Chapter 1010 Work Zone Safety and Mobility

1010.01 General

Addressing work zone impacts to all road users is an important component in the design of a project and needs to be given adequate consideration early in the design process. Most work zones create some level of traffic impacts and require additional safety features; therefore, identify and address all work areas and operations needed for construction during the project design. Planners, designers, construction engineers, maintenance personnel, and others all play a role in developing a comprehensive work zone design.

There is no "cookbook" solution to work zone design. Work zone design is based on general guidance and best practices; however, effective work zone design requires innovation, adaptation, and ingenuity and is as much art as science. This chapter provides the designer with guidance to develop comprehensive work zone strategies and plans to address a project's safety and mobility benefits/improvements for all modes, as well as constructability. A systematic process for addressing work zone impacts is required by federal regulations and state policy.

1010.02 Work Zone Design Strategy Meeting & Statement (New Section 2023)

In the Scoping phase, a Work Zone Design Strategy Meeting shall be held with the 000Region Transportation Operations Office and other critical attendees including, but not limited to: Bridge, Construction, Maintenance, Rail, Freight and Ports, Public Transportation, Active Transportation, Local Agencies, and Law Enforcement as appropriate. Participation in the conference will help develop work zone mitigation strategies that address the needs of the various divisions and road users while establishing an understanding for the project's initial work zone direction.

A Work Zone Strategy Statement shall be developed by Project Development and submitted to the Region Transportation Operations Office for acceptance early in design (30% to 60%). The accepted Work Zone Strategy Statement shall be included in the Project Development's Project Summary. It is meant to be a high-level, concise overview of the projects proposed overall work zone mitigation and shall include the following information as a minimum:

- Whether the project is classified as significant or non-significant
- Anticipated work zone traffic control strategies, closures, and staging configurations
- Concurrence from Region Transportation Operations on any anticipated proposed regulatory speed limit reduction and/or advisory speeds
- An explanation/justification for any proposed high-impact closures or restrictions.

1010.03 Transportation Management Plans and Significant Projects

1010.03(1) Transportation Management Plan (TMP)

A transportation management plan is a set of strategies such as Transportation Systems Management and Operations (TSMO) strategies (such as dynamic lane merge, dynamic speed control, or Smart Work Zone Systems) for managing the corridor-wide work zone impacts of a project. A TMP is required for all projects and is the key element in addressing known work zone safety and mobility impacts. The TMP development begins in the scoping phase of a project by assessing impacts known at the time and then selecting mitigating strategies and design solutions to manage those impacts. It is very important to continue the development of the TMP throughout the project development process.

Not all work zone impacts have to be addressed with traffic control plans only. Many work zone impacts can be reduced or eliminated through project design elements like alignment choice, materials selection, structure types, overbuilding, and phased construction. Work zone impacts related to work duration may be resolved or reduced through innovative bidding and contract administration.

For design-bid-build projects, the TMP is developed by Design and reviewed/approved by the Region Transportation Operations Office. For design-build projects, WSDOT may begin a preliminary TMP during Scoping and Project Development, but the TMP is completed by the Design-Builder and approved per the requirements of the RFP.

A TMP may include temporary modification to design elements outside the ranges discussed in the Design Manual.

For example, a work zone may temporarily reduce lane and shoulder widths. These temporary design elements are justified and documented in the TMP. They do not require a Design Analysis.

The three major components of a TMP are described in Section 1010.04(4).

1010.03(1)(a) Temporary Traffic Control

Temporary Traffic Control (TTC) components are those strategies for directing traffic through the work zone and minimizing the duration of the impacts. These components are to be included in the Plans, Specifications, and Estimates (PS&E) as Traffic Control Plans (TCPs) and contract provisions. The TTC components may include but are not limited to the following strategies:

- TTC strategies such as lane closures or shifts, one-lane two-way operations (flagging and or pilot car), staged construction, or full road closures and detours.
- Traffic Control Devices such as temporary signing, channelizing devices (cones, drums), changeable message signs, arrow boards, temporary signals, and temporary pavement markings.
- Corridor Project Coordination, Contracting Strategies, and Innovative Construction Strategies such as A+B bidding, incentives/disincentives, and precast members or rapid cure materials.

1010.03(1)(b) Transportation Systems Management and Operations (TSMO)

The TSMO components are those strategies for improving traffic flow and safety through the work zone. Some of these strategies may be included in the PS&E but could also be WSDOT-managed elements outside the contract. The TSMO components may include but are not limited to the following strategies:

- Transportation demand management strategies such as Transit service improvements, transit incentives, and park & ride promotion.

- Corridor/Network Management (traffic operations) Strategies such as Signal timing/coordination improvements, temporary signals, bus pullouts, reversible lanes, and truck/heavy-vehicle restrictions.
- Work Zone Safety Management Strategies such as using positive protective devices, speed limit reductions, automated flagger assistance devices, radar speed display signs.
- Traffic/Incident Management and Enforcement Strategies such as Traffic Management Centers (TMCs) and Intelligent Transportation Systems (ITS), Washington State Patrol, tow service, WSDOT Incident Response Team vehicle(s), traffic screens, and emergency pullouts in long work zones with narrowed shoulders.
- Smart Work Zone Systems and simpler version, Queue Warning Systems are dedicated specialized smart systems to provide more rapid information to drivers and to optimize the safety and efficiency of traffic through the work zone.
- For more information on TSMO, see Home | TSMO | WSDOT (tsmowa.org)

1010.03(1)(c) Public Information

The Public Information (PI) components are those strategies for raising awareness of the upcoming project impacts or current restrictions. Public awareness strategies may be developed and implemented by WSDOT through the region or Headquarters (HQ) Communications offices and implemented before and during construction.

Motorist information strategies may be WSDOT-managed elements with state equipment outside the contract or identified on plans in the PS&E. The PI components may include, but are not limited to, the following strategies:

- Public Awareness Strategies such as Brochures or mailers, press releases, paid advertisements, and project website (consider providing information in other languages if appropriate).
- Motorist Information Strategies such as Highway advisory radio (HAR), changeable message signs, and transportation management center (TMC).

It is very important to continue the development of the TMP throughout the project development process. Not all work zone impacts have to be addressed with traffic control plans only. Many work zone impacts can be reduced or eliminated through project design elements like alignment choice, materials selection, structure types, overbuilding, and phased construction. Work zone impacts related to work duration may be resolved or reduced through innovative bidding and contract administration.

The TMP Checklist in Exhibit 1010-2 will help identify and organize TMP components. Include the completed checklist in the Project File. For significant projects, develop this checklist and the supporting plans, data, impacts assessment, strategies, capacity/delay analysis and endorsements into a formal TMP document to be included in the Project File. For TMP examples, see:
http://ops.fhwa.dot.gov/wz/resources/final_rule/tmp_examples/sample_tmps.htm

http://ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/trans_mgmt_plans.pdf

1010.03(2) TMP Requirements for Significant & Non-Significant Projects

Transportation Management Plan components for design-bid-build and *design-build* projects are as follows:

Non-Significant Projects	Significant Projects
Temporary Traffic Control Plans	Temporary Traffic Control Plans
Contract Special Provisions *Request for Proposal Section 2.22*	Contract Special Provisions *Request for Proposal Section 2.22*
TMP Document Not Required + Temporary Modification to Design Element Explanations	TMP Document Required 1. Temporary Traffic Control (TTC) Strategies 2. Transportation Systems Management & Operation (TSMO) Strategies 3. Public Information (PI) Strategies + Agreements with Other Agencies & Stakeholders + Temporary Modification to Design Element Explanations + TMP Roles & Responsibilities, Contact Information

Significant projects, as defined in 23 CFR Part 630 J, are defined as:

1. A project that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable based on state policy and/or engineering judgment.
2. All Interstate system projects within the boundaries of a designated Transportation Management Area that occupy a location for more than three days with either intermittent or continuous lane closures shall be considered as significant projects unless FHWA grants an exception request based on the State's ability to show the project does not cause sustained work zone impacts.

For Significant Projects: A TMP Document is required per federal law (23 CFR Part 630 J) in addition to the temporary traffic control plan and contract provisions. The TMP Document's size and scale depends on the project's complexity and extent of adverse road user impacts but should be expanded to include agreements with other agencies/stakeholders, WSDOT commitments, and project contact information as appropriate. The TMP Checklist in Exhibit 1010-2 will help identify and organize TMP components.

In addition, Significant Projects may require a Value Engineering (VE) study (see Chapter 310) and a Cost Risk Assessment (CRA) or Cost Estimate Validation Process (CEVP) that could help define strategies or identify risks: Cost risk assessment | WSDOT (wa.gov)

For additional TMP Document information, see:

- WSDOT TMP Document examples, under the Tools, templates & links tab.
- FHWA-provided TMP Document examples
- FHWA Developing and Implementing Transportation Management Plans for Work Zones

For Non-Significant projects, temporary traffic control plans and contract provisions included in the PS&E will be considered the TMP; however, consider TSMO and Public Information components to address the work zone impacts.

1010.04 Developing TMP Strategies

1010.04(1) Key Considerations (Rewritten 2023)

The following list of actions and issues need to be addressed per WSDOT's work zone policy and federal regulations and are key to the successful development of a project's TMP:

- Hold a Work Zone Design Strategy Meeting during Scoping. Afterwards, create the Work Zone Design Strategy Statement and submit it to the Region Transportation Operations Office for acceptance.
- Integrate work zone impacts strategies during Scoping and early in Project Development to develop an accurate scoping estimate and integrate project constructability, work efficiency, and cost efficiency.
- Designers need to possess a good understanding of project constructability (work methods, needed work area, and reasonable work durations to complete the work). Contact the Construction Project Engineering Offices when making decisions on assessing and addressing constructability impacts.
- Designers need to possess a strong understanding of work zone traffic control strategies. Contact the Region Transportation Operations Office to discuss WZTC strategies and obtain preliminary closure hours used to develop traffic control plans, determine project duration, and estimate project costs.
- Designers need to circle back with Construction to assess the project's constructability with the WZTC strategies and preliminary closure hours. This may be an iterative process involving both Construction, the Region Transportation Operations Office, and others as appropriate to arrive to the final WZTC strategies and project's permitted closures and closure hours.
- Identify work zone safety and mobility impacts accounting for all needed work areas, operations, and possible staging areas. Implement appropriate safety strategies based on Work Zone Safety Management in *Traffic Manual* Chapter 5. Address traffic impacts extending beyond the project limits and impacting other roads and consider seasonal/special event/business impacts. The Region Transportation Operations Office can help determine an impact assessment via work zone traffic analysis and develop mitigation strategies.
- Continue developing the Transportation Management Plan throughout Design, refer to the TMP Checklist in Exhibit 1010-2 to help identify and organize TMP components.
- Take work zone training to better understand requirements, standard practices, and expectations including the legally adopted *Manual on Uniform Traffic Control Devices* (MUTCD) with Washington State modifications per WAC 468-95 as the minimum standard to develop adequate traffic control plans
- Approach work zone design from the road user's perspective. Except when required, consider positive protection devices when practical. Use established design criteria in work zone roadway and roadside design. A TMP will justify temporary design elements; a Design Analysis is not required.
- Address work vehicle ingress and egress to each work area.
- Consider impacts to freight based on Commercial Vehicle Considerations in *Traffic Manual* Chapter 5
- Accommodate pedestrian access (including ADA requirements) and bicycle access through or around the work zone. Consider the maintenance of existing transit stops.
- Consider school, hospital, emergency services, and postal delivery impacts.
- Consider maintenance issues and needs through the duration of the project.
- Consider law enforcement assistance and enforcement.

1010.04(2) Impacts Assessment

One of the most important tasks in developing a TMP is assessing the mobility impacts and safety performance. Careful consideration is needed when assessing the scope of the TMP. A designer needs to possess a clear understanding of how project features will be constructed, including work methods, equipment, materials, and duration, to complete the work. Involve the construction PE when making decisions on assessing and addressing impacts.

A complete and accurate impacts assessment will allow for the development of an effective TMP that should only need minor modifications to address construction considerations. The *Traffic Manual* provides information on how to determine expected work zone congestion along with mobility management strategies.

An early and ongoing impacts assessment allows time to:

- Develop Temporary Traffic Control (see Section 1010.04(5)), Transportation Systems Management Operations (see Section 1010.04(6)), and Public Information (see Section 1010.04(7))
- Resolve potential work zone impacts within the design features of the project. Decisions that consider work zone impacts during bridge type selection, materials selection, advertisement dates, and others have the potential to resolve or minimize work zone impacts.
- Consider innovative mitigation strategies that may involve many stakeholders.

Some impacts may be difficult to completely solve and may ultimately need a management decision to determine the level of mitigation or impact that is acceptable. These types of impacts need to be clearly addressed in the TMP with documentation supporting and explaining the decision.

The following are some examples of impacts that need to be managed during the design of a project:

1. Bridge construction sequence or falsework opening plans need to match the TTC staging or channelization plans. Coordination with the HQ Bridge and Structures Office is essential as the bridge design schedule may differ than the project schedule. Maintain the legal height of 16 feet 6 inches as the minimum falsework opening whenever possible; if this height cannot be maintained, then consider overheight vehicle impacts, possible additional signing needs, and temporary bypass routes. Reduction in shoulder widths due to barrier or bridge staging may affect active transportation access and mobility and are to be addressed in TTC plans. Refer to Chapter 720 for additional requirements and approvals. Coordination with the Permits Office may be needed.
2. If existing signal and illumination systems are not able to be maintained during the construction phases, plans for temporary systems or connections need to be included in the project.
3. Temporary relocation of existing signing (including overhead signing) may be required and shall be detailed in the plans.
4. Permanent traffic loop installation (such as advance loops, turn pockets, and stop bars, and ITS loops) and pavement marking installations (crosswalks, arrows, and so on) may require specific TTC plans.
5. Maintenance of pavement markings. The type of temporary markings to be used based on work duration, pavement surface and reducing the potential for a “ghost stripe” on the final pavement surface need to be considered.

6. Lane shifts onto existing shoulders:
    - The depth of the existing shoulder pavement must be adequate to carry traffic and rumble stripes need to be removed for long-term temporary roadway configurations. For short/intermediate-term durations, a single open lane can be shifted onto the paved shoulder with a variable regulatory speed limit reduction on freeways per *Traffic Manual* Chapter 5 Speed Limit Reductions in Work Zones.
    - Any existing catch basins or junction boxes located in the shoulder need to be addressed.
    - The existing clear zone needs to be reevaluated with when the edge of traveled way is temporarily shifted.
    - Shifting of more than one lane in a direction is only allowed with temporary pavement markings. Shifting lanes by using channelizing devices is not allowed due to the high probability that devices used to separate the traffic will be displaced.
    - Signal head alignment may need to be adjusted when lanes are shifted approaching an intersection.
7. Roundabout construction at an existing intersection requires site-specific staging plans to address the unique site-specific design features.
8. Evaluate impacts to the existing drainage system as discussed in Chapter 5 of the Hydraulics Manual, particularly for narrowed shoulders, superelevation and/or widening transitions.

1010.04(3) Work Duration

The duration of work is a major factor in determining a strategy and the amount and types of devices to use for work zone traffic control. A project may have work operations with durations that meet several or all of the following conditions:

1010.04(3)(a) Long-Term Stationary Work Zone

This is work that occupies a location continuously for more than three days. Construction signs should be post-mounted and larger; more stable channelizing devices should be used for increased visibility. Temporary barriers, pavement markings, illumination, and other considerations may be required for long-term stationary work. Staged construction or temporary alignment/channelization plans are required with this type of work.

1010.04(3)(b) Intermediate-Term Stationary Work Zone

This is work that occupies a location for up to three days. Construction signs may still be post-mounted if in place continuously but are typically tripod or barrier mounted. Conflicting overhead guide signs do not need to be modified. In addition to channelization devices, temporary pavement markings lane lines may be required where multiple lanes are laterally shifted in the same travel direction. Temporary barrier and temporary illumination would normally not be used in this work zone duration.

1010.04(3)(c) Short-Term Stationary Work Zone

This is work that occupies a location for more than one hour within a single day. At these locations, all devices are placed and removed during the single period.

1010.04(3)(d) Short-Duration Work Zone

This is work that occupies a location for up to one hour. Because the work time is short, simplified traffic control set-ups are allowed~~,~~ to reduce worker exposure to traffic as the time it may take to set up a full complement of signs and devices could exceed the amount of time required to perform the work.

Short-duration work zones usually apply to maintenance or some utility work and are not used on construction projects. (See Work Zone Traffic Control Guidelines for Maintenance Operations, M54-44 for more information.)

1010.04(3)(e) Mobile Work Zone

This is work that moves intermittently or continuously where workers are inside vehicles, except for a few minutes infrequently. Mobile operations include activities such as sweeping, paint striping, and raised pavement marker installation. Truck-mounted attenuators with truck-mounted Portable Changeable Message Signs or warning signs provide advance warning and shadow and protect the work vehicles with flashing lights as they move along at low speeds with infrequent stopping. Channelization devices are typically not used.

Mobile closures are not appropriate for work operations such as pavement milling and paving activities where workers are on foot for significant durations. Instead, stationary work zone traffic control closures are required.

1010.04(4) Transportation Management Plan Strategies

With a completed impacts assessment, strategy development can begin. There are often several strategies to address a work zone impact, and engineering judgment will be needed in selecting the best option. Constructability, along with addressing safety and mobility, is the goal. Selecting a strategy is often a compromise and involves many engineering and non-engineering factors. Work closely with bridge, construction, maintenance, and transportation operations office personnel when selecting and developing strategies for the Transportation Management Plan (TMP) and PS&E.

Do not assume that strategies chosen for past projects will adequately address the impacts for similar current projects. There may be similarities with the type of work, but each project is unique and is to be approached in that manner. Always look for other options or innovative approaches; many projects have unique features that can be turned to an advantage if carefully considered. Even a basic paving project on a rural two-lane highway may have opportunities for detours, shifting traffic, or other strategies.

The *Traffic Manual* Chapter 5 Work Zone Traffic Analysis contains comprehensive information regarding work zone traffic analysis to determine expected delay and queuing.

1010.04(5) Temporary Traffic Control Strategies (Section Rewritten 2023)

1010.04(5)(a) Work Near Traveled Way (Section Rewritten 2023)

If all work and work vehicles remain outside of the work zone clear zone, or behind barrier or guardrail when within the work zone clear zone, then no advanced warning signage is required.

If workers enter the work zone clear zone not protected by barrier and guardrail, add appropriate warning signs. See Section 1010.06(3).

1010.04(5)(b) Shoulder Closure (Section Rewritten 2023)

For active work operations when workers or work vehicles are on the paved shoulder or within the work zone clear zone not protected by barrier and guardrail, a shoulder closure should be used. Shoulder closures are not required for TTC device installation and removal activities. On roadways 40 mph or less, channelization devices may encroach into the adjacent open lane if a 10-foot minimum lane width is maintained. On roadways 45 mph and higher, channelization devices shall not encroach the adjacent open lane (instead close the adjacent open lane). Do not use sequential arrow sign at shoulder closures. Avoid using PCMSs only for shoulder closures. See Section 1010.06(3).

1010.04(5)(c) Lane Shift (Section Rewritten 2023)

On undivided roadways with three or more lanes, a single open lane can be shifted laterally into the closed two-way left turn lane (which maintains the thru lane in both direction) or into a closed oncoming travel lane. Do not use a sequential arrow sign at the lane shifts. PCMSs are optional.

1010.04(5)(d) Alternating One-Lane Two-Way Traffic (Section Rewritten 2023)

This strategy alternates all directions of traffic in a single open lane under the control of flagger, Automated Flagger Assistance Devices (AFADs), or temporary traffic signals where shown in traffic control plans. It is recommended to use AFADs on roadways 55 mph or higher, except near signalized intersections. Use temporary traffic signals for long-duration closures to alternate traffic during nonworking hours, but flaggers can control traffic during working hours (turn off the temporary signals and adjust signing as appropriate). Temporary rumble strips may be added in advance to increase driver alertness.

These stations shall be illuminated at night with either temporary illumination or existing illumination, except in emergencies. Pilot cars should be used to guide motorists between flaggers or AFADs for lane closures exceeding 1000 feet or having multiple intersecting roadways, driveways, or business accesses.

Refer to WAC 296-155-305 for flagging requirements. At least four advanced warning signs required on roadways 45 mph and higher and at least three advanced warning signs on roadways 40 mph or less. Flaggers are not to be used on freeways or expressways. Using flaggers solely to instruct motorists to proceed slowly is an unacceptable practice.

When flaggers are used at an intersection, a flagger is required for each leg of the intersection. Close lanes and turn pockets so only one lane of traffic approaches a flagger station on multilane roadways. When a signal is present, it shall be turned off or set to red flash mode when flagging. An additional flagger may be added at the center of an intersection provided each intersection leg is controlled by a flagger.

Only uniform police officers (UPOs) may flag from the center of an intersection without each intersection leg being controlled by a flagger. It is optional to close lanes and turn pockets approaching UPO-controlled intersections; however, two UPOs should be used on multilane roadways (2 or more thru lanes approaching the intersection in any direction). When a signal is present, it shall be turned off or set to red flash mode when UPOs are flagging.

See *Traffic Manual* Chapter 5 for more information on the use of law enforcement personnel at work zones.

1010.04(5)(e) Lane Closure on Multilane Roadways (Section Rewritten 2023)

On multilane roadways with two or more travel lanes in a direction, closing lanes and adjacent shoulders is a common strategy. Additional lanes shall be closed if encroachment is necessary. A separate sequential arrow sign shall be used at each lane closure taper.

On multilane roadways 45 mph and above, a 2-foot lateral buffer is provided between traffic and the work area. Consider closing additional lanes to increase the lateral buffer space for enhanced safety if practical.

Except at closure and shift tapers, channelization devices shall not encroach on the open lanes except when a single open lane is shifted onto the paved shoulder. Additional lanes shall be closed if encroachment is necessary whenever two or more lanes are open.

1010.04(5)(f) Single Open Lane Shifted onto Shoulder on Multilane Roadways (Section Rewritten 2023)

For multilane roadways requiring channelization devices to encroach into the only remaining open lane, that single open lane must be shifted over onto either the left or right paved shoulder. This shoulder shift configuration is necessitated by work operations including but not limited to:

- Two-lane freeway or divided highway with the work area extending up to the lane line adjacent to traffic for work including HMA pavement, concrete pavement, and/or expansion joint rehabilitation.
- Three-lane freeway with the work area including both lanes and extending up to the lane line adjacent to traffic for work including HMA pavement, concrete pavement, and/or expansion joint rehabilitation.

Reduced speed limits are required for this strategy on freeways and divided multilane highways with existing speed limits 60 mph or higher. See Speed Limit Reductions in Work Zones in *Traffic Manual* Chapter 5.

For travel widths less than 16 feet, see Commercial Vehicle Considerations in *Traffic Manual* Chapter 5.

1010.04(5)(g) Rolling Slowdown (Section Rewritten 2023)

This strategy involves using a slow-moving blockade of traffic control vehicles and/or law enforcement vehicles to create a large traffic gap enabling the completion of work activities requiring exclusive access across or over a directional roadway, including freeways, that otherwise presents a significant risk to motorists and workers.

Rolling slowdowns are not to be used for routine work that can be addressed by lane closures or other stationary traffic control strategies. Rolling slowdowns are intended for work operations needing up to 10 minutes of clear time. For longer durations, use directional freeway or roadway closure. See Rolling Slowdowns in *Traffic Manual* Chapter 5 for detailed information.

A Rolling Slowdown typical traffic control plan is now available in the WSDOT Typical Traffic Control Plan Library; however, a site-specific traffic control plan is required for complex rolling slowdown scenarios.

1010.04(5)(h) Traffic Holds (Section Rewritten 2023)

This strategy involves using flaggers and/or uniform police officers to stop traffic in all directions to enable completion of work activities requiring exclusive access across or over the roadway that otherwise presents significant risks to motorists and/or workers. On multilane highways, reduce each direction of traffic down to a single open lane. Traffic holds are not to be used on freeways. See Traffic Holds in Traffic Manual Chapter 5.

These traffic holds may be implemented with shoulder or lane closures, including alternating one-lane two-way traffic control. Traffic hold durations typically range from a few minutes up to 15 minutes. For unique situations needing longer traffic holds, contact the Region Transportation Operations Office.

Traffic holds are used for work operations including but not limited to:

- Rock scaling and/or tree clearing operations
- Bridge painting/rehabilitation projects to install containment/falsework across roadway
- Heavy truck ingress/egress
- Equipment crossing across roadway

1010.04(5)(i) Temporary Alignment and Channelization

Temporary alignments and/or channelization may be an option for long-duration work zones or staged traffic control. The following are guiding principles for the design of temporary alignment and channelization plans:

- Use site-specific base data to develop site-specific staged traffic plans.
- For all temporary design elements, use Design Manual guidance for permanent features to the extent practical and feasible. When use of permanent guidance is not feasible, justify any variance in the TMP.
- Provide beginning and ending station ties and curve data.
- Include lane and shoulder widths.
- Provide temporary roadway sections, including lateral clearance and temporary barrier deflection distances.
- To avoid confusion, do not show unnecessary details on the plan.
- Do not use straight line tapers through curves; use circular alignment.
- Consider existing crown points, lane/shoulder cross slope breaks, and super-elevation transitions that may affect a driver's ability to maintain control of a vehicle.
- If the project has multiple stages, from one stage to the next, show features constructed in previous stages as existing elements.
- Consider the time needed for removal of existing markings and placement of the new markings and possibly placement of barriers and attenuators. In urban areas where work hours for lane closures are limited, special consideration may be necessary to allow time to implement the plan, or an interim stage may be necessary.
- Use shoulder closure signing and channelizing devices to close a shoulder prior to a temporary impact attenuator/sloped terminal and run of temporary barrier.
- Existing signing may need to be covered or revised, and additional construction warning signs may be needed for the new alignment.
- Temporary pavement marking type (short-duration or long-duration) and colors shall be specified.
- For better guidance through shifting or taper areas, consider solid lane lines. Return to broken lane lines between shift areas.
- Provide a list of the approved temporary impact attenuators that may be used for the plan, if applicable.
- The plans are to provide all the layout information for all the temporary features just as a permanent pavement marking plan would.

1010.04(5)(i)(i) Staged Construction

Staged construction requires combining multiple work operations into a logical order to provide large, protected work areas and separate traffic spaces for long durations, which maximizes work operations and minimizes daily impacts to traffic. Design temporary alignment and channelization plans to place traffic in these semi-permanent locations. Permanent geometric design criteria are to be used when developing these plans to the extent practical and feasible; otherwise, the TMP will justify temporary design elements and a Design Analysis is not required. Design strategies such as overbuilding for future

stages, or the use of temporary structures are often part of staged construction on significant impact projects. Request that the Region Transportation Operations Office performs a detailed work zone traffic analysis for each stage.

1010.04(5)(i)(ii) Lane Shift/Reduced Lane Width

Traffic lanes may be shifted and/or width reduced in order to accommodate a long-duration work area when it is not practicable, for capacity reasons, to reduce the number of available lanes. Shifting lanes of traffic requires the removal of existing conflicting pavement markings and the installation of temporary markings. Use advanced warning signs and solid lane lines through L/2 lane shifts but consider more gradual shifting tapers for shifting multiple lanes on a freeway.

Utilizing the existing shoulder may be necessary to accommodate the shifting movement. First, determine the structural capacity of the shoulder to ensure its ability to carry the proposed traffic. Remove and inlay existing shoulder rumble strips prior to routing traffic onto the shoulder for long durations.

1010.04(5)(i)(iii) Traffic Split or Island Work Zone

This strategy separates lanes of traffic traveling in one direction around a work area. Some drivers have difficulty understanding the "lane split" configuration resulting in braking or unnecessary late lane changes. Braking and erratic lane changes decrease the traffic capacity through the work zone, which results in an unstable traffic flow approaching the lane split. This strategy should be avoided in urban areas due to frequency of ramps.

Evaluate other strategies to keep traffic on one side of the work area to avoid a traffic split if possible, such as a median crossover that utilizing a moveable barrier system to transfer the temporary center lane back and forth to the direction of heaviest traffic volumes.

Consider the following guidance for traffic split operations:

- If used, limit the duration the traffic split can be in place. Consider incentives and disincentives to encourage the contractor to be as efficient as possible. A higher level of traffic impacts may be acceptable if offset with fewer impacted days.
- Advance warning signs advising drivers of the approaching roadway condition are required. Consider the use of Portable Changeable Message Signs (PCMS), portable Highway Advisory Radio (HAR), and other dynamic devices. Overhead signing and in-lane pavement markings also may be necessary to give additional driver notice of the traffic split.
- Consider how the traffic split will impact truck traffic. If the truck volumes are high, restricted truck lanes approaching and through the traffic split may be appropriate. For questions concerning truck operations, contact the HQ Freight Systems Division.
- To discourage lane changing, consider the use of solid lane line markings to delineate traffic approaching the split or island. Refer to the MUTCD for additional details.
- Consider the use of STAY IN LANE (black on white) signs or set up a "no pass" zone approaching the lane split and coordinate with the Washington State Patrol (WSP).
- Supplement the existing roadway lighting with additional temporary lighting to improve the visibility of the island work area (see Chapter 1040).
- Coordinate with the Region Transportation Operations Office for signing and pavement marking details when designing island work zones.

Work area ingress and egress should be through and adjacent lane closure.

1010.04(5)(i)(iv) Temporary Bypass

This strategy involves total closure of one or both directions of travel on the roadway. Traffic is routed to a temporary bypass usually constructed within the highway right of way. An example of this is the replacement of an existing bridge by building an adjacent temporary structure and shifting traffic onto the temporary structure. A temporary channelization plan will show pavement markings, temporary barrier with impact attenuators/sloped terminals, sign, and device placement.

1010.04(5)(i)(v) Median Crossover

This strategy involves placing both directions of traffic on one side of a multilane divided highway. The number of lanes is usually reduced in both directions and one direction is routed across the median. Existing even-lane configurations may be converted to temporary odd-lane configurations with a moveable barrier system to transfer the temporary center lane back and forth to the direction of heaviest traffic volumes.

The design for elements of temporary crossovers needs to follow the same guidance as permanent design for alignment, barriers, delineation, and illumination. Permanent geometric design criteria are to be used when developing these plans to the extent practical and feasible; otherwise, the TMP will justify temporary design elements and a Design Analysis is not required.

- The goal is to design crossovers not less than 10 mph below the posted speed limit unless site conditions require a lower design speed. Warning signs with an advisory speed plaque, based on the median crossover design speed, shall be used at median crossovers. The continuous regulatory work zone speed limit is based on the geometric configuration of temporary roadway outside of isolated restrictive features, such as lane and shoulder widths.
- Median paving may be required to create crossover locations (consider drainage for the added pavement).
- When feasible, use temporary barrier on freeways to separate the two directions of traffic and evaluate the need for a glare screen. It is acceptable to separate two directions of traffic with a double yellow centerline or an 18-inch yellow barrier line. Pavement-mounted tubular markers may be added but consider the frequency of Oversize/Superload commercial vehicle freight and impacts to snow plowing operations.
- Provide temporary illumination at the crossover locations (see Chapter 1040)
- Straight line crossover tapers work best for highways with narrow paved medians.
- Temporary pavement markings, removal of conflicting existing markings, and construction signs are also required.
- Channelizing devices shall be used to supplement temporary markings at the crossover locations.
- Provide a design clear zone adjacent to the crossover and avoid placing crossover detours near structures.
- For traffic that is crossed over (going against the normal traffic flow direction) existing bridge rail ends, barriers, guardrails or other objects may require temporary barrier/impact attenuators for protection.

1010.04(5)(j) Total Closures and Detours

Total closures may be for the project duration or for a critical work operation because of major constructability considerations or safety performance. The main requirement for total closures is the availability of a detour route and if the route can accommodate the increased traffic volumes and truck turning movements.

Local roads may have lower geometric criteria than state facilities. Placing additional and new types of traffic on a local road may influence safety performance, especially when drivers are accustomed to the geometrics associated with state highways. Pavement integrity and rehabilitation may need to be addressed when traffic is detoured to specific local roadways.

For the traveling public, closing the road for a short time might be less of an inconvenience than driving through a work zone for an extended period of time (see the Traffic Manual and RCW 47.48). Advance notification of the closure is required, and a signed detour route may be required.

Consider the following road closure elements:

- Communication with all stakeholders, including road users, adjoining property owners, local agencies, transit agencies, the freight industry, emergency services, schools, and others, is required when considering a total closure strategy. This helps determine the level of support for a closure and development of an acceptable closure. Include the HQ Design Office Railroad Liaison, Rail, Freight, and Ports; Commercial Vehicle Services; and Public Transportation Divisions to help coordinate.
- Analyze a closure strategy and compare it to other strategies, such as staged work zones, to determine which is overall more beneficial. This information helps stakeholders understand the impacts if a closure is not selected.
- A closure decision (other than short-term, minor-impact closures) will require stakeholder acceptance and Regional management approval once impacts and benefits have been analyzed.
- Closures that reopen to a new, completed roadway or other noticeable improvements are generally more accepted by the public.
- Route-to-route connections and other strategic access points may have to be maintained or a reasonable alternative provided.
- Material selection, production rates, and work operation efficiencies have a direct tie to the feasibility of the closure strategy. A strong emphasis has been placed on this area and several successful strategies have been implemented, such as weekend-long closures or extended-duration single-shift closures. These strategies use specific materials such as quick-curing concrete, accelerated work schedules, prefabricated structure components, on-site mix plants, and so on, and are based on actual production rates. The WSDOT Materials Laboratory and the HQ Construction Office are good resources for more information on constructability as a component of an effective work zone strategy.
- Interstate or interstate ramp closures (including interstate closures with interchange ramps as detours) lasting more than 7 days require FHWA 60-day advance notice. See the Stewardship and Oversight Agreement for closure notification requirements.
- Short-duration closures of ramps or intersecting streets during off-peak hours do not require extensive approval if advance notice is provided and reasonable alternate routes are available.
- Detailed, project-specific traffic control plans, traffic operation plans, and public information plans are required.
- Depending on the duration of the closure/detour and the anticipated amount and type of traffic that will use the route, consider upgrades to the route such as signal timing, intersection turning radius for large vehicle, structural pavement enhancements, or shoulder widening.
- An approved detour agreement with the appropriate local agency is required for detour routes using local roadways and are to be completed prior to project advertisement.
- Document road closure decisions and agreements in the Project File.

Roadway closures, detours, and alternate routes must be analyzed by for disproportionate impacts to EJ and LEP communities. If an EJ or LEP community is identified along a proposed route and will be disproportionately impacted, appropriate mitigation must be coordinated between WSDOT Communications and the Contractor. When additional changes are made to the route, it should be evaluated to determine if the detour adds congestion, noise or creates safety issues for adjacent residences and businesses and/or adds considerably longer distance to access residences/businesses that may affect low income and minority population. WSDOT will work with local agencies and conduct public outreach as necessary, to ensure that the proposed route will not have a disproportionately high and adverse effect on EJ or LEP populations. A Communications Plan must include appropriate accommodations for identified populations and businesses.

1010.04(5)(k) Pedestrian and Bike Accommodations

When existing pedestrian access routes and bike routes are disrupted due to construction activities, see Section 1010.06(7) for accommodation strategies. Also, consider the impacts to transit stops for pedestrians.

1010.04(5)(l) Project Delivery Methods

To reduce construction times and minimize impacts to the traveling public, consider alternative delivery techniques to accomplish this. For more information, see: Project delivery methods | WSDOT (wa.gov)

1010.04(5)(m) Innovative Design/Construction Methods

- Overbuild beyond normal project needs to maintain additional traffic or facilitate staged construction.
- Replace bridges using new alignments so they can be built with minimal impacts.
- Bring adjacent lifts of hot mix asphalt (HMA) to match the latest lifts (lag up) and require a tapered wedge joint to eliminate drop-off and abrupt lane edges.
- Require permanent pavement markings at intervals during multi-season projects to limit the duration temporary markings are needed and to support pavement marking visibility during winter shutdown.

1010.04(6) Transportation Systems Management and Operations (TSMO) Strategies

The following are operational strategies to consider based on project specific needs:

1010.04(6)(a) Transportation Demand Management

- Provide transit service improvements and possible incentives to help reduce demand.
- For long-term freeway projects, consider ramp metering.
- Provide a shuttle service for pedestrians and bicyclists.
- Provide local road improvements (signals modifications, widening, and so on) to improve capacity for use as alternate routes.
- Provide traffic screens to reduce driver distraction.

1010.04(6)(b) Corridor/Network Management

- Provide a temporary express lane with no access through the project.
- Consider signal timing or coordination modifications.
- Provide emergency pullouts for disabled vehicles on projects with long stretches of narrow shoulders and no other access points.
- Use heavy-vehicle restrictions and provide alternate routes or lane use restrictions.

1010.04(6)(c) Work Zone Safety Management

- Provide temporary access road approaches for work zone access.
- Use positive protective devices (barrier) for long-term work zones to improve the environment for workers and road users.
- Consider including temporary portable transverse rumbles strips and/or automated flagger assistance devices (AFADs) for flagging operation plans.
- Use temporary portable traffic control systems for long duration one-lane two-way traffic control.
- Refer to the *Traffic Manual* Chapter 5 for additional information, guidance, and approval requirements for speed limit reductions in work zones.
- Use advanced queue mitigation systems depending on the extent of expected work zone congestion on high-speed roadways. Refer to the *Traffic Manual* Chapter 5 for additional information and guidance for Smart Work Zone Systems, Queue Warning Systems, and other simpler PCMS versions.

1010.04(6)(d) Traffic/Incident Management and Enforcement

- Provide law enforcement patrols to reduce speeding and aggressive drivers.
- Provide incident response patrols during construction to reduce delays due to crashes in the work zone.
- Provide a dedicated tow service to clear incidents.

1010.04(6)(e) Smart Work Zone System (SWZS)

- Deploy roadway monitoring technology such as queue length detection, mobile surveillance, and over-dimension vehicle detection.
- Deploy dynamic traffic control technology such as temporary ramp metering, variable speed control, and dynamic lane merge.
- Deploy driver information systems such as portable changeable message signs (PCMS), travel time and congestion information, and integration with third-party trip planning applications.

See Section 1010.09(5) for more information on SWZS and potential integration with TMCs and broader ITS operations.

1010.04(7) Public Information

The Public Information (PI) strategies help raise awareness of the upcoming project impacts and/or current restrictions.

Typical public awareness strategies planned during Design and performed during Construction typically include:

- Advanced closure notification via R11-1501 signage or using portable changeable message signs
- Schematics detailing maps of the closure along with detour/alternative route information
- Oversize/overweight and vertical clearance restrictions via WSDOT Commercial Vehicle Services and construction warning signs. Coordinate freight travel information and restrictions with Rail, Freight, and Ports Division.
- Coordinate transit travel information and restrictions with the Public Transportation Division
- Pedestrian and bicycle access information and alternative routes via information signing and alternative route maps/brochures

Public awareness strategies are typically developed by WSDOT Region Communications offices and implemented before and during construction closures by utilizing different public outreach tools such as news coverage via press releases, WSDOT social media (Facebook, Twitter, YouTube), WSDOT Construction Projects webpage, and WSDOT Blog. Consider providing information in other languages when appropriate.

Maintain effective public relations throughout both design and construction phases for projects with high-impact closures. Avoid surprising stakeholders and the public by informing them answers to "What is closed and when?", "How do you get to where you need to go?", and "What are the anticipated delays and times to avoid traveling through the work zone?" Be sure to explain the benefits of high-impact closures: Why is the inconvenience worth it and what work will be/was completed?

1010.04(7)(a) Public Awareness

One PI strategy is a public awareness campaign using the media, project websites, public meetings, e-mail updates, and mailed brochures. This gives regular road users advance notice of impacts they can expect and time to plan for alternate routes or other options to avoid project impacts. Involve the region or HQ Communications Office in developing and implementing these strategies. Coordinate transit travel information and restrictions with the Public Transportation Division. wwwi.wsdot.wa.gov/PubTran/

Coordinate freight travel information and restrictions with the Rail, Freight, and Ports Division.

https://geo.wa.gov/datasets/WSDOT::wsdot-freight-data-truck-freight-economic-corridors/about

1010.04(7)(b) Driver Information

In addition to work zone signs, provide driver information using highway advisory radio (HAR) and changeable message signs (existing or portable). Include a Smart Work Zone System to provide drivers with real time information on queuing and delays. Involve the region TMC in the development and implementation of these strategies. Additional information on smart work zone systems can be found on the Work Zone Safety web page: https://wsdot.wa.gov/engineering-standards/design-topics/traffic-work-zone-traffic-control-wztc

The Freight Alert system should be used to communicate information with freight industry on work zones. Each region has the capability to send alerts with this system.

https://geo.wa.gov/datasets/WSDOT::wsdot-freight-data-truck-freight-economic-corridors/about

Work zone strategy development is a fluid process and may be ongoing as project information and design features are developed during the design process. There may be many factors involved with strategy development, and it is necessary to be well organized to make sure all the relative factors are identified and evaluated.

1010.04(7)(c) Pedestrian and Bicycle Information

Include pedestrian and bicycle access information and alternate routes in the public awareness plans. Pedestrian and bicyclist information signing, including alternate route maps specifically for these road users, could be considered.

1010.05 Work Zone Traffic Analysis

Work zone congestion and delay is a significant consideration for many highway projects. At high-volume locations with existing capacity problems, even shoulder closures will increase congestion.

All work zone traffic restrictions need to be analyzed to determine the level of impacts and the appropriate queue mitigation system and public information outreach. See Chapter 5 in the Traffic Manual for additional information. Include a Work Zone & Traffic Analysis in the TMP.

Work zone mobility impacts can have the following effects:

- **Crashes:** Most work zone crashes are congestion-related, usually in the form of rear-end crashes due to traffic queues. Traffic queues extending beyond the advance warning signs may increase potential for crashes.
- **Driver Frustration:** Drivers expect to travel to their destinations in a timely manner. If delays are excessive, driver frustration can lead to aggressive or inappropriate driving actions.
- **Constructability:** Constructing a project efficiently relies on the ability to pursue work operations while maintaining traffic flow. Delays in material delivery, work hour restrictions, and constant installation and removal of traffic control devices all detract from constructability.
- **Local Road Impacts:** Projects that reduce capacity can sometimes cause traffic to divert to local roadways, which may impact the surrounding local roadway system and community.
- **Public Credibility:** Unanticipated work zone congestion and delay can create poor credibility for WSDOT with drivers and the surrounding community without sufficient public outreach in advance.
- **Restricted Access:** Severe congestion can effectively gridlock a road system, preventing access to important route connections, businesses, schools, hospitals, and so on.
- **User Cost Impacts:** Traffic delays have an economic impact on road users and the surrounding community. Calculated user costs are part of a work zone capacity analysis and may be used to determine liquidated damages specifications.

While maintaining the optimum carrying capacity of an existing facility during construction may not be possible, but efforts should be made to maintain existing traffic mobility through and/or around the work zone.

Maintaining mobility does not rule out innovative strategies such as roadway closures. Planned closures can accelerate work operations, reducing overall impacts to road users. These types of traffic control strategies are to include transportation demand management and public information plans to notify road users and mitigate and manage the impacts as much as possible.

A work zone capacity analysis helps determine whether a work zone strategy is feasible. Mitigation measures that provide the right combination of good public information, advance signing and notification, alternate routes, detours, and work hour restrictions, as well as innovations such as strategic closures, accelerated construction schedules, or parallel roadway system capacity improvements, can be very effective in managing mobility impacts.

Many projects will have several potential work zone strategies, while other projects may only have one obvious work zone strategy. It is possible that a significant mobility impact strategy may be the only option.

There is no policy on the acceptable level of work-zone-created congestion and delay allowed on a project. In conjunction with the Region Traffic Engineer, the designer uses engineering judgment along with knowledge of the projects traffic conditions, alternate routes, and more to determine an acceptable level of congestion and delays. This level of impact anticipated by the work zone strategy are to be in concurrence with region management.

The traffic analysis process helps shape the TMP as the work zone strategies are evaluated and refined into traffic control plans and specifications. Maintain work zone traffic analysis documents in the Project File.

Current volume data in the project vicinity is required for accurate work zone traffic analysis results.

Seasonal adjustment factors may be needed depending on the data was collected and when the proposed traffic restrictions may be in place. Assess existing data as early as possible to determine whether additional data collection may be required. The Region Transportation Operations Office and the HQ Transportation Data & GIS Office can assist with collecting traffic volume data. Coordination with local agencies may be needed to obtain data on affected local roads.

Refer to Chapter 5 in the Traffic Manual for comprehensive work zone mobility management, work zone capacity information, and work zone queue and delay estimation calculations. The following resources are also available to assist with the actual analysis and mitigation strategy development upon request:

- HQ Transportation Operations Division
- HQ Transportation Data & GIS Office
- Region Transportation Operations Office
- Region Public Information Office

1010.06 Work Zone Design

Part 6 of the MUTCD mostly addresses short-duration temporary traffic control standards. Some long-duration work zones may require temporary alignments and channelization, including barrier and attenuator use, temporary illumination and signals, and temporary pedestrian and bicycle routes. Use Design Manual guidance for permanent features to the extent practical and feasible with temporary modification to design elements may be modified as justified in the TMP; a Design Analysis is not required.

1010.06(1) Lane Widths

While it is desirable to maintain existing lane widths during work zone operations whenever practical, often temporary lane width reductions are necessary.

For projects that require lane shifts or lane width reductions due to work area limits and staging, consider the following before determining the work zone lane configurations to be implemented:

- Overall roadway width available
- Posted speed limit
- Traffic volumes through the project limits
- Number of lanes
- Existing lane and shoulder widths
- Crown points and shoulder slope breaks
- Treat lane lines and construction joints to provide a smooth flow
- Length and duration of lane width reduction (if in place)
- Roadway geometry (cross slope, vertical and horizontal curves)
- Vertical clearances
- Transit and freight vehicles, including over-sized vehicles

Abrupt geometric transitions in the work zone shall be minimized or avoided if possible. When necessary, such transitions should be made as smoothly as the space available allows. Maintain approach lane width, if possible, throughout the connection. Design lane width reductions prior to any lane shifts within the transition area. Do not reduce curve radii and lane widths simultaneously.

Work with the Region Transportation Operations Office to determine appropriate lane widths. The objective is to use lane geometrics that will be clear to the driver and keep the vehicle in the intended lane. In order to maintain the minimum lane widths, temporary widening may be needed.

1010.06(2) Buffer Space

Buffer spaces separate road users from the workspace or other areas off limits to travel. Buffer spaces also might provide some recovery space for an errant vehicle.

- A lateral buffer provides space between the vehicles and adjacent workspace, traffic control device, or a condition such as an abrupt lane edge or drop-off. A 2-foot lateral buffer space is recommended on roadways 45 mph or higher. Consider positive protection devices for long-duration closures (2 weeks or more) when workers are substantially exposed to vehicular traffic on roadways 45 mph or higher. When temporary barriers are used, place a temporary edge line (typically 2-foot laterally from the barrier, but may be reduced).
- When feasible, a longitudinal buffer space is used immediately downstream of a closed or shifted traffic lane or shoulder. This space provides a recovery area for errant vehicles as they approach the workspace.

The body of any channelization devices used to separate the road user from the workspace shall not encroach into adjacent lanes except where a single open lane is laterally shifted onto the shoulder. If encroachment is necessary, the adjacent lane must be closed to maintain the lateral buffer space except for shoulder closures on roadways 40 mph or less.

To achieve the minimum lateral buffer, there may be instances where pavement widening or a revision to a stage may be necessary. In the case of short-term lane closure operations, the adjacent lane may need to be closed or traffic may need to be temporarily shifted onto a shoulder to maintain a lateral buffer space. During the design of the traffic control plan, the lateral buffer needs to be identified on the plan so that additional width is available; use temporary roadway cross sections to show the space in relation to the traffic and work area.

1010.06(3) Work Zone Clear Zone

The contractor's operations present opportunities for errant vehicles to impact the clear area adjacent to the traveled way. The work zone clear zone(s) (WZCZ) in a project are determined by the posted speeds of the roadways in the project using Exhibit 1010-1. The WZCZ applies only to roadside objects introduced by the contractor's operations (vehicles, equipment, and materials). It is not intended to resolve existing objects in the Design Clear Zone or clear zone values established at the completion of the project.

During nonworking hours, vehicles, equipment, or materials shall not be within the WZCZ unless they are protected by permanent guardrail or temporary barrier. The use of temporary concrete barrier shall be permitted only if the engineer approves the installation and location.

During actual hours of work, unless protected as described above, only equipment and materials absolutely necessary to construction shall be within the WZCZ, and only construction vehicles absolutely necessary to construction shall be allowed within the WZCZ or allowed to stop or park on the shoulder of the roadway.

Exhibit 1010-1 Minimum Work Zone Clear Zone Distance

Posted Speed	Distance From Traveled Way (ft)
35 mph or less	10
40 mph	15
45 to 50 mph	20
55 to 60	30
65 mph or greater	35

1010.06(4) Abrupt Lane Edges and Drop-offs

Minimize, mitigate, or eliminate abrupt lane edges and drop-offs whenever practicable. When unavoidable, traffic control plans should provide a protection method. Consider temporary barriers for long duration drop off protection and contract provisions limiting the duration of edges from daily paving operations consistent with Standard Specification section 1-07.23(1).

When a temporary barrier is used to protect a drop-off, provide a lateral offset from the drop-off to the back side of the barrier with an offset distance equal-to or greater than the distance listed in DM Exhibit 1610-3. Provide an edge line on the traffic side of the temporary barrier (typically 2-feet from the face of the barrier). Provide a barrier end treatment; such as an impact attenuator, or end terminal, when the barrier end is located inside the Design Clear Zone.

Unless behind guardrail or barrier, open trenches are prohibited within the Traveled Way, Auxiliary Lanes, Shoulders, or other areas in the work zone clear zone. Backfilling and paving operations are required to reopen to vehicular traffic. Steel plates are allowed for open and closed Pathways, provided the walking surface is painted with either a non-slip paint, anti-slip tape, or rolled roofing surface and transverse edges are beveled at 2:1 with a maximum ¼" vertical lip.

When backfilling is not possible, steel plates may be used. Detailed steel plate drawings and Special Provisions (including steel plate dimensions, maximum allowable span and overlap dimensions, and nonskid surface, anchorage/shoring, and material requirements) shall be included in the PS&E in collaboration with Bridge & Structures and Region Transportation Operations. Steel plate shall be anchored and either embedded flush with the existing road surface or a wedge of suitable material provided for a smooth transition between the pavement and the steel plate.

Abrupt lane edges, and drop-offs and steel plates require additional warning and considerations for motorcyclists, bicyclists, and pedestrians, including pedestrians with disabilities.

Signing to warn the motorcycle rider, bicyclists and pedestrians, including pedestrians with disabilities of these conditions is required. (See RCW 47.36.200 and WAC 468-95-305). See *Design Manual* Chapter 1510 for work zone pedestrian accommodation guidance.

See Standard Specifications section 1-07.23(1) for the contract requirements for drop off protection and address project specific protection if necessary.

1010.06(5) Vertical Clearance

In accordance with Chapter 720, the minimum vertical clearance over new highways is 16.5 feet. For locations where this minimum cannot be met, follow the reduced clearance criteria discussed in Chapter 720 and include it in the traffic control plans. Maintain legal height on temporary falsework for bridge construction projects. If legal height on temporary falsework cannot be provided, consider over-height vehicle impacts and possible

additional signing needs and coordination with permit offices. Widening of existing structures can prove challenging when the existing height is at or less than legal height, so extra care is required in the consideration of over-height vehicles when temporary falsework is necessary. Coordination with the HQ Bridge and Structures Office is essential to ensure traffic needs have been accommodated. Vertical clearance requirements associated with local road networks may be different than what is shown in Chapter 720. Coordinate with the local agency.

1010.06(6) Speed Limit Reductions & Advisory Speeds in Work Zones (Section Rewritten 2023)

All work zone speed limit reduction and/or advisory speed requests must be submitted through Region Transportation Operations for review. Designers shall collaborate with Region Transportation Operations and obtain their concurrence early in project development in the Work Zone Designer Strategy Meeting. Refer to the *Traffic Manual Chapter 5* for additional information, guidance and approval requirements for speed limit reductions in work zones. Include approval documents in the Project File.

Speed reduction for work zones is categorized as follows:

- **Continuous Regulatory Speed Limit Reduction**: In place 24 hours a day during both active work operations and nonworking hours for a stage of work lasting 4 or more calendar days.
- **Variable/Intermittent Regulatory Speed Limit Reduction**: In place only during active work operations when temporary lane closures are in place lasting 3 calendar days or less but typically used during daily/nightly lane closures. When the lane closure is removed, the existing speed limit or continuous regulatory work zone speed limit is restored.
- **Advisory Speed**: Associated with a warning sign for an isolated work zone condition or roadway restriction up to ½ mile in length based on the reduced design speed or ball banking measurement. Advisory speeds may be in place continuously or variably.

Drivers tend to reduce their speed only if they perceive a need to do so. Unless Region Transportation Operations accepts otherwise, continuous regulatory speed limit reductions will only be considered for restrictive temporary roadway configurations that exceed ½ mile in length that cannot be designed for the existing speed limit; warning signs with advisory speeds, matching the reduced design speed, shall be used at restrictive features up to ½ mile in length provided it is within 10 mph of the regulatory speed limit. In addition, continuous regulatory speed limit reductions are also considered during bituminous surface treatment (BST) operations, alternating traffic under temporary portable traffic signal control, and emergency situations.

Variable/intermittent regulatory speed limit reductions will be considered during lane closures utilizing active work operations with workers, equipment, or materials adjacent to traffic on roadways posted 45 mph or higher without positive protection devices. Variable/intermittent regulatory speed limit reductions may be considered as part of an overall safety strategy and shall be in compliance with *Traffic Manual Chapter 5.*

Advisory speeds are associated with a warning sign for an isolated work zone condition or restricted roadway features up to ½ mile in length and posted based on the reduced design work zone speed or ball banking measurement provided it is within 10 mph of the regulatory speed limit, unless approved otherwise by Region Transportation Operations. Advisory speeds are used for restricted sight distance, median crossover, roadway realignment where the feature's design speed does not match the regulatory speed limit.

1010.06(7) Accommodation for Pedestrians and Bicyclists

Many public highways and streets accommodate pedestrians and bicyclists, predominately in urban areas. During construction, access must be maintained through or around the work zones. When existing pedestrian routes are closed, design and construct the alternate routes to be detectable and to meet or exceed the existing level of accessibility.

When existing accessible routes are closed, temporary pedestrian facilities within the work zone are required to meet ADA accessibility criteria to the maximum extent feasible. Covered walkways are to be provided where there is a potential for falling objects.

Shared bicycle-vehicle lanes are prohibited on freeways and multilane roadways 45 mph and higher. On these routes, bicyclists will need either a 4-foot shoulder, detour/alternate route (via sidewalk, shared path, or another roadway), shuttle, or some other reasonable accommodation through or around the work zone.

When existing separated bicycle lanes are closed during construction, bicycles are to be detoured onto the adjacent sidewalk. If that sidewalk is also closed, then a combined bicycle-pedestrian detour route, free shuttle, or another reasonable accommodation is to be provided.

On highways 30 mph or less without separated bicycle lanes, a shared vehicle-bicycle lane may be used with a R4-11 sign (Bicycles MAY USE FULL ROADWAY).

On highways 35 mph or higher without separated bicycle lanes, a shared-bicycle lane may be used with additional W11-15 MOD (Bicycles SHARE THE ROAD) warning signs placed in advance and along the route except when existing separated/protected bicycle lanes are present.

Bicycles may be combined with vehicular traffic when alternating traffic is controlled via flagger, AFAD, or temporary signal on all roadways regardless of the posted speed limit.

It may be possible to make other provisions to transport pedestrians and bicyclists through a work zone or with a walking escort around the active work area. Roadway surfaces that are reasonably smooth provide for greater accessibility for those walking, biking and rolling. Conditions such as loose gravel, uneven surfaces, milled pavement, or asphalt tack coats restrict access and may increase the potential for falling or tripping. It is recognized that construction may create these temporary conditions and to the extent feasible should be avoided or signs shall indicate the conditions.

Information can be gathered on considerations for bicyclists by contacting local bike clubs and local agencies. Coordination with local bike clubs increases the likelihood that their members are notified of work zone impacts, and it helps maintain good public relations. (See Chapter 1510 for more pedestrian and bicyclist design requirements and MUTCD Chapter 6D for pedestrian work zone design requirements.)

1010.06(8) Warning Signs for Motorcyclists

The roadway surface condition requires additional warning signs to alert the motorcyclist of work zone conditions. Per RCW 47.36.200 paragraph 2, “(2) If the construction, repair, or maintenance work includes or uses grooved pavement, abrupt lane edges, steel plates, or gravel or earth surfaces, the construction, repair, or maintenance zone must be posted with signs stating the condition, as required by current law, and in addition, must warn motorcyclists of the potential hazard only if the hazard or condition exists on a paved public highway, county road, street, bridge, or other thoroughfare commonly traveled. For the purposes of this subsection, the department shall adopt by rule a uniform sign or signs for this purpose, including at least the following language, "MOTORCYCLES USE EXTREME CAUTION."

1010.06(9) Oversized Vehicles

The region Maintenance offices and the HQ Commercial Vehicle Services Office issue permits to allow vehicles that exceed the legal width, height, or weight limits to use certain routes. If a proposed work zone will reduce roadway width or vertical clearance, or have weight restrictions, adequate warning signs and notification to the HQ Commercial Vehicle Services Office and the appropriate region Maintenance Office is required as a minimum. When the total width of a roadway is to be reduced to less than 16 feet for more than three days, communication with these offices and any other stakeholders is required; include documentation in the Project File. The contract documents shall include provisions requiring the contractor to provide a 30-calendar-day notice prior to placing the restriction.

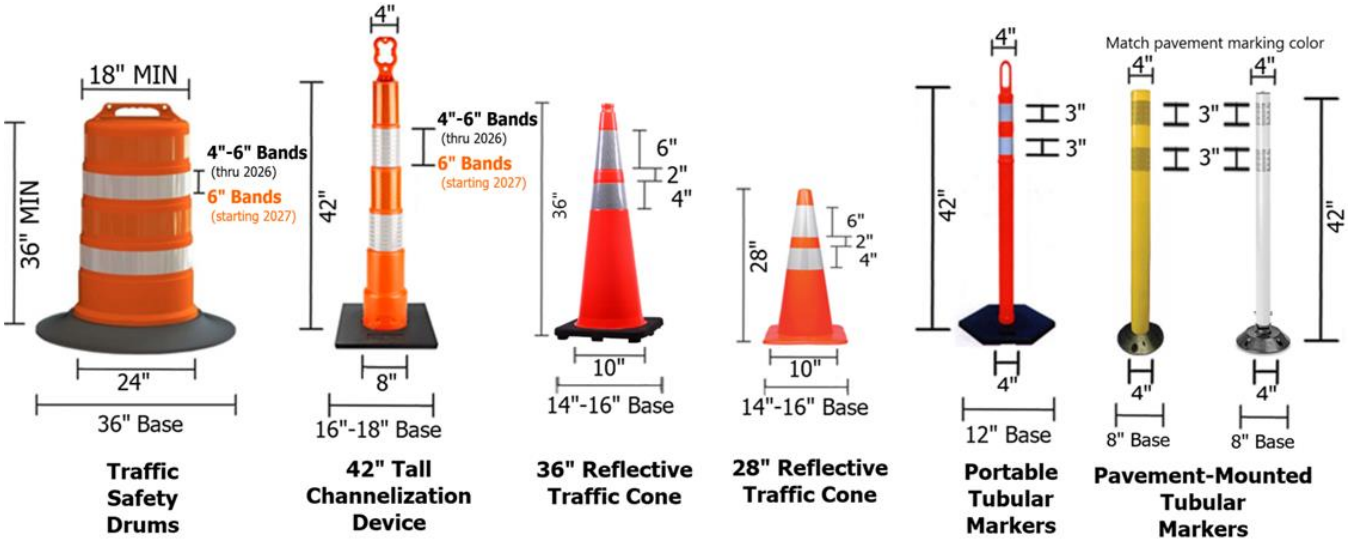
In the permit notification, identify the type of restriction (height, weight, or width) and specify the maximum size that can be accommodated. On some projects, it may be necessary to designate a detour route for oversized vehicles. Oversized vehicles can sometimes be unexpected in work zones, even though warning and restriction or prohibition signs may be in place. Some oversized loads can overhang the temporary barrier or channelization devices and encroach on areas where workers are present. Assess the exposure of those within the work zone. Routes with high volumes of oversized loads or routes that are already strategic oversized load routes may not be able to rely only on warning or prohibition signs. Protective features or active early warning devices may be needed.

Consider bridge height restrictions, signage of conditions or other bridge strike mitigation measures in cases where an oversized load has the potential to cause significant damage to structures or expose workers to injury. The structure design, staging, and falsework openings may need to be reconsidered to accommodate oversized loads passing through these structures without striking them.

1010.07 Temporary Traffic Control Devices

FHWA regulations require that temporary traffic control devices be compliant with the 2016 edition of the Manual for Assessing Safety Hardware (MASH) crash test requirements. In some cases, either the 2009 MASH or the National Cooperative Highway Research Program (NCHRP) Report 350 compliant devices may be used. See Standard Specification 1-10.2(3) for more information.

1010.07(1) Channelizing Devices (Section Rewritten 2023)



Channelizing devices warn and guide road users through the work zone. They are used to channelize traffic away from the work area, pavement drop-offs, or opposing directions of traffic. Typical channelization devices and their dimensions are as follows:

On freeways and multilane roadways 45 mph or higher, traffic safety drums are required on lane closure and lane shift tapers and recommended on the tangents. For restricted areas, 42-inch tall channelization devices may be used on tangents. When a single open lane is shifted onto the shoulder, the edge of the shoulder pavement shall be delineated with 28-inch traffic cones during hours of darkness.

For one-lane, two-way traffic configurations using 28-inch traffic cones is recommended.

Portable tubular markers are not a recommended device unless they are being used to separate 40 mph or less traffic and are located near or on existing pavement markings. Pavement-mounted tubular markers may be added to supplement long-term temporary pavement markings (such a double yellow centerline for two-lane, two-way traffic) but its color shall match the adjacent lane line.

Longitudinal channelizing devices are interconnected devices that provide channelization with no gaps but are not approved positive protection devices.

Barricades are a channelization device mostly used to supplement other channelization devices in traffic control operations involving road and ramp closures. Avoid using barricades to delineate sidewalk closure limits.

Pedestrian channelization devices shall be used to delineate sidewalk closure limits and may be used to delineate pedestrian detour routes.

1010.07(2) Construction Signs

Construction signs are used to regulate, warn or guide road users through a work zone. Class A construction signs are signs that remain in service throughout the construction or during a major phase of the work. They are mounted on posts, existing fixed structures, or substantial supports of a semi-permanent nature. Class A signs will be designated as such on the traffic control plan. Class B construction signs are those signs that are placed and removed daily/nightly or are used continuously in one location for durations extending up to 7 calendar days and are mounted on portable or temporary crashworthy mountings with a minimum mounting height of 1 foot.

Temporary sign supports with 5-foot minimum mounting heights should be used when temporary signs are mounted behind channelizing device or in urban areas with roadside parking that may obstruct sign visibility. Construction signs need to be placed such that they do not obstruct active transportation facilities.

See Chapter 1020 and the *Standard Plans* for signing details. Sign messages, color, configuration, and usage are shown in the MUTCD and the *Sign Fabrication Manual*. Existing signs may need to be covered, removed, or modified during construction.

1010.07(3) Warning Lights

Warning lights are either flashing or steady burn and can be mounted on channelizing devices, barriers, and signs. Secure crashworthy mounting of warning lights is required. Except for special circumstances permitted by Region Transportation Operations, warning lights will be phased out completely by January 1, 2027.

- **Type A:** Low-intensity flashing warning light used on a sign or barricade to warn road users during nighttime hours that they are approaching a work zone.
- **Type B:** High-intensity flashing warning light used on a sign or barricade to warn road users during both daytime and nighttime hours.
- **Type C and Type D 360 degree:** Steady-burn warning lights designed to operate 24 hours a day to delineate the edge of the roadway.

1010.07(4) Arrow Board (Sequential Arrow Sign)

An arrow board is a sign with a matrix electronic display elements capable of either flashing or sequential displays. They are usually trailer mounted with solar power and batteries to energize the electronic displays. An arrow board with merge displays are required for lane closures on multilane roadways. When closing more than one lane, use an arrow board for each lane reduction. Place the arrow board at the beginning of the transition taper and out of the traveled way. The caution display (four corner lights) is only used for shoulder work or when within lane closures away from the merge tapers. Arrow boards are not used on two-lane, two-way roadways at flagger tapers or lateral shifts. These devices are not crashworthy and shall be removed when not in use or placed behind barrier or guardrail.

1010.07(5) Portable Changeable Message Signs (PCMS)

PCMS have electronic displays that can be modified and programmed with specific messages and may be used to supplement other warning signs. These signs are usually trailer mounted with solar power and batteries to energize the electronic displays. A two-second display of two messages is the recommended method to provide time to motorists to read the sign's message twice. These devices are not crashworthy and shall be removed when not in use or placed behind barrier or guardrail. PCMS are best used to provide notice of unexpected situations like the potential for traffic delays or queuing and to provide a notice of future closures or restrictions. PCMSs shall not be used in place of required signs.

1010.07(6) Portable Temporary Traffic Control Signals

These versatile trailer-mounted portable signals are battery powered, with the ability to be connected to AC power. They can operate on fixed timing or be traffic actuated. They are typically used on two-lane two-way highways to alternate traffic in a single lane for extended durations. Portable signals work best when the length between signals are 1,500 feet maximum and no accesses lie between the temporary signals. Temporary stop bars, and lighting at the stop bars is required for signal use. For assistance on using these devices, contact Region Transportation Operations.

1010.07(7) Portable Highway Advisory Radio

Highway Advisory Radio (HAR) can be used to broadcast AM radio messages about work zone traffic and travel-related information. The system may be a permanently located transmitter or a portable trailer-mounted system that can be moved from location to location as necessary. Contact the Region Transportation Operations Office for specific guidance and advice on the use of these systems.

1010.07(8) Automated Flagger Assistance Device

An Automated Flagger Assistance Device (AFAD) is a flagging machine that is operated remotely by a flagger located off the roadway and away from traffic. This device is recommended on 45 MPH routes to support flagger safety especially on highways with reduced sight distance or limited escape routes. A traffic control plan is required for use of the AFAD and a flagger is required to operate each device. If used, a Red/Yellow lens AFAD is required, see the MUTCD for additional guidance on temporary traffic control zone devices.

1010.07(9) Radar Speed Display Sign

RSDS are a work zone speed management device that display motorist's speed in real time along with a regulatory speed limit sign or advisory speed sign mounted above the speed display.

RSDS work best when a single lane of traffic remains open but may be used when multiple lanes are open. When multiple lanes are open in heavy traffic volume conditions, it may be unclear which vehicle's speed is actually displayed.

RSDS are not an automated speed enforcement speed, but a passive feedback system to drivers. Modest speed reductions of 3 to 6 mph have been recorded when used within an active work zone.

1010.08 Positive Protection Devices

Channelizing devices will not provide worker and road user protection in some work zones. Positive protection devices such as temporary barriers, impact attenuators, transportable attenuators, and protective vehicles shall be considered per federal law (23 CFR Part 630 K).

Unless Region Transportation Operations decides otherwise, situations when positive protection devices are required include:

- In advance of work areas within shoulder and lane closures that are adjacent to vehicular traffic
- To separate opposing traffic traveling 45 mph and faster normally separated by a median or existing median barrier.
- Where existing traffic barriers or bridge railings are to be removed.
- For drop-off protection during widening or excavations (see Standard Specification 1-07.23(1)).
- When temporary slopes change clear zone requirements.
- For bridge falsework protection.
- When equipment or materials are to remain in the work zone clear zone.
- When newly constructed features in the clear zone will not have permanent protection until later in the project.
- Where temporary signs or light standards are not crashworthy.
- To separate workers from motorized traffic when work zone offers no means of escape for the worker, such as tunnels, bridges, and retaining walls, or for long-duration worker exposure within one lane-width of high-volume traffic with speeds of 45 mph and faster.

1010.08(1) Temporary Barriers (Section Rewritten 2023)

Temporary barriers are meant to reduce the overall severity of crashes, but do not prevent crashes or injuries from occurring nor will they restrain or redirect all vehicles in all conditions. Consequently, barriers should not be used unless a reduced crash severity potential is likely as barrier itself is a potential hazard.

To use temporary barriers effectively and economically, it usually requires a long-duration (2 week or longer) stationary work zone to be cost effective as it will increase the traffic control costs of a project. The safety benefit versus the cost of using barrier requires careful consideration, and cost should not be the only or primary factor determining the use of barrier.

Temporary barrier should be anchored or pinned per the standard plans when the lateral deflection space is reduced. Narrow base barrier shall always be anchored. When anchoring temporary barrier across existing bridge expansion joints, a special steel plate spanning a barrier opening over the expansion joint may be required to avoid damaging the structure; contact Bridge & Structures Office. The lateral deflection space ("slide distance") of the traffic barrier must be shown on the staged traffic control plan, desirably using a cross-section.

F-shape concrete barrier with scuppers (holes at the base of barrier to allow for storm water drainage off the roadway) may be needed depending on roadway hydraulics due to pooling water. See Chapter 5 in *Hydraulics Manual*.

Temporary barrier should typically begin with a temporary impact attenuator and be laterally offset from the traveled way as far as feasible, then the barrier will be tapered toward the traveled way to the proposed lateral offset from the edge of traveled way. Consideration must be given to construction vehicles access to the work area (provide 10-foot wide construction access where feasible), location of existing barriers or guardrails and placement space for the temporary impact attenuator. It should begin a minimum 4 feet laterally from any retaining wall or existing barrier. When flared temporary barrier begins at the existing guardrail or existing barrier, a transition section is needed to connect them.

Use Chapter 1610 for guidance and design criteria on traffic barriers. For temporary barrier, the permanent barrier design criteria apply to the extent practical and feasible with temporary modification to design elements may be modified as justified in the TMP. For example, an unanchored temporary precast concrete barrier deflection distance could be reduced to 1 foot (from 3 feet) for a temporary bypass with a 25-mph regulatory speed limit.

1010.08(1)(a) Concrete Barriers

Concrete barriers are the safety-shape barriers (Type F, Type 2) shown in the Standard Plans. Safety-shape barriers can be unanchored or anchored. See Chapter 1610 for more detailed information on these barriers and their deflection characteristics.

1010.08(1)(b) Movable Barrier Systems

Movable barriers are specially designed segmental barriers that can be moved laterally one lane width or more as a unit with specialized equipment. This allows strategies with frequent or daily relocation of a barrier. The ends of the barrier must be located out of the design clear zone or fitted with a temporary impact attenuator and storage sites at both ends of the barrier will be needed for the barrier-moving machine.

WSDOT owns a limited quantity of this type of barrier for project use; however, the barrier moving machine must be leased. Contact HQworkzone@wsdot.wa.gov for additional information.

1010.08(1)(c) Portable Steel Barriers

Portable steel barriers have a lightweight stackable design. They have options for gate-type openings and relocation without heavy equipment. Steel barriers can be unanchored or anchored per the manufacturer's specifications. The lateral displacement of unanchored steel barriers from vehicle impacts typically ranges from 5 to 8 feet depending on manufacturer.

The lateral displacement of anchored steel barriers from vehicle impacts typically ranges from 1 to 3 feet depending on manufacturer and anchor pinning arrangement. Steel barriers are proprietary items. See manufacturer website for more information.

1010.08(2) Temporary Impact Attenuators

Within the Design Clear Zone, the approach ends of temporary barriers shall be fitted with impact attenuators on roadways 30 mph or faster. On roadways 25 mph or slower, a sloped concrete terminal is permitted. The information in Chapter 1620 provides all the necessary temporary impact attenuator performance and selection information. In addition to the guidance in Chapter 1620, consider the characteristics of the work zone when selecting an attenuator. Selection should consider site specific conditions and the dynamic nature of work zones throughout the project.

Contract plans showing temporary impact attenuator placement need to include a list of the approved attenuators that a contractor may use for that installation. See the Attenuator Selection Template at: www.wsdot.wa.gov/publications/fulltext/design/ProductFolder/Impact_attenuator_selection_template.xlsx

1010.08(3) Transportable Attenuators

A transportable attenuator is a positive protection device attached to the rear of a large truck or as a trailer that can be positioned to provide protection for a work area just in front of the device after a proper roll ahead distance is provided in case of an impact. A transportable attenuator shall be used for active work areas when speeds are 45 mph and greater (except for alternating traffic controlled via flagger, AFAD, or temporary signal) when other positive protection devices are not in place.

1010.08(4) Protective Vehicles (New section 2023)

A protective vehicle is typically a work truck (without an attenuator) that can be positioned to provide protection for a work area just in front of the vehicle after a proper roll ahead distance is provided in case of an impact. A protective vehicle is suitable for active work areas when speeds are 40 mph or less but may be used for any speed when alternating traffic is controlled via flagger, AFAD, or temporary signal. Protective vehicles may be used behind channelizing devices to block closed on-ramps.

1010.09 Other Traffic Control Devices or Features

1010.09(1) Delineation

Temporary pavement markings will be required when permanent pavement markings are obliterated due to construction operations or temporary reconfigurations needed for long-term work zone strategies. Temporary pavement markings can be made using paint, preformed tape, or raised pavement markers. Complex projects will most likely require both long- and short-duration temporary markings. All temporary pavement markings are to be retroreflective and match permanent pavement marking colors. All conflicting pavement markings are to be completely removed. Temporary pavement markings are installed in accordance with the Standard Plans and Standard Specifications.

Short-duration temporary pavement markings are made with materials intended for short-duration (up to two months) until permanent markings can be installed on paving and BST projects, or for short durations between construction stages. Short-duration temporary pavement markings are abbreviated patterns. Broken line patterns typically consist of a 4-foot line with a 36-foot gap for paint and tape markings but may be increased to a 10-foot line with a 30-foot gap when specified in the Contract. Short-duration broken line patterns consist of a grouping of three raised pavement markings at 3-foot spacing with a 34-foot gap. Short-duration traffic arrows, HOV symbols, and other markings mimic permanent marking standards. Edge lines and gore lines are not installed unless otherwise specified in the Contract.

Flexible raised pavement markers are required for bituminous surface treatments but typically are not allowed on other pavement types. Temporary edge lines are installed only when specified in the plans. When specified, temporary edge lines are either solid lines or raised pavement markers at 5-foot spacing.

Long-duration temporary pavement markings layouts will match permanent pavement marking standards and shall be used on projects spanning multiple seasons and/or wintering over. To enhance wet-weather visibility, long-duration temporary pavement markings should be supplemented with reflective Type 2 Raised Pavement Markers. Long-duration markings need to be detailed in the contract plans for installation and material type. Pre-formed tapes should be used on the final pavement surface to avoid leaving scars when removed.

Lateral clearance markers are used at the angle points of barriers where they encroach on or otherwise restrict the adjacent shoulder. Barrier delineation is necessary where the barrier is less than 4 feet from the edge of traveled way and shall match the color of the adjacent edge line.

Guideposts may be considered to aid nighttime driving through temporary alignments or diversions. (See Chapter 1030 for delineation requirements.)

1010.09(2) Screening

Screening devices can be used to reduce motorists' distraction due to construction activities adjacent to the traveled way. Consider screening when a highway operates near capacity during most of the day.

Screening should be positioned behind traffic barriers to prevent impacts by errant vehicles and should be anchored or braced to resist overturning when buffeted by wind. Commercially available screening or contractor-built screening can be used, provided the device meets crashworthy criteria if exposed to traffic and is approved by the Engineer prior to installation.

Glare screening may be required on concrete barriers separating two-way traffic to reduce headlight glare from oncoming traffic. Woven wire and vertical blade-type screens are commonly used in this installation. This screening also reduces the potential for motorist confusion at nighttime by shielding construction equipment and the headlights of other vehicles on adjacent roadways.

Make sure that motorists' sight distance is not impaired by these glare screens. Contact the HQ Design Office and refer to AASHTO's Roadside Design Guide for additional information on screening.

1010.09(3) Illumination

Illumination might be justified if construction activities take place on the roadway at night for an extended period of time. Illumination might also be justified for long-term construction projects at the following locations:

- Road closures with detours or diversions.
- Median crossovers on freeways.
- Complex or temporary alignment or channelization.
- Haul road crossings (if operational at night).

- Temporary traffic signals.
- Temporary ramp connections.
- Projects with lane shifts and restricted geometrics.
- Projects with existing illumination that needs to be removed as part of the construction process.

Illumination is required when:

- Traffic flow is split around or near an obstruction.
- Flaggers are necessary for nighttime construction activities (supplemental lighting of the flagger stations by use of portable light plants or other approved methods). Refer to *Standard Specification* 1-10.3(1)A.

For information on light levels and other electrical design requirements, see Chapter 1040.

1010.09(4) Signals

A permanent signal system can be modified for a temporary configuration such as temporary pole locations during intersection construction, span wire systems, and adjustment of signal heads and alternative detection systems to accommodate a construction stage (see Chapter 1330).

1010.09(5) Smart Work Zone Systems (SWZS)

A Smart Work Zone System (SWZS) uses real time information to optimize the safety and efficiency of traffic through the work zone and should be considered on long term closures with recurring work zone queuing exceeding 3 miles.

SWZS can provide information such as queue detection for "slowed or stopped traffic ahead" messaging before motorists sees brake lights, merging instructions (zipper merging where motorists are instructed to use all open lanes up to the merge point and take turns merging) to reduce the queue lengths, or travel time information so drivers can choose alternate routes. A SWZS may be limited to the highway approaching the work area or a more complex highway network system to manage regional impacts from the projects mobility impacts.

Portable equipment used in a SWZS may include portable changeable message signs, portable roadside traffic sensors and cameras that communicate wirelessly through a web-based central management platform. Pre-determined messages will be displayed on the changeable message signs approaching a work area based on traffic data from the portable sensors also placed approaching the work area. A SWZS technician will install, program, and monitor the system.

A simplified version of a SWZS, A Queue Warning System (QWS) should be considered for daily, nightly, or weekend long closures for warning of non-recurring work zone queuing up to 3 miles.

As a minimum, A PCMS should be positioned in advance of a lane closure with messages about queuing when they are present and relocated as needed by a traffic control supervisor.

Refer to the Traffic Manual for additional information and guidance on work zone queuing mitigation.

1010.10 Traffic Control Plan Development and PS&E

WSDOT projects need to include plans and payment items for controlling traffic based on a strategy that is consistent with the project construction elements, even though there may be more than one workable strategy. A constructible and biddable method of temporary traffic control is the goal. The contractor has the option of adopting the contract plans or proposing an alternative method.

1010.10(1) Traffic Control Plans

"Typical" traffic control plans are generic in nature and are not intended to address all site conditions. They are intended for use at multiple work locations when they can be applied with little or no modifications to address site conditions. They include spacing tables to address different roadway speeds. Typical plans may be all that are needed for basic paving projects. Some typical plans are located at: Design - Work Zone Typical Traffic Control Plans | WSDOT (wa.gov)

"Project-specific" traffic control plans are typical-type plans that have been modified to fit a specific project or roadway condition. Dimension lines for signs and device placement provide the distances based on the regulatory speed limit, and only minimal spacing tables should remain; the lane and roadway configuration may also be modified to match the project conditions.

"Site-specific" traffic control plans are drawn for a specific location. Scaled base data drawn plans will be the most accurate as device placement and layout considerations can be resolved by the designer; however, schematic plans are also permitted. Making a "project-specific" plan applicable for a site-specific location is another option if the device layout will match the site-specific location since the plan is usually not to scale.

"Staged Traffic" plan should be used for temporary alignment and channelization for long-duration traffic control.

For additional information, see Division 4 of the Plans Preparation Manual.

The following plans, in addition to the TCP types above addressing the TTC strategies, may be included in the PS&E.

1010.10(1)(a) Construction Sign Plan

Show Class A Construction Signs that will remain in place for the duration of the project located by either station or milepost. Verify the locations to avoid conflicts with existing signing or other roadway features. These locations may still be subject to movement in the field to fit specific conditions. For simple projects these signs are often shown on the vicinity map sheet.

1010.10(1)(b) Construction Sign Specification Sheet

Provide a Class A Construction Sign Specifications sheet on complex or staged projects. Include location, post information, and notes for Standard Plans or other specific sign information and sign details.

1010.10(1)(c) Quantity Tabulation Sheets

Quantity Tabulation sheets are recommended for barrier and attenuator items and temporary pavement markings on projects with large quantities of these items or for staged construction projects.

1010.10(1)(d) Traffic Control Plan Index

An Index sheet is a useful tool for projects that contain a large quantity of traffic control plans and multiple work operations at various locations throughout the project. The Index sheet provides the contractor a quick referencing tool indicating the applicable traffic control plan for the specific work operation.

1010.10(1)(e) Construction Sequence Plans

Sequence plans are placed early in the plan set and are intended to show the proposed construction stages and the work required for each stage. They should refer to the corresponding TCPs for the traffic control details of each stage.

1010.10(1)(f) Temporary Signal Plan

The temporary signal plan will follow conventions used to develop permanent signals (as described in Chapter 1330) but will be designed to accommodate temporary needs and work operations in order to prevent conflicts with construction operations. If channelization has been temporarily revised then opposing left-turn clearances should be maintained as described in Chapter 1310, or signal timing should be adjusted to accommodate the revision. Some existing systems can be maintained using temporary span wires for signal heads and video, microwave actuation, or timed control.

1010.10(1)(g) Temporary Illumination Plan

Full lighting is normally provided through traffic control areas where power is available. The temporary illumination plan will follow conventions used to develop permanent illumination (as described in Chapter 1040) but will be designed to accommodate temporary needs and work operations so that there will be no conflicts with construction operations.

1010.10(2) Contract Specifications

Work hour restrictions for lane closure operations are to be specifically identified for each project where traffic impacts are expected and liquidated damages need to be applied to the contract. Refer to the Plans Preparation Manual for additional information on writing traffic control specifications.

1010.10(3) Cost Estimating

Temporary traffic control devices and traffic control labor can be difficult to estimate. There is no way of knowing how many operations a contractor may implement at the same time. The best method is to follow the working day estimate schedule and the TCPs that will be used for each operation. Temporary signs and devices will be used on many plans, but the estimated quantity reflects the most used at any one time. A lump sum item can be used to pay for temporary traffic control when an assessment of the cost risk associated with that approach indicates that the traffic control operation is sufficiently well defined. Criteria to use in the assessment include the number and complexity of planned intersection, interchange, mainline, transit, bicycle, pedestrian, and other high impact closures; rolling slowdowns; multiple work shifts; and roadway detours. A template for assessing risk is available at the design support webpage www.wsdot.wa.gov/design/support/.

1010.11 Training and Resources

Temporary traffic control-related training is an important component in an effective work zone safety and mobility program. Federal regulations require that those involved in the development, design, implementation, operation, inspection, and enforcement be trained at a level consistent with their responsibilities. Contact the State Work Zone Engineer at HQWorkZone@wsdot.wa.gov for training options.

1010.11(1) Resources

It is the responsibility of the designer to address all anticipated work zone traffic control impacts because the level of safety and mobility will be directly affected by the effectiveness of the transportation management plan (TMP). The following resources are available to assist the designer with various aspects of the work zone design effort.

1010.11(1)(a) Region Work Zone Resources

Each region has individuals and offices with various resources that provide work zone guidance and direction beyond what may be available at the project Design Office level. They include the:

- Region Transportation Operations Office
- Region Construction and Design Offices

1010.11(1)(b) Headquarters Work Zone Resources

The following Headquarters staff are available to answer questions and provide information:

- State Work Zone Engineer (email: HQworkzone@wsdot.wa.gov)
- WSDOT Work Zone web page
- TSMO Subcommittee on Work Zones
- State Assistant Transportation Operations Design Engineer

1010.11(1)(c) FHWA Work Zone Resources

The FHWA Washington Division Office and Headquarters (HQ) Office may be able to provide some additional information through the WSDOT HQ Transportation Operations Division.

The FHWA also has a work zone web page: http://ops.fhwa.dot.gov/wz/

1010.12 References

1010.12(1) Federal/State Laws and Codes

23 Code of Federal Regulations (CFR) Part 630 Subpart J and Subpart K – Work Zone Safety and Mobility and Temporary Traffic Control Devices

See Chapter 1510 for Americans with Disabilities Act policy and references.

"Final Rule on Work Zone Safety and Mobility," Federal Highway Administration (FHWA), Published on September 9, 2004

http://ops.fhwa.dot.gov/wz/resources/final_rule.htm

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC "Manual on uniform traffic control devices for streets and highways" (MUTCD)

1010.12(2) Design Guidance

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO

Executive Order E 1001, Work Zone Safety and Mobility

wwwi.wsdot.wa.gov/publications/policies/fulltext/1001.pdf

Executive Order E 1060, Speed Limit Reductions in Work Zones

wwwi.wsdot.wa.gov/publications/policies/fulltext/1060.pdf

Executive Order E 1033, WSDOT Employee Safety

wwwi.wsdot.wa.gov/publications/policies/fulltext/1033.pdf

Plans Preparation Manual, M 22-31, WSDOT

Standard Plans for Road, Bridge, and Municipal Construction (Standard Plans), M 21-10, WSDOT

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

Traffic Manual, M 51-02, WSDOT

Work Zone Traffic Control Guidelines, M 54-44, WSDOT

1010.12(3) Supporting Information

Construction Manual, M 41-01, WSDOT

"Crashworthy Work Zone Traffic Control Devices," Report 553, NCHRP, 2006

Environmental Manual, M 31-11, WSDOT

Highway Capacity Manual, 2010, TRB

ITE Temporary Traffic Control Device Handbook, 2001

ITS in Work Zones http://ops.fhwa.dot.gov/wz/its/

"Recommended Procedures for the Safety Evaluation of Highway Features," Report 350, NCHRP, 1993

Roadside Design Guide, AASHTO, 2011

Manual for Assessing Safety Hardware, AASHTO, 2009

Manual for Assessing Safety Hardware, AASHTO, 2016

Work Zone & Traffic Analysis, FHWA http://ops.fhwa.dot.gov/wz/traffic_analysis.htm

Work Zone Operations Best Practices Guidebook, FHWA, 2007
http://ops.fhwa.dot.gov/wz/practices/practices.htm

Work Zone Safety and Mobility, FHWA http://ops.fhwa.dot.gov/wz/index.asp

Work Zone Safety Web Page, WSDOT https://wsdot.wa.gov/engineering-standards/design-topics/traffic-work-zone-traffic-control-wztc

WSDOT Project Management website: Project management guide | WSDOT (wa.gov)

Exhibit 1010-2 Transportation Management Plan Components Checklist

Use the following checklist to develop a formal TMP document on significant projects. ☐

1. Introductory Material
    a. Cover page ☐
    b. Licensed Engineer stamp page (if necessary) ☐
    c. Table of contents ☐
    d. List of figures ☐
    e. List of tables ☐
    f. List of abbreviations and symbols ☐
    g. Terminology ☐
2. Executive Summary
3. TMP Roles and Responsibilities
    a. TMP manager ☐
    b. Stakeholders/review committee ☐
    c. Approval contact(s) ☐
    d. TMP implementation task leaders (public information liaison, incident management coordinator) ☐
    e. TMP monitors ☐
    f. Emergency contacts ☐
4. Project Description
    a. Project background ☐
    b. Project type ☐
    c. Project area/corridor ☐
    d. Project goals and constraints ☐
    e. Proposed construction phasing/staging ☐
    f. General schedule and timeline ☐
    g. Adjacent projects ☐
5. Existing and Future Conditions
    a. Data collection and modeling approach ☐
    b. Existing roadway characteristics (history, roadway classification, number of lanes, geometrics, urban/suburban/rural) ☐
    c. Existing and historical traffic data (volumes, speed, capacity, volume-to-capacity ratio, percent trucks, queue length, peak traffic hours) ☐
    d. Existing traffic operations (signal timing, traffic controls) ☐
    e. Incident and crash data ☐
    f. Local community and business concerns/issues ☐
    g. Traffic growth rates (for future construction dates) ☐
    h. Traffic predictions during construction (volume, delay, queue) ☐
6. Work Zone Impacts Assessment Report
    a. Qualitative summary of anticipated work zone impacts ☐
    b. Impacts assessment of alternative project design and management strategies (in conjunction with each other) ☐
        I. Construction approach/phasing/staging strategies ☐
        II. Work zone impacts management strategies ☐

- c. Traffic analysis results (if applicable) ☐
  - I. Traffic analysis strategies ☐
  - II. Measures of effectiveness ☐
  - III. Analysis tool selection methodology and justification ☐
  - IV. Analysis results ☐
- d. Traffic (volume, capacity, delay, queue, noise, design vehicle) ☐
- e. Safety ☐
- f. Adequacy of detour routes ☐
- g. Business/community impact ☐
  - I. Emergency services ☐
  - II. Utility and delivery services (i.e., trash collection, postal, etc.) ☐
- h. Seasonal impacts ☐
- i. Cost-effectiveness/evaluation of alternatives ☐
- j. Selected alternative ☐
  - I. Construction approach/phasing/staging strategy ☐
  - II. Work zone impacts management strategies ☐

7. Selected Work Zone Impacts Management Strategies
   - a. Temporary Traffic Control (TTC) strategies ☐
     - I. Control strategies ☐
     - II. Traffic control devices ☐
     - III. Corridor Project coordination, contracting, and innovative construction strategies ☐
   - b. Public Information (PI) ☐
     - I. Public awareness strategies ☐
     - II. Motorist information strategies ☐
   - c. Transportation Systems Management and Operations (TSMO) ☐
     - I. Demand management strategies ☐
     - II. Corridor/network management strategies ☐
     - III. Work zone safety management strategies ☐
     - IV. Traffic/incident management and enforcement strategies ☐

8. TMP Monitoring
   - a. Monitoring requirements ☐
   - b. Evaluation report of successes and failures of TMP ☐

9. Contingency Plans
   - a. Trigger points ☐
   - b. Decision tree ☐
   - c. Contractor's contingency plan ☐
   - d. Standby equipment or personnel ☐

10. TMP Implementation Costs
    - a. Itemized costs ☐
    - b. Cost responsibilities/sharing opportunities ☐
    - c. Funding source(s) ☐

11. Special Considerations (as needed)
12. Attachments (as needed)