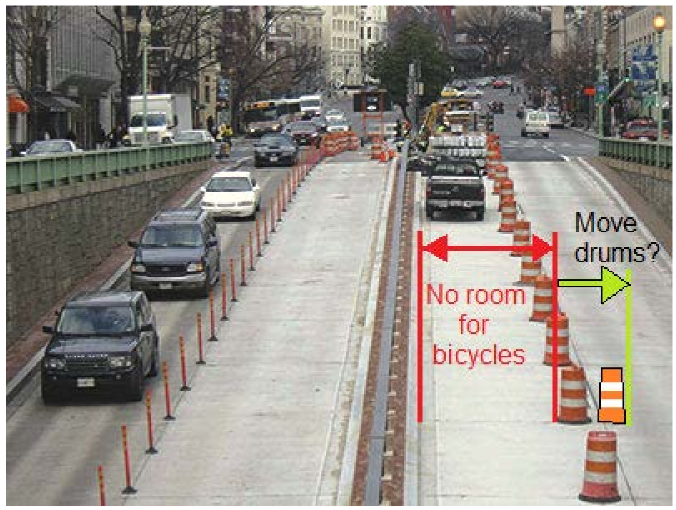
Include the "Bicycles On Roadway" *Unique Special Provision* language from the Specifications Unit website into your project Special Provisions. The Unique Special Provision also includes additional information regarding the application and installation of the signs.

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

CHANNELIZING DEVICES

When construction staging creates a situation where a shoulder of 5-feet or more can be maintained between a traffic lane and the work area, Designers should show enough detail on TCP plan sheets to clearly convey the proper location of channelizing devices that will retain enough of the shoulder width to accommodate bicycle traffic. In these cases, the devices should be shown immediately adjacent to the work area (e.g. longitudinal saw cut, excavation, pavement overlay edge, etc.), or as far from the edge of the traffic lane to optimize the width of the shoulder for bicycle traffic. See the photos below.





Include cross-section details at multiple locations to emphasize the proper placement of devices with respect to the bicycle travel space. Designers should include additional notes or details to clarify the intent of how bicycles are to be accommodated in the work zone.

As the level of detail for bicycle and pedestrian accommodation is often higher and more site-specific than it is for motor vehicles, the benefits of including bicycle-specific details on the TCP sheets may be more apparent.

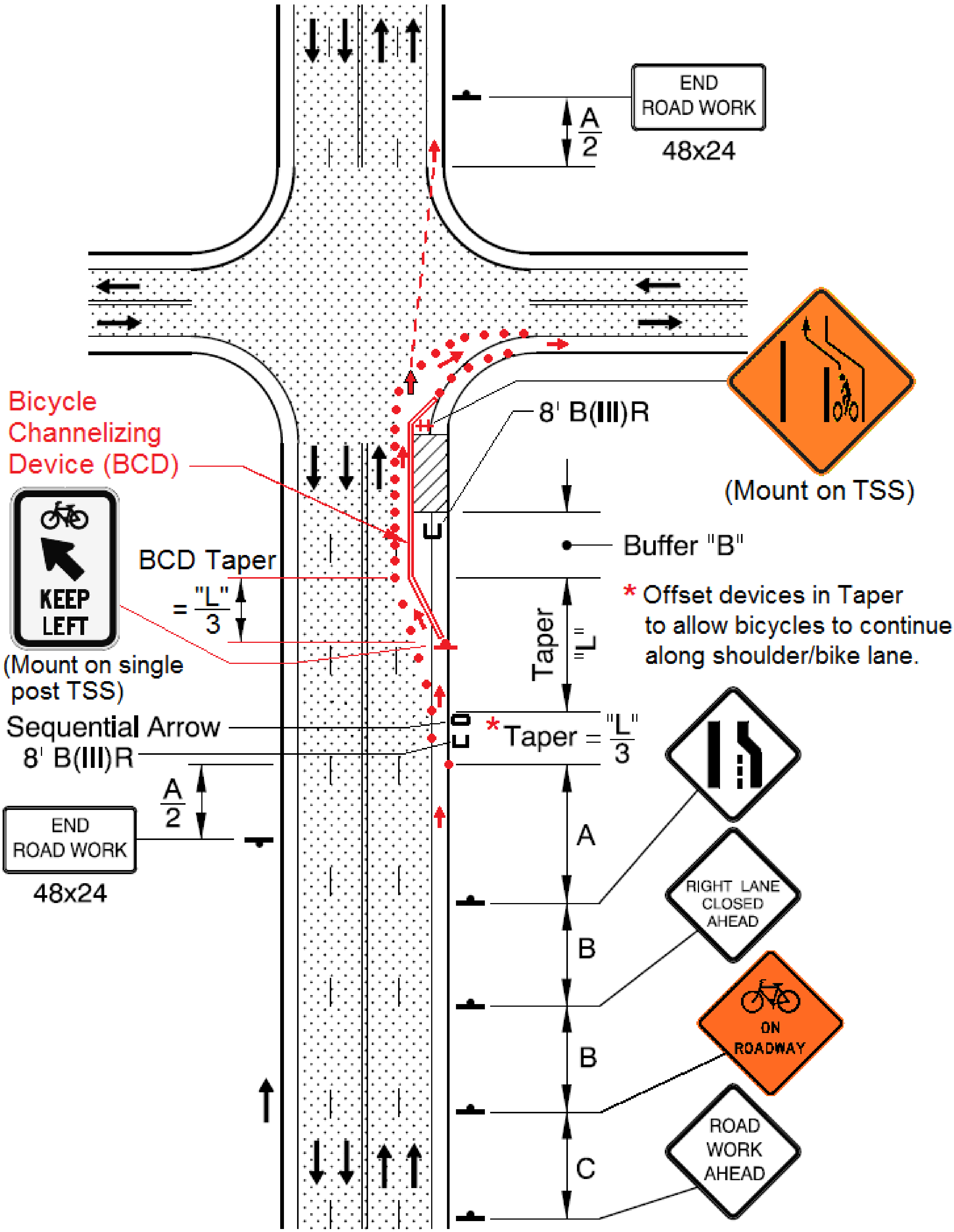
BICYCLE CHANNELIZING DEVICE (BCD)

To help agencies and contractors better manage work zone safety and liability, and provide a safer travel space for bicycle traffic, the Bicycle Channelizing Device (BCD) can be included in the TCP and placed between bicycle traffic and the active work area.

The intent of the BCD is to guide bicyclists along a designated path, and encourage them to stay on the roadway and out of the active work area. BCD will typically be placed on the right, between the active work area and the roadway space identified for bicycle traffic.

Where a temporary bicycle pathway alignment may differ from the motor vehicle alignment, BCD placement along the edge of the active work are should be considered. An additional alignment of individual channelizing devices (cones, drums, etc.) may be placed on the opposite side of the temporary bicycle pathway to facilitate bicycles entering and exiting the temporary bicycle pathway. See *Figure 3.2*, below, for suggested BCD placement details.

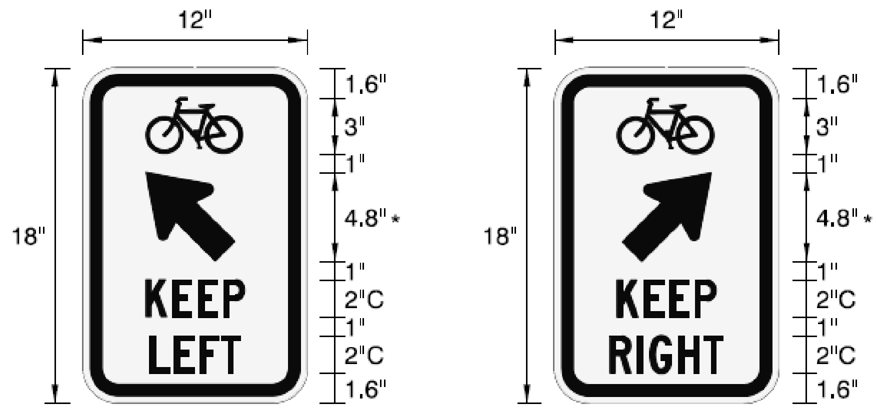
SUGGESTED BCD USAGE – Figure 3.2



BCD SUPPLEMENTAL SIGNING

To reinforce compliance and enforceability in having bicycles stay out of the work area, regulatory signing has been developed that can be posted at the beginning and regular intervals along a BCD alignment. See the *ODOT Sign Policy & Guidelines*, Chapter 6, for sign design details.

Sign No. CR4-22a　　Sign No. CR4-22b



* 4" X 6" Arrows @ 45 degrees
Border = 0.625"
Inset = 0.375"
Radius = 1.5"

Sign Background: White, Retroreflective Sheeting

Sign Legend: Black, Non- Reflective

The "Bicycles KEEP LEFT (RIGHT)" sign (CR4-22a, b) is used at the beginning of a section of temporary bicycle pathway within a construction work zone. The sign is intended to direct bicycle traffic into the temporary bicycle pathway and out of the active work area. The sign may be repeated at regular intervals throughout a longer work zone as a reminder to bicycle traffic.

See the ODOT Traffic Control Plans Design Manual for additonal details.

OREGON DEPARTMENT OF TRANSPORTATION

Approved By: S.T.E. Date: 3/16	Publication Date: 3/16

3.3.7 – CLEAR ZONES IN THE WORK ZONE

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

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

ODOT provides suggested minimum clear zone distances (see *Table 3.4*, below). However, clear zone distances should be maximized, where possible. When clear zone distances are critical to a project, distances should be identified within the project documents – e.g. shown in cross sections on the plans, or clearly described in the project Special Provisions.

When determining clear zones, account for traffic speeds, volumes, roadway geometry, available right of way, and work duration. Document specific clear zone widths in the project file.

STORED CONSTRUCTION EQUIPMENT & MATERIALS

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

DROP OFFS

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

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

SUGGESTED MINIMUM CLEAR ZONE DISTANCE – Table 3.4

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

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

CONSTRUCTION VEHICLE CONTRAFLOW

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

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

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

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

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

Contraflow Mitigations

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

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

  NOTE: Contractors may propose construction vehicles turn off their headlights when driving toward oncoming traffic while within the work area. To legally operate the vehicles at night without headlights, "…the work area shall be illuminated to a minimum of 2 foot-candles per square foot." See ***OSHA 1926.600(7)***.
- Limiting the speed of construction vehicles to 20 mph or less (the slower the better)
- Maximizing the separation between live traffic and construction vehicles (e.g 1 buffer lane)
- Using larger channelizing devices (e.g. Plastic drums) to separate work area from live traffic, and reducing channelizing device spacing
- Minimizing dust and flying debris (e.g. Temporary glare screens)
- Using Type "O4" Truck Crossing (W11-10) warning sign or a PCMS to warn traffic about construction vehicles in the work area.

- Temporarily reducing the legal posted speed of the highway. Use the Work Zone Speed Reduction Request Form and seek State Traffic-Roadway Engineer approval before posting a reduced regulatory speed.
- Identifying safe and efficient locations where construction vehicles can turn around without accessing the highway.
- Identifying specific ingress and egress access points to the work area. Designers may incorporate a *Smart Work Zone System* (SWZS) designed for *Construction Vehicle Access*. The SWZS can be included in the TCP at each critical ingress location to warn approaching traffic by displaying real-time warning messages of entering vehicles. See *Chapter 2* and *Chapter 3* for more information about *Smart Work Zone Systems*.

3.3.8 – CROSSOVER DESIGN AND "ON-SITE DIVERSIONS"

A crossover is a construction staging technique used to shift traffic from one side of a divided roadway onto a portion of roadway not under construction – typically sharing the remaining roadway with opposing traffic. A specific type of crossover, known as an "on-site diversion", moves traffic onto a temporary alignment constructed either in the median or adjacent to the original alignment. Crossovers are an effective method for completing construction of a roadway by replacing or repairing the roadway or a structure while maintaining traffic in both directions. A crossover also provides an effective means for providing long-term positive separation between workers and live traffic. In determining the feasibility of a crossover or an on-site diversion, record any design-related issues or decisions into the *Guiding Principle Decision Tree* (See Chapter 1 for more details).

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

Construction of an on-site diversion typically consists of a temporary roadway alignment (possibly construction of a temporary structure, as well). The limits of the on-site diversion extend from the initial reversing curve (Curve 1, see *Figure 3.3* below) leaving the existing roadway to the final reversing curve tying the alignment back into the existing roadway (Curve 4).

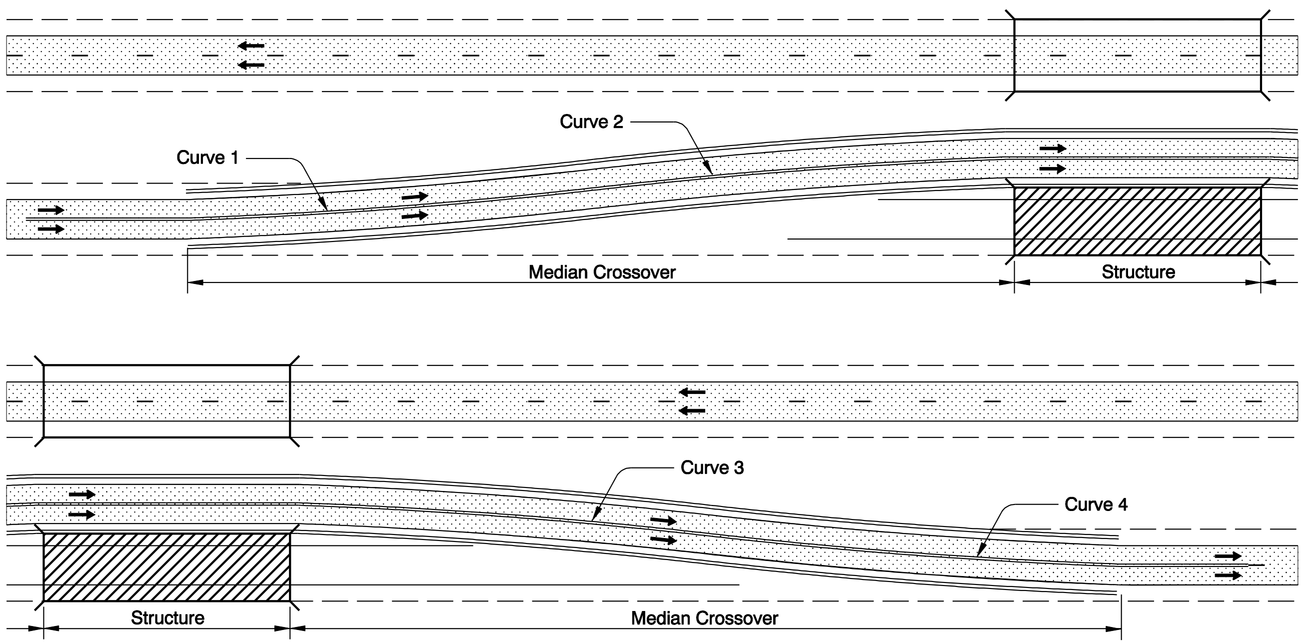


Figure 3.3

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

An engineered alignment and cross-sections should be developed for the crossover. Temporary crossover alignments do not need to incorporate spirals, spiral segments or partial spirals. However, spiraled curves should be considered when the existing alignment is located on a curve. TCP Designers should provide at least one cross-section taken somewhere along the crossover alignment and show this on the TCP plan sheets. See *Figure 3.4*, below.

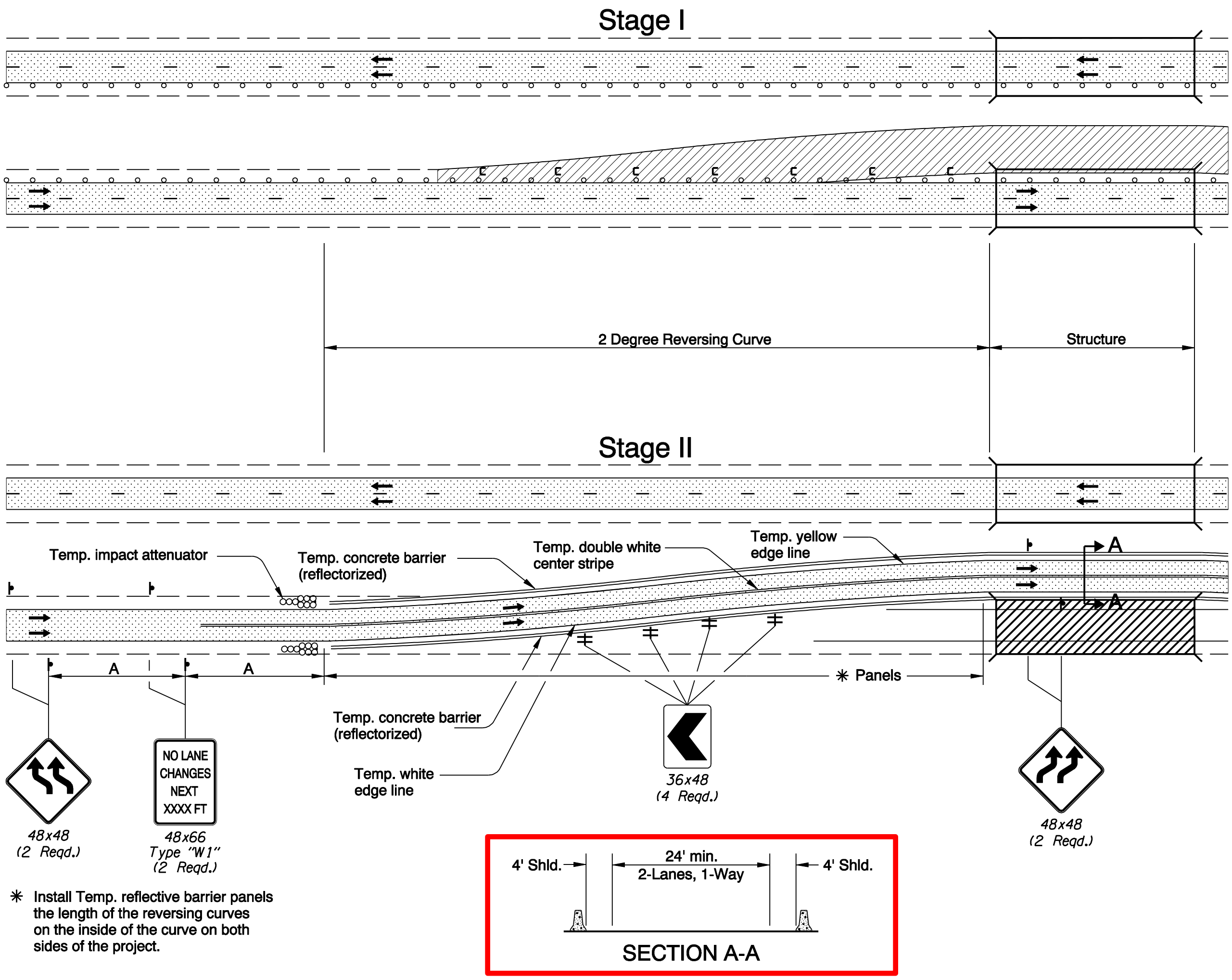


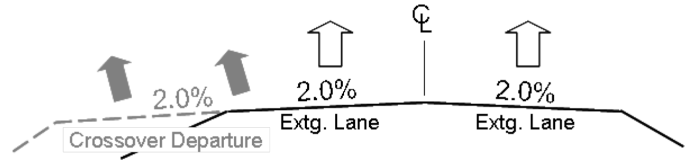
Figure 3.4

CROSSOVER DESIGN

In determining the radius of curvature for crossover alignments, the Designer should begin with the *Comfort Speed* table (*Table 3.5, below*). For radii of Curves 1 and 4 (Figure 3.3a), use the existing mainline superelevation rate in the lane adjacent to the crossover departure and return points. It is not practical to build temporary pavement on mainline to develop superelevation for the crossover departure and return curves. Therefore, Designers should attempt to use curves based on the superelevation rate of mainline at these points.

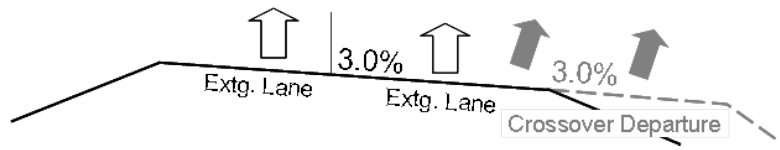
<u>Example 1</u>: Given: Pre-construction posted speed = 65 mph. Mainline super = normal 2.0% crown at centerline.

If crossover is built in the median, as shown, using *Table 3.5*, the minimum radius for Curves 1 and 4 would be **2292 ft.** ($2^0$30’) = 66 mph Comfort Speed at 2.0% superelevation.



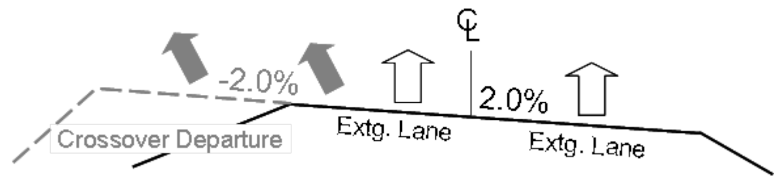
<u>Example 2</u>: Given: Pre-construction posted speed = 55 mph. Mainline super = 3.0%.

If crossover is built to the right, using *Table 3.5*, the minimum radius for Curves 1 and 4 would be **1273 ft.** ($4^0$30’) = 55 mph Comfort Speed at 3.0% superelevation.



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

If crossover is built in the median, as shown, using *Table 3.5*, the minimum radius for Curves 1 and 4 would be **2546 ft.** ($2^0$15’) = 61 mph Comfort Speed at -2.0%***** superelevation.



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

CROSSOVER DESIGN CONSIDERATIONS

- Where physical space within the work area allows, flatter curves may be used.
- For driver comfort and ease in negotiating the crossover, use the same or similar radii for all four curves in the diversion alignment. Be particularly aware of truck volumes using the alignment. Large trucks are sensitive to sharp reversing curves and adverse superelevation.
- If existing mainline superelevation rates exceed 5.0%, or radius of curvature exceeds 12^0, see the *ODOT Highway Design Manual* (HDM), *Table 3-6*.
- Spirals, spiral segments or partial spirals may be necessary to transition from the existing mainline alignment to the temporary crossover alignment.
- If Crossover departures and return points are in close proximity to existing entrance or exit ramps, show channelizing devices (typically, plastic drums) on TCP plan sheets that mimic acceleration lanes and exit gores areas.
- Include minimum acceleration lane lengths and a terminal taper for Entrance ramps.
- If Exit ramps are too close to the return point of a crossover, closing the Exit ramp and detouring traffic to the next exit is recommended. ***<u>NOTE</u>*:** The alternate Exit may be in ***<u>advance</u>*** of the closed Exit ramp. Provide thorough advance warning (e.g. PCMS) and detour signing in these cases. Include all necessary signing for ramp closures and detour routes for mainline *and* any impacted crossroads.

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

COMFORT SPEED – Table 3.5

CROSSOVER WIDTHS

- Use 4-ft minimum shoulder widths in multilane crossovers to accommodate large vehicle off-tracking. Use 2-ft minimum shoulder widths for single-lane crossover alignments.
- Use *Table 3.6* to provide horizontal widths between positive barriers (concrete or steel barrier, guardrail or other rigid system) through crossovers.

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

CROSSOVER WIDTHS – Table 3.6

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

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

OTHER CROSSOVER DESIGN CONSIDERATIONS

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

  Appropriate signage can include:

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

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

3.3.9 – DESIGN SPEED

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

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

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

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

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

3.3.10 – DETOURS

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

In determining the feasibility of a detour, record design-related issues or decisions in the *Guiding Principle Decision Tree* (See Chapter 1 for more details). Consider developing a detour for the project under the following conditions:

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

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

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

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

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

3.3.11 – DEVICE SPACING

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

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

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

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

REDUCED SPACING

Channelizing device spacing around radii at intersections, business accesses, driveways or other locations where additional emphasis is desired, may be reduced to 10 feet. If done, include additional language in the Special Provisions, or show the reduced spacing on plan sheets. See ODOT Standard Drawing TM800 for additional details.

INCREASED SPACING

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

SPECIAL PROVISIONS

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

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

3.3.12 – "DO NOT PASS" SIGNING

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

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

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

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

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

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

3.3.13 – FLAGGING

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

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

PAY ITEM QUANTITIES

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

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

Multiplying out each activity with the number of flaggers needed:

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

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

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

FLAGGING PRINCIPLES

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

FLAGGING on MULTI-LANE ROADWAYS

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

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

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

FLAGGING at INTERSECTIONS

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

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

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

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

FLAGGING at SIGNALIZED INTERSECTIONS

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

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

FLAGGING at UNSIGNALIZED INTERSECTIONS

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

FLAGGING on FREEWAYS

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

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

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

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

SIDE ROADS WITHIN the WORK ZONE

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

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

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

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

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

3.3.14 – FLAGGING – ADVANCE FLAGGERS FOR EXTENDED TRAFFIC QUEUES

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

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

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

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

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

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

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

3.3.15 – FLAGGING – FLAGGER / PILOT CAR OPERATIONS

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

Pilot Cars are typically included in the TCP when:

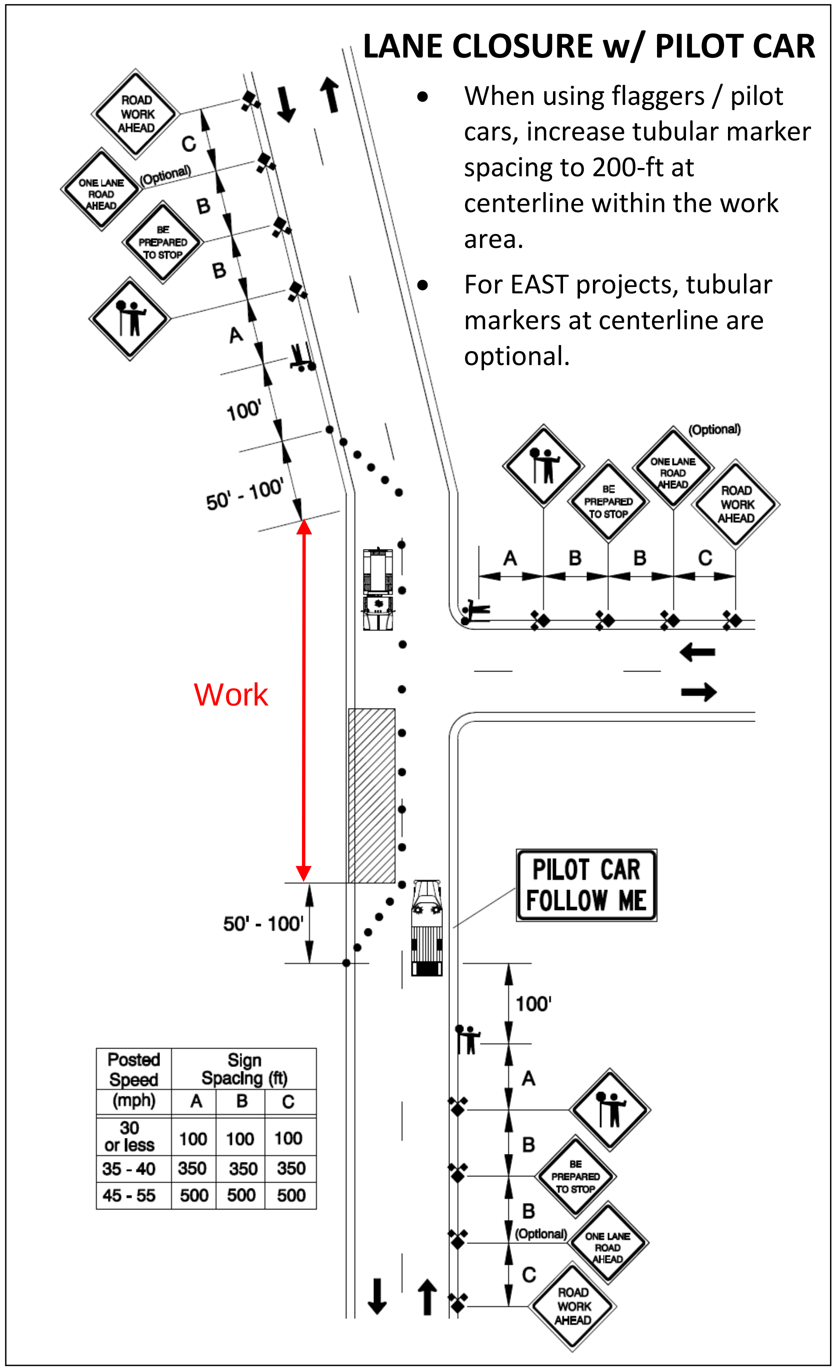
- Lane closures exceed 1/2 mi. and sight distance between Flagger Stations obscured by:
  - Roadway topography/ geometry – horizontal/ vertical curvature, foliage
  - Geography – terrain limiting communication (radios, cell coverage, etc.)
- Workers immediately adjacent to high-speed traffic, not separated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

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

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

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

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



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

Figure 3.4

WAIT FOR PILOT CAR Signing

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

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

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

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

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

3.3.16 – FREEWAY CLOSURES (SHORT TERM)

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

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

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

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

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

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

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

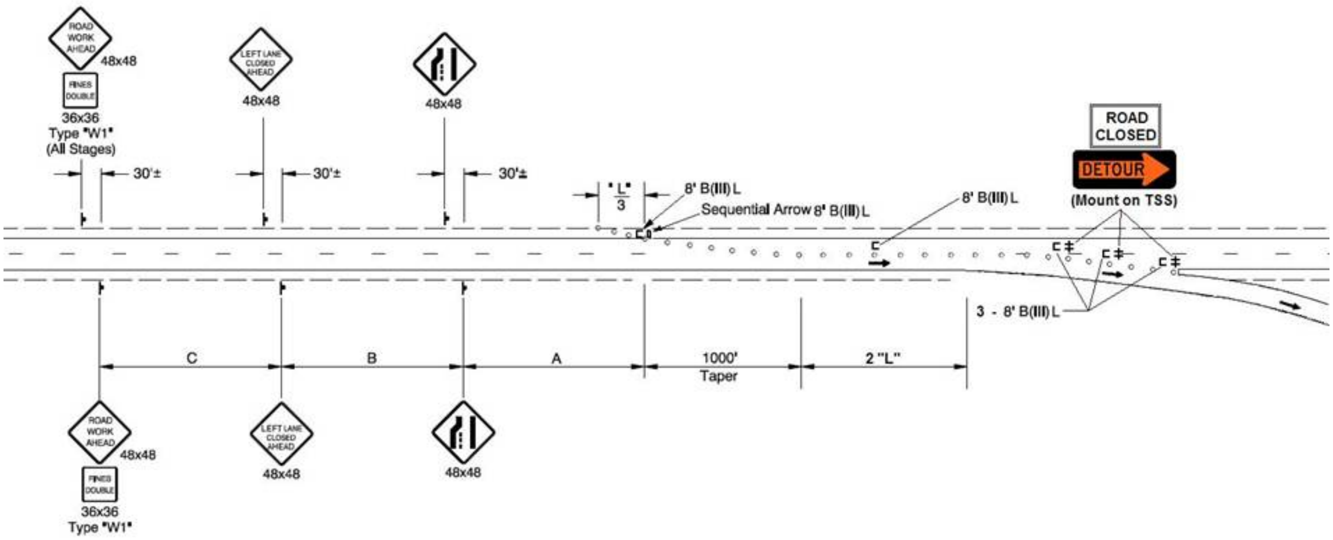
   Use PCMS to alert drivers of the approaching closure and to provide advance notification of what actions must be taken and where traffic must go.

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

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

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

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



Freeway Closure – Figure 3.5

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

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

NOTES:

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

3.3.17 – HORIZONTAL AND VERTICAL DESIGN POLICY

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

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

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

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

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

HORIZONTAL DESIGN

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

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

The total horizontal dimensions shown in *Table 3.7* below are ***minimums***. Designers should make efforts to increase these dimensions, where practical. For consistency with MCTD policies, dimensions shown are separated into Daylight and Nighttime hours. Daytime hours are defined as those times between, "1/2 hour before sunrise and 1/2 hour after sunset."

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

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

Minimum Horizontal Design Widths – Table 3.7

The majority of projects will use the Daylight horizontal widths listed in *Table 3.7*. As such, Table 3.8, below, can help in dividing up horizontal widths into traffic lane and shoulder widths:

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

Lane & Shoulder Widths – Table 3.8

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

- Depending on staging needs, but without falling below minimums shown in *Table 3.7*, lane and shoulder widths can be adjusted to favor construction requirements or traffic operations.
- If reduced horizontal widths are granted by MCTD/ODOT Region Mobility Liaison, lane widths should be reduced first, followed by shoulder width reductions, as follows:

    - Interstate Recommended Min. Widths: Lanes = 11 ft.; Shoulders = 1 ft.
    - Non-Interstate Recommended Min. Widths: Lanes = 10 ft.;Shoulders = 1 ft.
    - Reduced widths should be analyzed for the off-tracking of the design vehicle. AutoTurn within MicroStation, or other comparable modeling software, may be used for the analysis.
- If a ***positive barrier*** (e.g. concrete barrier, guard rail, bridge rail, bridge abutments, or other rigid obstacle) exists on one side of the roadway only, the needed width for one or two lanes becomes dependent on pavement width availability, vehicle overhang and axle width. Discuss vehicle details with the MCTD and adjust your design accordingly.

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

VERTICAL DESIGN

For temporary vertical clearance, the following design standards apply:

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

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

3.3.18 – RUMBLE STRIPS

LONGITUDINAL SHOULDER RUMBLE STRIPS

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

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

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

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

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

TEMPORARY TRANSVERSE RUMBLE STRIPS (TTRS)

Transverse rumble strips consist of a series of narrow, transverse bands of a raised material or depressed road surface extending across the travel lanes that provide a tactile and audible warning for drivers. Through noise and vibration, the rumble strips alert drivers of unexpected changes in alignment, surfaces, traffic control and other conditions that may require them to slow or stop. See the MUTCD, the ODOT Traffic Manual and ODOT Standard Detail DET4710 for additional information. Temporary transverse rumble strips may introduce other concerns regarding the work zone. Drivers may try to avoid them because they look like debris, drivers may pull over because they think they hit something. The location and advanced warning of transverse rumble strips needs to be clear in the project plans.

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

1) A completed "Temporary Transverse Rumble Strip Request" form must be completed and sent to the State Traffic Control Plans Engineer's office for review. A recommendation will be sent to the State Traffic Engineer. If approved, a signed approval letter will be returned to the original submitter.
2) The ODOT Standard Detail DET4710 must be included in the TCP. Dimensions to the warning sign warning of the condition or the condition itself have to be included in the project specific plan sheet. Current guidance on the detail shows the rumble strips located 100' in front of the warning sign.
3) Language from the "00225 Temporary Transverse Rumble Strips" Unique specification must be incorporated into the project Special Provisions. When a specific type of transverse rumble strip is needed, adjustments to the Unique special provision language are needed to identify special restrictions or requirements.

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

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

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

3.3.19 – SMART WORK ZONE SYSTEM (SWZS)

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

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

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

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

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

3.3.20 – "ROAD WORK AHEAD" SIGNING

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

As a project progresses and as the new roadway is completed – including surfacing and pavement markings – specification language or plan sheet instructions should direct the contractor to move and reinstall the ROAD WORK AHEAD sign to a location that minimizes its distance from the active work area. When the project is substantially completed, but there is still some work on the roadway, the permanent ROAD WORK AHEAD sign should be removed, and temporary ROAD WORK AHEAD signs should be used for advanced notification while work occurs. Removing the permanent ROAD WORK AHEAD while little to no work is occurring helps with the effectiveness of the ROAD WORK AHEAD sign.

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

MULTIPLE WORK AREAS

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

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

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

3.3.21 – ROLLING SLOWDOWN METHOD (RSM)

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

PURPOSE

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

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

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

CONSIDERATIONS

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

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

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

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

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

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

PROCEDURE

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

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

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

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

* Assumes a pre-slowdown speed of 55 mph.

ROLLING SLOWDOWN LENGTHS – Table 3.9

Table 3.9 assumes a pre-blockade speed of 55 mph (from truck speed limits of 55 mph). The table does not take into account horizontal or vertical alignments, lane widths, number of lanes, or other variables that may slow traffic moving through the project. Wherever practical, Rolling Slowdowns should combine the highest Blockade speed with the shortest Desired Gap to conduct the work.

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

A detail sheet should be developed and incorporated into the Traffic Control Plan sheets depicting all sign, PCMS and devices being used, and their placement for each closure point. Include Table 3.9 on the plan sheet, as well, in case adjustments are needed for the Slowdowns. See ODOT Standard Detail DET4740 for Rolling Slowdown Method details. DET4740 may be used as the basis for the added plan sheet in the TCP.

ADDITIONAL INFORMATION

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

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

ROLLING SLOWDOWN CALCULATION

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

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

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

$V_{blockade}$ = Blockade Speed (mph)

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

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

3.3.22 – SIGN PLACEMENT

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

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

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

- First, conduct a field investigation and collect an inventory of existing signing – including specific sign locations – and any other roadside features that may conflict with temporary sign placement. See the ***Facility Features*** discussion earlier in Section 3.2.4.
- Use the inventory to place temporary signing within the TCP. Avoid locating temporary signing in the immediate vicinity of existing signing. Wherever practical, provide standard sign spacing between temporary and permanent signs.
- URBAN AREAS: Placement of temporary signing is more challenging with the presence of added roadside obstacles and facilities. Consider the following when specifying sign locations or showing them on TCP sheets:
    - Investigate the work site and collect data regarding available shoulder widths and the presence of sidewalks. Use this data to determine if widths will allow signs to be post-mounted or will require a Temporary Sign Support (TSS).
    - Collect additional data identifying designated bicycle lanes, multi-use paths, landscape strips between roadway and sidewalk, and other facilities that may affect temporary sign placement.

- Be aware that the "shoulder" may also be a designated Bicycle Lane. Showing temporary signs in the "shoulder" (on the plans or in the Special Provisions) will force cyclists into live travel lanes, potentially creating an unsafe condition.
  - ***NOTE*:** If multiple TSS will be placed on a shoulder frequently used by bicycles for extended periods, add a "**Bicycles ON ROADWAY**" (CW11-1) sign in advance of the TSS-mounted sign sequence. Repeat the "Bicycles ON ROADWAY" sign approximately every mile, as needed.
- Temporary signs may sometimes be installed on existing utility poles, but ONLY if prior arrangements have been made with the appropriate utility or local jurisdiction. Larger signs may exceed load limits for some utility structures. This should also be checked.

3.3.23 – SPEED ZONE REDUCTIONS

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

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

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

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

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

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

SPEED REDUCTION PROCESS INFORMATION

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

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

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

If a speed reduction is being considered, the following guidance can optimize the approval process:

- Include a copy of the current TCP in the submittal. Provide as much detail as practical.
- Add a quantity of Temporary Signs in the estimate to cover signs used for the Speed Zone reduction – Typically, two signs per direction being slowed. Multi-lane facilities would need four signs per direction.
- ***DO NOT*** draw the specific **Speed Zone signs** on your plan sheets! 'Sign Outlines' or 'placeholders' may be included and labeled as, "Hold for Temp. Speed Zone Signing," or other notation.
- Following the Plans-in-Hand meeting, issuance of Final Plans, or after Award, a Speed Zone Order can be requested. The signed Order will establish the final placement and duration of the temporary speed zone signs.

Use *Figure 3.6* to determine what needs to be submitted for Traffic-Roadway Section for review.

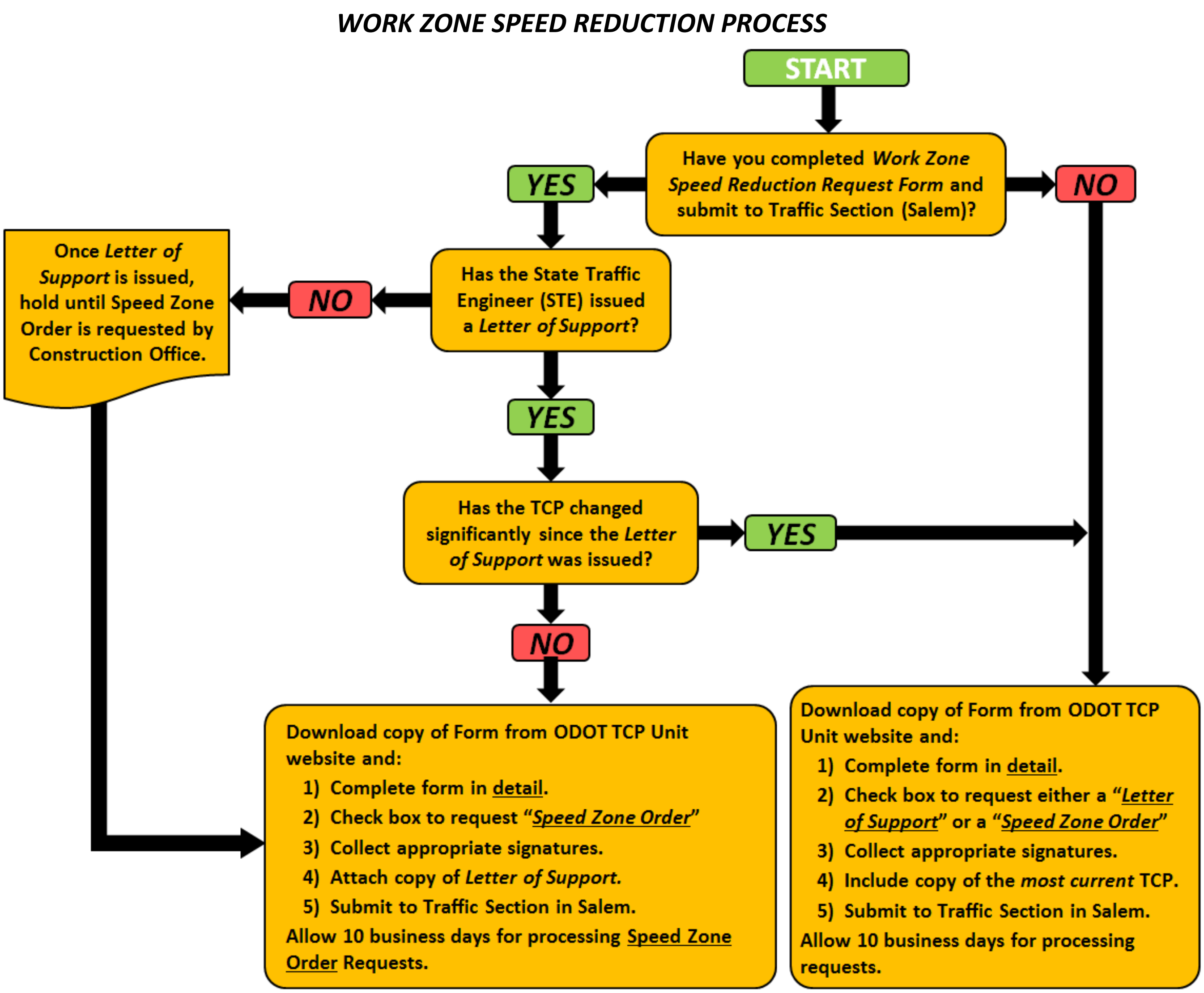

WORK ZONE SPEED REDUCTION PROCESS
START
Have you completed Work Zone Speed Reduction Request Form and submit to Traffic Section (Salem)?
YES
NO
Has the State Traffic Engineer (STE) issued a Letter of Support?
NO
Once Letter of Support is issued, hold until Speed Zone Order is requested by Construction Office.
YES
Has the TCP changed significantly since the Letter of Support was issued?
YES
NO
Download copy of Form from ODOT TCP Unit website and:
1) Complete form in detail.
2) Check box to request "Speed Zone Order"
3) Collect appropriate signatures.
4) Attach copy of Letter of Support.
5) Submit to Traffic Section in Salem.
Allow 10 business days for processing Speed Zone Order Requests.
Download copy of Form from ODOT TCP Unit website and:
1) Complete form in detail.
2) Check box to request either a "Letter of Support" or a "Speed Zone Order"
3) Collect appropriate signatures.
4) Include copy of the most current TCP.
5) Submit to Traffic Section in Salem.
Allow 10 business days for processing requests.

Figure 3.6

"LETTER OF SUPPORT"

Requesting a *Letter of Support* is typically done no sooner than after the completion of the Preliminary Plans for a project. Issuance of a *Letter of Support* depends largely on the amount of detail shown in the traffic control plan. The *Letter of Support* is ***not*** a Speed Zone Order and ***cannot*** be used to include specific speed zone signs in the TCP or place signs on a project.

The purpose of the *Letter of Support* is to:

- Inform the Traffic-Roadway Section, Project Manager, and Region Traffic Manager that a regulatory, work zone speed reduction is being considered for the project
- Open a dialog between Designers and Traffic-Roadway Section on the use of a regulatory speed reduction, and related temporary traffic control measures
- Enhance the consistency and quality of the design of work zone speed reductions
- Provide a means to capture temporary speed zone signing quantities in the TCP estimate
- Accelerate the processing of the Speed Zone Order request

PLAN AHEAD: Allow ***10 business days*** for Work Zone Speed Reduction requests to be processed and a *Letter of Support* to be issued.

Once a TCP Designer has received the *Letter of Support*, include the language from the Unique Special Provision, "***00225 – Temporary Speed Zone Reduction***" in the project Special Provisions.

TEMPORARY SPEED ZONE ORDER

A Temporary Speed Zone Order is typically requested after the contract is awarded and both the contractor and Project Manager (or District Manager for permit projects) have agreed on the project staging and traffic control. Allow **10 business days** for the Speed Zone Order request to be processed and the Order to be issued.

If a *Letter of Support* has been issued by the State Traffic Engineer, and no (significant) changes have been made to the traffic control plan since the *Letter of Support* was issued, the Project Manager (or District Manager for permit projects) can submit a signed Order request to the Traffic-Roadway Section. No additional information is required for processing the Order request.

TCP Unit staff will determine if a speed zone reduction is warranted based on the contents of the submitted Order request and current traffic control plans. Speed Zone Orders for a work zone are written specifically for the conditions present in the work zone. The presence of one or more conditions or factors from Section 6 of the Speed Reduction Request Form may not necessarily result in the support of a speed reduction. Some conditions may be better mitigated with temporary traffic control measures other than a speed reduction.

A Speed Zone Order can be issued without a *Letter of Support* for projects already under contract. Similar materials and information should be submitted as part of the Speed Zone Order request if a *Letter of Support* has not previously been issued (see Figure 3.6, above).

SPEED ZONE REDUCTION SIGNING

The standard sign sequence for a temporary speed zone reduction should include the following signs in the following order:

1) A fluorescent orange (ODOT: *Type "O8"*) version of the Speed Reduction (W3-5) sign
2) A SPEED XX (OR2-1) sign [or SPEED LIMIT XX (R2-1)* sign]

    *Use the "SPEED XX" or "SPEED LIMIT XX" sign in accordance with Oregon Law.

1) Speed Reduction (W3-5)

2) "SPEED XX" (R2-1) ***OR***

"SPEED LIMIT XX" (R2-1)

SIGN PLACEMENT

In most cases, sign placement for temporary speed zone signing is no different than for any other temporary signing. Nonetheless, the following guidelines can be used for locating temporary speed zone signing within a TCP:

- Two-lane, two-way roadways: Located on right side of roadway.
- Four-lane Divided or Access-controlled (freeway) roadways: Matching sequence located on right and left (median) side of the roadway, where practical. Supplemental (left-side) signs should not be placed in a center continuous two-way left turn lane.
- Roadways with three or more lanes per direction: Matching sequence located on right and left (median) side of the roadway, where practical.

A PCMS can be used to provide supplemental, advance notification of an approaching reduced speed zone. However, specific regulatory messages should be avoided on the PCMS to avoid confusing public traffic and law enforcement as to where the reduced speed zone begins.

MESSAGES to AVOID

SPEED	SLOW	SPEED
LIMIT	SPEED	XX
XX	XX	CAUTION

SUGGESTED MESSAGES

SPEED XX	SLOW TO	REDUCED	SLOW TO
AHEAD	XX MPH	SPEED	XX FOR
X MILES	AHEAD	X MILES	WORKERS

Speed Zone Reductions are written for a segment or length of roadway affected by some condition that warrants a reduction in speed to enhance safety for road users and workers. Speed Zone signing can placed in ***one*** <u>or</u> ***both*** directions of a roadway segment – depending on whether construction is making an impact on the original roadway environment and/or workers are present and adjacent to live traffic without the aid of positive protection.

Speed Zone Reduction signing locations will vary, but generally should be located after the Road Work Ahead sign and terminate before the End Road Work sign. The speed zone signs should not be placed between warning signs and the condition requiring the warning signs. The Speed Zone Order will include specific details regarding sign placement. Contact the Traffic Control Plans Unit for additional guidance.

FREEWAY SPEED ZONE REDUCTIONS

In an effort to help control speeds and optimize safety for high-speed work zones, new traffic control measures for select project types on Oregon freeways and divided highways have been developed. Projects on these facilities involving moving operations, where workers are immediately adjacent to live traffic, would qualify for a temporary speed zone reduction. The speed zone reductions are typically approved for 10 – 15 mph below the pre-construction posted speed limit.

In developing the TCP, include a Work Zone Speed Reduction Request for projects that include ***all*** of the following:

- Moving operations on Interstate freeways or multilane divided highways (e.g. paving, concrete rubblization, barrier replacement/installation)
- Pre-construction posted speed ≥ 45mph
- Workers will be adjacent to live traffic and not behind concrete barrier, guardrail or other positive protection barrier system
- Work is done at night. Consider requesting a speed zone reduction for daytime operations where the facility ADT > 10,000.

If the project meets all of the criteria listed above, include the Unique Special Provision, "00225 – Speed Reduction Measures (Paving Operations)", identify Standard Drawing **TM880 - Freeway or Divided Highway Speed Reduction (Paving Operations)** on the list of applicable drawings in Section 00225 of the Special Provisions, and include language and quantities for all of the associated bid items. The freeway/divided highway speed zone reduction request process is the same as the process used to request a temporary speed zone reduction for other project types and scopes of work:

- A "Letter of Support" may be obtained from the State Traffic-Roadway Engineer (STRE) by completing and submitting a "Work Zone Speed Reduction Request" and a copy of the TCP. Having the "Letter of Support" will help expedite the processing of the Speed Zone Order Request once the project has been awarded.*
- To obtain a Speed Zone Order, a "Work Zone Speed Reduction Request" MUST be completed and submitted with a copy of the TCP to the STRE for approval.

ADDITIONAL TRAFFIC CONTROL ENHANCEMENTS FOR SPEED ZONE REDUCTIONS

Where speed compliance is critical, additional enhancements to the TCP should be considered, including the following:

- Radar Speed Trailers
- Dedicated PCMS with speed zone-specific messages.
- Sign Flag Boards for SPEED XX signs
- "Reminder" SPEED XX signs posted on 1/2 mile intervals. (NOTE: Update Speed Zone Order Recommendation Letter template to confirm this matches.)
- Supplemental SPEED XX sign lighting (e.g. amber flashers)

SPEED ZONE REDUCTION ALTERNATIVES

As an alternative to a formal Speed Zone Reduction Order, other signs may be added to the TCP to warn of conditions that warrant reduced speeds.

Example signs include:

- Reverse Curve (W1-4), or Two Lane Reverse Curve (W1-4b) – (*right*)
- Advisory Speed (W13-1) riders below advance warning signs – (*right*)
- “LANE NARROWS” (CW23-5)
- Curve (W1-2a) with an advisory speed included on sign face – (*right*)

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

The “ROAD WORK XX MPH” (CW20-1a) sign (*right*) may be used as a general warning for a reduced speed condition. The speed displayed on the sign should be determined through engineering judgment and have ODOT approval.

Avoid creating a temporary situation that would require an Advisory Speed of more than 20 mph below the pre-construction posted speed for non-freeways, and more than 15 mph below the posted speed for freeways.

IMPORTANT NOTES

- The “CONSTRUCTION SPEED XX” sign (*right*) has been deleted from the ODOT Sign Policy. ***Do not*** use this sign in a Traffic Control Plan.
- Reducing the posted speed of a facility through a Temporary Speed Zone reduction ***DOES NOT*** constitute a reduction in the DESIGN SPEED for traffic control measures or the traffic control plan.

3.3.24 – TEMPORARY ALIGNMENTS

Temporary roadways used by traffic during construction staging should be engineered alignments. Crossovers, on-site diversions, temporary ramps or other roadway elements should be designed and constructed based on an engineered alignment.

Designers should consider the following design elements in developing a temporary roadway:

- Spirals are not mandatory, but are recommended. It may be necessary to include a spiral, spiral segment or partial spiral in the design if the alignment departs from or returns to a curvilinear segment of roadway. Spiral elements will aide in proper superelevation and transitions.
- Minimum superelevation rates may be obtained from **Table 3-5 – Comfort Speed** of the HDM.
- See Section 3.3.3 for freeway crossover design details.
- Radii for all non-freeway projects shall not be less than that needed to meet a design speed equivalent to the pre-construction posted speed.
- Match mainline shoulder widths, where practical. For freeway crossover shoulder widths, 4 feet is recommended. Use a minimum of 2 feet for temporary freeway alignments.
- Include appropriate pavement markings and channelizing devices.

Pavement design and materials needed to construct temporary alignments are not normally included in the Traffic Control Plan. Embankment, aggregate, and pavement material quantities should be included in the Roadway pay item schedule.

3.3.25 – TEMPORARY CONCRETE BARRIER

Temporary concrete barrier is a commonly used traffic control measure and provides one of the most effective means for separating workers from public traffic within work zone. Several factors should be considered when determining the need for temporary concrete barrier.

BARRIER WARRANTS

The need for temporary concrete barrier is not always obvious. Engineering judgement and experience can help a Designer decide when to use barrier. As for guidance from a technical reference, the AASHTO Roadside Design Guide suggests the following as warrants for placing temporary concrete barrier:

- If setting and removing the concrete barrier to protect a hazard takes less time than the hazard is expected to be exposed to traffic.
- If the presence of the concrete barrier presents a lesser risk to safety than the hazard being protected.

Use the following as additional warrants for the inclusion of concrete barrier in your TCP:

- For freeway applications, if the existing means of separating opposing directions of traffic is altered or reduced through construction staging, temporary concrete barrier is warranted.

  For example:

  - Staging decreases a 30-ft wide landscaped median to a 20-ft median

  - Southbound traffic is moved into the median on a temporary crossover
  - Existing concrete median barrier is being replaced
- Protecting structure falsework, a bridge column or abutment, or other structure work
- Separating traffic from deep excavations adjacent to the travelled way. Examples of factors that emphasize this warrant include:
  - Providing a 3:1 aggregate wedge is impractical due to the depth of the excavation
  - Exposure to lengthy longitudinal excavations. (For lower speeds, shorter lengths; or for higher speeds, longer lengths.)
  - If a minimum 4-ft shoulder cannot be provided with the 3:1 aggregate wedge; or, the pavement surface replaced by the end of the shift
- Other work activities where severe damage or injury may result if left unprotected by a physical barrier

While not all inclusive, this list of warrants or conditions presents the Designer with an appropriate amount of lattitude and an opportunity to use their engineering judgement in the final decision to use concrete barrier or not.

BARRIER PLACEMENT

Due to the physical properties and nature of temporary concrete barrier, it needs to remain crashworthy when placed in a work zone. Therefore, there are strict requirements for the placement of concrete barrier. To remain crashworthy, temporary concrete barrier must be:

- Set on a level asphalt concrete (AC) or portland cement concrete (PCC) surface
- Installed with 3-ft of clearance behind it – measured from the back face of the barrier to the nearest obstacle. The 3-ft clearance shall be free of all permanent and temporary obstructions, including construction materials, parked vehicles, etc.
- Secured to a PCC or AC pavement surface when a 3-ft clearance cannot be provided. Refer to the ODOT Temporary Traffic Control Plan Standard Drawings for securing details.
  - Even when secured, a 1-ft minimum clearance must be provided behind the barrier.
  - Designers should identify barrier that requires securing on plan sheets as:

    “Temp. Conc. Barrier, Secured – XXX.XX ft.”; *or*

    “Temp. Conc. Barrier, Reflectorized, Secured – XXX.XX ft.”
- Anchored to a PCC bridge deck. See the ODOT Bridge Section’s Bridge Design & Drafting Manual , Section 1.1.21.4, for specific barrier designs and installation details.

When installing temporary concrete barrier:

- Protect all blunt ends exposed to live traffic with a temporary impact attenuator from the ODOT QPL.
- Do not install on a gravel or dirt surface.
- Do not install concrete barrier at an angle greater than 25^0 from parallel with the approaching traffic flow.

- Do not use concrete barrier to close a roadway unless placed in a crashworthy manner with appropriate, crashworthy end treatments (see *End Treatments*, below).
- Do not install without pinning individual barrier sections together.
- Channelizing devices should close a lane/shoulder when preceding a lane/shoulder closure utilizing concrete barrier. Errant vehicles will be alerted to the closure by the channelizing devices, and will hopefully avoid striking the concrete barrier.

Temporary concrete barrier may be moved into place and used as “Permanent” barrier at the completion of the project, as long as the barrier meets all of the requirements of Standard Specifications Section 820.

REFLECTIVE BARRIER PANELS

Reflective barrier panels are a very effective device, when used properly, in improving the delineation and visibility of temporary concrete barrier. Panels are installed on the face of the barrier and provide drivers with a highly reflective series of markers.

Because of their reflectivity, Barrier Panels are most effective on barrier in curved sections of a road where, by itself, barrier may otherwise be difficult to see at night or in inclement weather.

For calculating relective barrier panel quantities, two panels are attached to each piece of barrier. Include a percentage of the total quantity for replacement (typically, 10-20%). Make small adjustments to the replacement percentage depending on factors such as the number of times barrier is moved, the width of the shoulders, traffic speeds and volumes, radius of curvature, and project duration.

Additional Reflective Barrier Panel information is included in Section 00225 of the ODOT/APWA Standard Specifications for Construction.

HIGHWAY MEDIAN BARRIER REPLACEMENT PROJECTS

An occassional component in freeway construction projects is the removal and replacement of obsolete permanent median barrier. In developing a traffic control plan for this type of activity, ODOT has found most contractors use the following procedure to replace the barrier:

- Place an equal length of temporary concrete barrier along side the existing barrier to be removed.
- Close the adjacent lane to provide sufficient room to work. Occassionally, the adjacent lane on both sides of the highway are closed.
- The contractor is given a quantity for the, “Temp. Concrete Barrier, Move” pay item equal to the length of the temporary barrier placed.
- If multiple lifts of pavement are needed to repair the pavement under the existing barrier, include enough quantities for the “Temp. Concrete Barrier, Move” pay item for ***each*** lift of

paving. Appropriate barrier connections or blunt end protection are required. Designers should include barrier connection details in the TCP, as needed (see *End Treatments*).

- Including at least two Truck-Mounted Impact Attenuators (TMA) is recommended.

NOTE: Providing a perceived "*clear zone*" between opposing directions of travel by closing inside traffic lanes, in lieu of installing temporary concrete barrier, is not a standard practice.

TEMPORARY GLARE SCREEN

To minimize the potential for distracted drivers in the work zone, a new pay item has been developed and added to the ODOT QPL. The Temporary Barrier Screen is a visual and protective system installed on top of temporary concrete barrier. The Glare Screen is made of low-density polyethylene (LDPE) plastic, is lightweight and extends approximately 24 inches above the top of the barrier. While purposefully designed as an anti-"gawk" screen, the screens can also be used to control some dust and debris from passing over the barrier and into live traffic lanes.

Systems made of plywood sheets and steel piping, or of chainlink fencing materials are no longer allowed on ODOT construction projects. Glare screen products must come from the ODOT QPL or be otherwise approved by the Construction Project Manager.

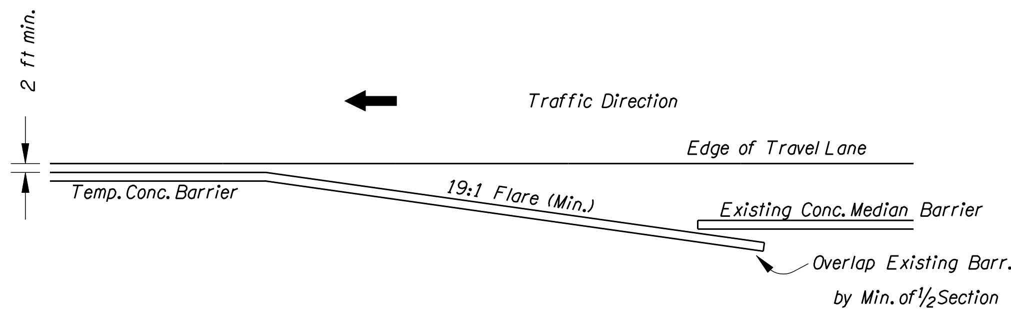
The ODOT TCP Unit continues to investigate additional barrier screen products for approval and addition to the ODOT QPL. Contact the ODOT Traffic Control Plans Unit office for additional information.

END TREATMENTS

The blunt end of a temporary concrete barrier run presents a serious hazard when exposed to traffic. When concrete barrier is placed on the project site, a number of methods are available for protecting the blunt ends:

1) ***Temporary Impact Attenuators*** – The most common device used for protecting blunt ends. Availalble in a wide variety of styles for various applications:
    - Barrel or Drum Array – A sand-filled array of plastic barrels. See the ODOT Temporary Traffic Control Plan Standard Drawings for additional details.
    - Narrow Site system – Approx. 2-ft in width. Used where space does not allow for the placement of the drum arrays. A tall concrete barrier transition to standard concrete barrier must be used when attaching narrow site systems to tall concrete barrier. See the ODOT QPL for additional details.
    - Truck-Mounted Attenuator (TMA) – Installed on a truck. A TMA is intended as a short-term, mobile protection device. Portability gives the TMA greater flexibility in placement. Use of a TMA to protect blunt ends should be limited to three consecutive days.
2) ***Temporary Connections*** – Several devices are available to connect runs of temporary concrete barrier with other barrier systems including existing barrier, bridge rail and guard rail sections. For examples, please see ODOT Standard Drawings RD530, DET110 and others depending on the needed connection.

3) ***Overlapped Ends*** – If sections of barrier are being moved, installed or reinstalled frequently such that matching up the ends of the runs is impractical, blunt ends may be overlapped so as to "hide" the exposed end from approaching traffic. See the following diagram for additional details:



TYPICAL OVERLAP OF TEMPORARY CONCRETE BARRIER

4) ***Buried Ends in Fill/Back Slopes*** – When the work zone presents itself and other protection techniques listed here are impractical, the blunt end of the barrier may be buried in the roadside backfill or a cut slope. For examples of this type of application, see ODOT Standard Drawing RD526.

5) ***Sloped End Terminals*** – This device is limited to facilities with a posted speed of **30 mph or less**. Sloped end terminals are primarily used in urban, low-speed settings or in a ramp terminal or other intersection where traffic is coming to a stop. See ODOT Drawing RD510 for additional details.

NON-RECOMMENDED and DISCONTINUED PROTECTION METHODS

ODOT ***does not recommend*** the following measure for "protecting" blunt ends:

- ***Flaring the end of the barrier beyond the "clear zone."*** – Often, there is inadequate space available to provide the proper clear zone. In addition, the entire barrier flare must be installed on an AC or PCC surface to maintain the crashworthy properties of the barrier. Furthermore, the length of barrier needed (and any temporary surfacing) to provide the necessary clear zone can end up costing as much as a temporary impact attenutor.

The following measure for "protecting" blunt ends has been ***discontinued***:

- ***Barrier Mounds:*** Following a letter issued by the Federal Highway Administration (FHWA) in February, 2003, the use of barrier mounds as a means of protecting the blunt end of a concrete barrier run is ***no longer allowed***. ***Do not use*** mounded fill material at the end of a concrete barrier run to protect the blunt end – for either temporary or permanent applications. ***Do not include*** ODOT Standard Drawings RD525, RD565 or DET152 in your Traffic Control Plans.

TALL CONCRETE BARRIER ("F" SHAPE)

Tall "F" (42-inch) barrier was originally designed to replace the "single slope" concrete barrier. The Tall "F" barrier provides effective protection against median crossover crashes – particularly from large trucks. During Test Level 3 (TL-3) and 4 (TL-4) testing, the Tall "F" barrier performed very well, seeing deflections of approximately 32 inches.

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

In the TCP, Tall “F” barrier may be used as temporary barrier. Typically, however, the Tall “F” barrier is then moved into a final location and used as permanent barrier. Due to the limited availability and greater difficulty with moving this type of barrier, it is impractical for a TCP Designer to specify Tall “F” barrier to be used ***exclusively*** as temporary barrier.

Do not specify the use of Tall “F” barrier in your TCP as temporary bridge rail or in a situation where the Tall “F” barrier would need to be restrained on a PCC surface. The current *Barrier Restraint* Detail shown in the ODOT Traffic Control Plan Standard Drawings has not been approved for use with Tall “F” barrier.

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

3.3.26 – WORK ZONE TRAFFIC ANALYSIS (WZTA)

All construction projects affecting traffic flow on State Highways require a Traffic Analysis to determine when the existing lanes will exceed their capacity. The Traffic Analysis is used to identify how many lanes are needed to support projected construction year volumes during specific times of day or night, days of the week, or months of the year, while accounting for multiple work zone factors that can create delays or congestion.

For ODOT projects, the project-specific traffic analysis should be conducted by someone trained to use ODOT's proprietary Work Zone Traffic Analysis (WZTA) web-based software, or other comparable traffic analysis software. ODOT provides a *Work Zone Traffic Analysis Theory and Application Workshop* that focuses on the use application of the WZTA software. The *"Work Zone Traffic Analysis Manual"* is specific to the new web-based work zone analysis tool (see Work Zone Traffic Analysis Tool @ http://wpdotappl21/WZTA/). The manual is available on the ODOT Traffic-Roadway Section's *Publications* website. The Work Zone Traffic Analysis Tool methodology is designed for highway segment analysis only. Intersection or Network analyses that demand greater levels of detail and accuracy – including refined delay calculations, require different modelling and analysis software applications (e.g. HCS, QuickZone, SYNCHRO, CORSIM, etc.) for work zone lane closures, but still requires using the principles, thresholds and guidance discussed in the Work Zone Traffic Analysis Manual. Contact the ODOT Region Traffic Analysts to determine the appropriate traffic analysis method.

Travel Delay Estimates are also generated from Work Zone Traffic Analysis. ODOT's Statewide Traffic Mobility Program was created to manage delays on the state highway system. In 2005, the Mobility Program created 'delay thresholds' for Oregon's major highway corridor segments. The thresholds correspond with the maximum acceptable *additional* delay generated by construction and maintenance projects for each highway segment. Segment lengths vary, but are typically between 1-2 miles in most parts of the state, with longer segments in the more rural areas.

When Travel Delay Estimates are generated by the Traffic Analyst, discuss the results with the Project Leader and ODOT's Region Mobility Liaison (responsible for coordinating regional travel delay estimates). ODOT's current Region Mobility Liaisons are listed below:

ODOT REGIONAL MOBILITY LIAISONS				
Tony Coleman	Region 1 Mobility Liaison	123 NW Flanders St Portland, OR 97209	503.731.8531	anthony.t.coleman@odot.state.or.us
Angela Kargel	Region 2 Mobility Liaison	455 Airport Rd SE Bldg A Salem, OR 97301	503.986.2656	angela.j.kargel@state.or.us
Matt Malone	Region 3 Mobility Liaison	3500 NW Stewart Parkway Roseburg, OR 97470	541.957.3503	richard.malone@state.or.us
Joel McCarroll	Region 4 Mobility Liaison	63055 N. Hwy 97 Bend, OR 97708	541.388.6189	joel.r.mccarroll@odot.state.or.us
Jeff Wise	Region 5 Mobility Liaison	3012 Island Ave La Grande, OR 97850-1902	541.963.1902	jeff.wise@odot.state.or.us

Within ODOT, the Region Traffic Analysts will complete the analysis and return a report to the TCP Designer identifying the number of lanes needed to accommodate the anticipated traffic volumes through the work zone, and the times of day when the lanes are needed. The TCP Designer can then use this information to make edits to the Special Provisions subsection ***00220.40(e) – Lane Restrictions***. The language in Section 00220.40 should be modified based on each project's unique set of circumstances, with the TCP Designer carefully editing the language to ensure the intent of the traffic analyst is accurately conveyed. See Chapter 4 for further discussion on Section 00220.40.

If ***all*** of the following criteria are met, the only remaining Lane Restrictions to be enforced are the standard Weekend and Holiday lane restrictions:

- ADT < 3000;
- Simple roadway geometry, including two-way, two-lane configurations; and,
- The TCP Designer determines there are no complicating factors and construction does not affect the normal flow of traffic.

Current Lane Restriction specification language can be found in Section 00220.40 of the ODOT/APWA Standard Specifications and the Section 00220 Special Provision "boilerplate". Both references are available on the Specifications Unit website. Follow the link to, "*Specifications*" from the *ODOT Traffic-Roadway Section* main page.

SPECIAL EVENTS

The TCP Designer and the Work Zone Traffic Analyst should work together to determine if there are local events which could seriously affect traffic flows through the work zone, and if special lane restrictions need to be imposed during the event.

The TCP Designer should contact the local Chamber of Commerce to collect a list of special events that may affect traffic flow through the work zone. Conversations with the Chamber of Commerce will provide additional information including; anticipated number of participants, start and end times for the activities and the general location for the event(s). Following discussions with the Region Traffic Analyst, additional Lane Restrictions for any relevant special events may need to be included in the Special Provisions under Section 00220.40(e).

After award of the contract, Lane Restrictions may be modified if it is determined the original restrictions were excessive. This determination can be made through conversations with Region staff and by making field observations. Any requests to modify Lane Restrictions should be forwarded to the TCP Engineer of Record and the Region Traffic Engineer for review and concurrence.

3.4 – DESIGN-RELATED SPECIFICATIONS

Special Provision language is a key component in every TCP. The specifications in this Section can present additional challenges for a TCP Designer – resulting in inconsistent applications – thus, additional clarification has been included here.

As is evident in several locations throughout this Design Manual, it is strongly recommended the TCP Designer be very familiar with the contents of the current ODOT/APWA Standard Specifications for Construction, Special Provision "boilerplates", and the "Unique" Special Provisions from Sections 00220 and 00225. Being familiar with other related and cross-referenced Sections is also encouraged. See Chapter 4 for additional Specification information.

3.4.1 - 20-MINUTE STOP OR HOLD

In keeping with ODOT's commitment to mobility and minimizing delay to the traveling public, the following bulleted item is included in *Section 00220.02 – Public Safety and Mobility* in the ODOT/APWA Standard Specifications for Construction:

- Do not stop or hold vehicles on a highway within the project site for more than 20 minutes.

Because of this strong commitment, this bulleted item should never be deleted through the project-specific Special Provisions.

It is rare, and often unnecessary, but changes to the amount of time ("20 minutes") made through the Special Provisions must be concurred with by the ODOT Traffic Control Plans Engineer.

> ***NOTE***: Requests to lengthen the amount of delay will not be granted as this creates undue delays in the work zone – leading to driver frustration and potential road rage situations.

IMPORTANT NOTES:

- Carefully take into account the scope of work, project schedule and cumulative, long-term effects on traffic traveling through this project before considering any modifications to this Standard Specification.
- This language is primarily aimed at two-way, one-lane operations – typically, during flagging operations – but can also apply to flagging of side roads or private accesses within a work zone.
- This language ***does not apply to freeway operations***, as stopping or holding traffic on Oregon freeways is not allowed for planned construction or maintenance activities.
- The *2008 Standard Specifications for Construction*, rewrote the original 2002 language and split it into two separate bulleted items for clarity. The second bullet addresses temporary driveway closures:
    - Do not block driveways for more than two hours, unless otherwise authorized in writing.

In addition, Liquidated Damages (see Section 00180.85) may not be applied to this portion of the Special Provisions. Under this situation, ODOT notifies the contractor that they are in 'Breach of Contract,' and they must modify work practices to relieve the excess delay or they will be issued a "Suspend Work" order.

3.4.2 – ALTERNATIVE CONTRACTING METHODS

Alternative contracting methods can be used to accelerate the completion of a project. By reducing the overall project duration, traffic delays and inconveniences to public traffic can be minimized. Examples of effective Alternative Contracting methods include:

- Incentive/Disincentive (I/C) bonuses
- "A+B" Contract – where, "A" = Material costs; "B" = Time needed for construction
- "A+C" Contract – where, "A" = Material costs; "C" = Value of Contractor's pre-qualifications
- "Design-Build" Contract – Where early project segments are built, while subsequent segments are designed and prepared for construction. Method allows for flexibility in construction sequencing and design modifications to fit unanticipated site needs
- "Lane Rentals" – Where contractors can pay a premium to extend lane closures to complete time consuming, costly work that would otherwise require extensive staging

Project Development Teams may choose to use an alternative contracting method if the following conditions exist:

- High traffic volumes – generally in large, urban areas
- Work which completes a critical gap in the highway system
- Major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic (i.e. high-volume bridges, Interstate routes, commuter routes)
- Projects requiring lengthy detours, creating large amounts of out-of-direction travel
- A highway element with a significant crash history, or other operational deficiency

When project teams decide an alternative contracting method will be use to deliver the contract, TCP Designers can assist by identifying any additional traffic control measures or special needs for the contract, and by:

- Conducting work zone traffic analysts for a number of staging scenarios
- Determining the Lane Restrictions in Section 00220.40(e) for each staging scenario
- Attempting to determine user delay costs and impacts to traffic (used to compare one scenario against another, not necessarily to find the "lowest cost")
- Examining staging plan scenarios and soliciting potential construction schedules
- Assembling draft special provision language – particularly looking at lane restrictions and other work limitations – e.g. times, locations, activities, seasons, etc.

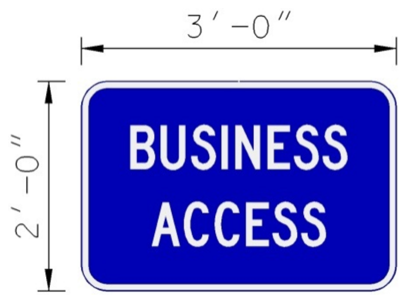
Alternative contracting methods should be discussed and agreed upon at the Project Team level, including issues of sufficient funding incentives, seasonal or other time constraints, stakeholder agreements, etc. Alternative contracting methods, and their feasibility, can also be discussed with members of the ODOT Office of Project Letting in Salem.

3.4.3 – BUSINESS ACCESSES

This traffic control measure is used to help delineate business accesses disrupted by construction. Driveway approaches for private businesses are occasionally disturbed making them less visible to passing traffic, and particularly difficult to find at night or during inclement weather.

In an effort to partner with local businesses affected by construction, ODOT uses additional signing and special channelizing devices to clearly identify temporary business accesses.

Signing and Blue Tubular Markers in place



(CG20-11)

ODOT uses the "BUSINESS ACCESS" (CG20-11) sign (*above*) to identify the affected accesses. Refer to the ODOT Sign Policy & Guidelines, Chapter 6, for additional guidance on sign designs and placement.

The sign is to be installed on a single-post Temporary Sign Support (TSS). On plan sheets, Designers should add, "(Mount on Single-Post TSS)" under each sign. ***Do not*** indicate the sign is to be mounted on a Type II barricade. Current ODOT temporary signs include the cost of the sign support. A Type II barricade is a separate pay item. A conflict arises when the sign is installed on the Type II barricade. ODOT expects the barricade cost to be included in the cost of the sign, while the contractor expects to be paid for the barricade. Therefore, indicate the sign is to be installed on a single-post TSS.

When included in the TCP, also include the current Unique Special Provision, "***00220-00225 – Business Access***" in the project-specific Special Provisions. Due to the specific purpose of the signing, this measure should limited to business accesses and not applied to private residential driveways or public streets.

3.4.4 – PAVEMENT PRESERVATION PROJECTS

INTRODUCTION

Pavement preservation projects make up a largest part of the highway construction projects completed each year. While larger, complex modernization or bridge replacement projects get most of the attention, pavement preservation projects demand a surprising amount of attention to detail regarding the temporary traffic control. Preservation projects have the potential of creating much more delay to the traveling public due to the nature of the work and the traffic control measures used – e.g. flagging one-lane two-way traffic.

PAVEMENT PRESERVATION PROJECT TYPES

ODOT includes Uniques Special Provisions for three distinct types of pavement preservation projects. Each Unique Special Provision includes a list of specific usage criteria described in the "Instructional Notes":

- For ***Minor Hot Mix Asphalt Concrete (MHMAC) and HMAC*** preservation projects:

  "Unique 00225 - MHMAC and HMAC Preservation Projects"

  Use this Unique Specification on Level 1, 2, or 3 MHMAC and HMAC Overlay (00744 or 00745) Preservation projects, provided the following criteria are met:

  - *Obtain Region Technical Center Manager's approval*
  - *Perform and/or document enough traffic analysis to confirm traffic volumes meet the following criteria:*
    - *ADT < 5,000 for roadways with posted speed > 45 mph*
    - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*

- For ***Emulsified Asphalt Surface Treatment (EAST)*** preservation project (a.k.a. "Chip Seals"):

  "Unique 00220/00225 - Emulsified Asphalt Surface Treatment"

  Use this Unique Specification on Chip Seal "Emulsified Asphalt Surface Treatment" (00710 or 00715) projects, provided the following criteria are met:

  - *Obtain State Traffic Engineer's approval*
  - *Compile Field Data Summary*
  - *ADT < 5,000 for roadways with posted speed > 45 mph*
  - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*
  - *Federally funded projects require FHWA approval*

- For ***Cold In-place Recycle (CIR) or Emulsified Asphalt Concrete (EAC)*** preservation projects:

  "Unique 00220/00225 - CIR and EAC"

  Use this Unique Specification on "Cold in Place Recycle" (00720) or "Emulsified Asphalt Concrete" (00735) projects, provided the following criteria are met:

  - *Obtain State Traffic Engineer's approval*
  - *Compile Field Data Summary*
  - *ADT < 5,000 for roadways with posted speed > 45 mph*
  - *ADT < 10,000 for roadways with posted speed ≤ 45 mph*
  - *Federally funded projects require FHWA approval*

SPECIAL PROVISION "BOILERPLATES"

In the context of this manual, "Boilerplates" are prepared documents that can be used in the same way a form letter or a document "template" might be used. Boilerplates can be thought of as generic 'fill-in-the-blanks' documents where the TCP Designer inserts additional project-specific information, and deletes superfluous language.

Due to the dynamic nature of the temporary traffic control discipline, Boilerplates can also be used to make corrections or additions to the ODOT/APWA *Standard Specifications for Construction* after the book is published.

When beginning any new ODOT/APWA highway construction project, the TCP Designer must download a ***new copy*** of the Special Provision boilerplates for Sections 00220 and 00225 from the ODOT Specifications Unit web site.

For some projects, such as preservation projects, the Designer must also download copies of applicable "Unique" Special Provisions depending on the scope of work and other features of the project – "Unique" examples include: "00225 - MHMAC and HMAC", "00225 - Bicycles on Roadway", "00220 - Pipe Excavation", "00220-00225 Flagging 24 Hours", etc.

Boilerplates are updated frequently, so the TCP Designer should ***always*** download the current edition available on the ODOT Specifications web site before ***every*** project.

> ***NOTE***: If several months pass between the first time the boilerplates were downloaded and the completion of a project, the TCP Designer should consider downloading another new copy of the boilerplates and updating the Special Provisions for the project.

SIGNS AND STRIPING

Because preservation projects frequently obliterate existing striping, No Passing and Passing Zones need to be identified using, "DO NOT PASS" (R4-1) and "PASS WITH CARE" (R4-2) signs. In addition, the "NO CENTER STRIPE" (W8-12) signs with "NEXT XX MILES" (W7-3a) riders must be used to alert drivers and supplement temporary pavement markings.

From Section 00225.02 of the three preservation project Unique Special Provisions, contractors are given instructions to install these signs to replace the missing centerline pavement markings.

While the Unique Special Provision language for preservation projects also describes temporary pavement marking requirements, the markings are not sufficient enough to solely convey regulatory Passing and No Passing Zone restrictions. Therefore, the signs described above must be installed and remain posted until permanent markings are in place.

Other project-specific requirements for striping, signing and traffic control are included in each of the Unique Special Provision for the preservation projects.

3.4.5 - STEEL PLATING

On State Highways with a posted speed greater than 35 mph, contractors are not allowed to use steel plating to temporarily cover open trenching across the roadway or adjacent to the edge of the traveled way. Details of this specification language have been incorporated into the 2008 Standard Specifications for Construction under Section 00220.

The language is intended to address the placement of steel plating anywhere in the travel lane and on the shoulder.

For higher-speed roadways (40 mph and greater), it has been determined unsafe to have traffic, especially large trucks, traverse the steel plating. Despite efforts to secure the plating to the roadway, the high impact loads to the plates eventually loosen the plate and create extremely severe hazards for drivers.

If steel plating is used on lower-speed roadways, the current Section 00220 Special Provision boilerplate describe methods and materials to be used by the contractor to safely use steel plating under live traffic.

A separate Unique Special Provision, "*00220 – Pipe Excavation*", is available to address various scenarios involving trenching or the installation of piping or conduit transversely under the roadway. Conversations with the Construction Project Manager will help determine the appropriate language to include in your Special Provision.

3.4.6 – TRAFFIC CONTROL SUPERVISOR (TCS)

The Traffic Control Supervisor (TCS) is a specially trained and certified employee working for the prime contractor, or as a subcontractor. The TCS is responsible for coordinating the administration, proper installation, maintenance, layout and overall quality of the Traffic Control Plan, and the necessary temporary traffic control devices used on the project.

The TCS must carry a valid TCS Certificate. According to the specifications, the Project Superintendent shall not be assigned as the TCS on a construction project. For every day a TCS is to be on the project, the Engineer must be notified 24-hours in advance.

TCS are currently measured and paid for on a "per Construction Work Shift" basis. The payment of one TCS "work shift" will be made regardless of length of the work shift. Payment will not be made until a Traffic Control Inspection Report (No. 734-2474) is completed for each day the TCS has finished a work shift.

Below are examples of some of the duties of the TCS from the current Specifications:

- Overseeing the installation, maintenance and removal of traffic control devices and markings
- Coordinating personnel, mobile equipment and supplies used in traffic markings, sign installations and roadway channelization
- Scheduling and insuring that all field assignments are satisfactorily completed according to prescribed traffic engineering plans.
- Supervising traffic control and maintenance crews

See Section 00225 of the Standard Specifications for additional information regarding TCS duties, measurement and payment details.

WHEN SHOULD A TCS BE INCLUDED IN A CONTRACT?

A TCS can be included on any project. However, it is recommended that a TCS be used when a project meets any of the following criteria:

- Multiple Stages involving repeated lane closures, traffic shifts or other significant disruptions to normal traffic operations
- The placement and/or repeated relocation of multiple TCD, including significant signing changes – i.e. detours or alternate route signing
- Projects with complex construction staging or complicated temporary alignments
- Night paving operations
- High mainline ADTs (> 10,000)
- Freeway work
- High profile projects with substantial community or stakeholder involvement
- When a TMP is developed for a "Significant" project

TCS QUANTITIES

The current unit of measure for the TCS is the "Construction Work Shift". The use of and quantities for the TCS depend on a variety of conditions and factors, including:

- Scope and complexity of the work
- Duration of the contract (1 month? 1 year? Longer?)
- Physical length of the project
- Number of changes (Stages or Phases) to the traffic control layout
    - Lane closures or shifts
    - Work areas that progress along mainline on a regular basis
    - Opening/closing detour routes
- Facility type (freeways and high-speed, multilane roadways warrant additional TCS)
- The amount of work done at night (traffic control quality more critical at night)
- Site location and roadway geometry
- Seasonal weather conditions

However, the general practice is to provide one TCS construction work shift for each anticipated day of active work. A Designer should do their best in determining the construction schedule for the project, and determine a reasonable number of active work days. Winter shutdowns and other periods of work suspension should not be included in the TCS quantity estimate.

Additional TCS information is available in Section 00225 of the Standard Specifications and Boilerplate Special Provisions. See Subsections 00225.32, 225.88 and 225.98 for additional TCS details.

QUANTITY CALCULATIONS – EXAMPLES

- Freeway paving project expected to last 4 weeks. Paving approximately 2 miles per night. Shifting traffic three times per shift. Long, straight, flat section of freeway.
  - TCS Quantity: 4 weeks @ 5 nights per week = 20 shifts

    Consider adding small quantity for weather/mechanicals = 0 – 5 shifts

    TOTAL = 20-25 Work Shifts
- Bridge Replacement on two-lane, rural highway. ADT = 4500. Bridge replaced in three Stages. Two-way, one-lane traffic moved three times over 6-month-long project. Project starts in April. July and April likely to run two 8-hour shifts to meet completion date.
  - TCS Quantity: Three stages over 6 months = 6 x 23 days per month = 138 shifts

    July – Second shift = 23 shifts
    August – Second shift = 23 shifts
    Two weekends (1 shift each Sat & Sun) July & August = 2 x 2 x 2 = 8 shifts
    Contingency shifts = 5 shifts

    TOTAL = 197 Work Shifts

The TCP Designer should have regular discussions with the Construction Project Manager's office to confirm appropriate TCS quantities. Consider small adjustments (3%–10%) to TCS quantities as a contingency for changes in the staging plan or construction schedule.

However, like Flagger Hours, Designers should be prepared to justify their quantities for this pay item. Arbitrary or over-inflated quantities for this pay item should be avoided.

TCS PAYMENT

Within Section 00225.88, the TCS item is ***measured*** per "construction work shift". Under Section 00225.98, the TCS is ***paid*** for at the contract unit price, per each for the item "Traffic Control Supervisor" – meaning each unit is a, "construction work shift."

Payment is made for each Construction Work Shift that a TCS has been authorized to work on the project. Current language limits payment of a maximum of two TCS per single work shift. This is done to allow a TCS to be at each end of a very long project with active work areas many miles apart. It is also used to keep contractors from abusing the pay item quantity.