Chapter 5 Work Zone Traffic Control

5-1 General

Effective work zone traffic control strategies allow all road users to successfully maneuver through or around work areas while still permitting needed work to be completed efficiently and economically. This chapter focuses on operations while *Design Manual* Chapter 1010 focuses on work zone traffic control design and Transportation Management Plans.

Work zone traffic control must effectively balance safety of workers and the traveling public with mobility, constructability, and cost effectiveness while understanding prioritizing one means sacrificing the others. Give the highest priority to safety of highway workers and traveling public while managing congestion to maintain mobility through/around work zones.

Properly mitigating work zone impacts to all road users is a critical component in the successful design, construction, maintenance, and operation of a fully functional highway system and is required by federal regulations and state policy.

Road users include pedestrians (including those with disabilities), bicyclists, motorcyclists, motorists, transit operators/users, and Commercial Vehicle freight operations (including Oversized and Superload permitted freight).

5-2 Federal and State Laws Applicable to Work Zones

5-2.1 Federal Laws

23 CFR Part 630 J focuses on work zone **standards**, **policy**, and **processes**:

- The *Manual on Uniform Traffic Control Devices* is the national standard for traffic control devices on all public roads.
- States shall develop policy to systematically consider and manage work zone impacts.
- All **significant** projects shall have Transportation Management Plan Documents.
- States shall perform a work zone process review at least every five years.

23 CFR Part 630 K focuses on work zone **design** and **implementation**:

- Maintain quality and adequacy of all temporary traffic control devices.
- Manage work zone exposure and reduce the risk of fatal crashes or injuries to workers.

5-2.2 State Laws and Codes

Washington laws applicable to work zones are listed below along with a brief description:

- RCW 46.04.200 (Hours of Darkness definition)
- RCW 46.61.527 (Work Zone Traffic Fines Double)
- RCW 47.36.030 (Signs, signals, and banners over roadway requirements)
- RCW 47.36.200 (Motorcycles Use Extreme Caution sign requirements)
- RCW 47.48.010 (Roadway closure, restrictions, & reduced speed limit authority)
- RCW 47.48.020 (Roadway closure, restrictions, & reduced speed limit notification)
- WAC 296-155-305 (Flagging Requirements, 4-Sign Requirement for ≥ 45 mph)

Washington has adopted the MUTCD; however, specific work zone-related MUTCD sections have been modified as listed below and include a brief description in parenthesis:

- WAC 468-95-017 (Traffic Control Devices & Engineering Judgement)
- WAC 468-95-045 (Speed Limit Signs & Radar Speed Display Signs)
- WAC 468-95-205 (Supplemental Raised Pavement Markers)
- WAC 468-95-210 (Avoid Raised Pavement Markers at Right Edge Line)
- WAC 468-95-300 (Temporary Sign Spacing Table)
- WAC 468-95-301 (Maximum Channelization Device Spacing Table)
- WAC 468-95-3015 (Traffic Signal Display Requirements When Flagging)
- WAC 468-95-302 (Single Flagger At Center of Intersection Restrictions)
- WAC 468-95-305 (Motorcycles Use Extreme Caution Sign)
- WAC 468-95-306 (Motorcycles Use Extreme Caution Supplemental Plaque)
- WAC 468-95-307 (Abrupt Lane Edge Warning Sign)
- WAC 468-95-310 (Temporary Pavement Markings)

5-3 Work Zone Standards, Content & Resources

5-3.1 *Manual on Uniform Traffic Control Devices* (MUTCD)

Per federal code, the current revised 2009 MUTCD edition is approved by the Federal Highway Administration (FHWA) and recognized as the national standard for traffic control devices on all public roads. Part 6 of the MUTCD focuses on temporary traffic control.

11th Edition MUTCD is expected to be adopted by Washington in 2026 after WACs are updated.

5-3.2 Public Rights-of-Way Accessibility Guidelines (PROWAG)

PROWAG are recommended best practices with technical guidelines based on ADA that are to be met to the "maximum extent feasible" for temporary work zone pedestrian facilities within the public right-of-way.

When PROWAG is more stringent or conflicts with MUTCD, then PROWAG takes precedence.

5-3.3 WSDOT ADA Guide for Accessible Public Rights of Way

WSDOT, in collaboration with FHWA, developed the WSDOT ADA Guide for Accessible Public Rights of Way as a field guide reference to be used by professionals when evaluation accessible pedestrian features, including in work zones, reflecting PROWAG best practices.

5-3.4 WSDOT *Standard Specifications*

The WSDOT *Standard Specifications* are legal and enforceable language for WSDOT Contracts and when incorporated into local agency construction projects receiving FHWA federal funding. These specifications include requirement, measurement, and payment information and may specify work zone standards that exceed requirements in the MUTCD.

Sections 1-07.8, 1-07.23, 1-10, 8-23, 9-34 and 9-35 are the most relevant to work zones.

See Sections 6-10 for temporary barriers and 8-17 for temporary impact attenuators.

5-3.5 WSDOT *Design Manual* M 22-01

Chapter 1010 focuses on work zone design topics and Transportation Management Plans for construction projects. Chapter 1610 focuses on traffic barriers. Chapter 1620 focuses on impact attenuator systems. See Chapter 1510 and 1520 for additional information as guidance for pedestrian and bicycle facilities within work zones.

5-3.6 WSDOT *Work Zone Traffic Control Guidelines for Maintenance Operations* M 54-44

The M 54-44 manual focuses on temporary traffic control for **maintenance**, **utility**, and **developer operations of 3 days or less** and is not intended for use in WSDOT Contracts.

5-3.7 WSDOT Work Zone Typical Traffic Control Plans

The WSDOT Typical Traffic Control Plans Library provides generic traffic control plans that have been furnished as a guide to be modified with sound engineering judgement and working knowledge of work zone policy and guidance.

All WSDOT Typical Traffic Control Plans must be accepted through Region Transportation Operations, see Section 5-25. Work zone speed limit reductions and advisory speeds must be approved through Region Transportation Operations, see Section 5.18 and Section 5-19.

5-3.8 WSDOT *Plans Preparation Manual*

The WSDOT *Plans Preparation Manual* provides instructions and guidelines for preparation of PS&Es and CADD standards. For work zone related content, see Division 4 and Division 4 Contract Plan Examples.

5-3.9 WSDOT *Sign Fabrication Manual*

The WSDOT *Sign Fabrication Manual* assists sign fabricators by providing sign layouts for standard highway signs with unique naming convention typically based on the MUTCD.

5-3.10 WSDOT *Standard Plans*

WSDOT *Standard Plans* provides standardized fabrication, installation, and construction methods.

- Section C: F-shape temporary barrier details.
- Section K: Short-duration pavement marking layout, Class A construction sign layout, Type 2 and Type 4 temporary barrier, and barrier anchoring details.
- Section M: Permanent & long-duration temporary pavement marking layout.

5-3.11 Quality Guidelines for Temporary Work Zone Traffic Control Devices

The *ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features* available for purchase and is used, per *Standard Specifications* 1-10.2(3), by the Engineer to determine signs and traffic control devices are acceptable, marginal, or unacceptable.

5-3.12 MASH-2016 & NCHRP-350 Hardware Eligibility Letters

FHWA provides crash eligibility letters for temporary barriers, impact attenuators, transportable attenuators, temporary sign supports, channelizers, and barricades:

- MASH-16
- NCHRP-350

5-4 WSDOT Region and Headquarters Typical Roles and Responsibilities

5-4.1 Typical WSDOT Region Responsibilities

"WSDOT Region" includes all region offices or design-builders when applicable.

- Develop a work zone design strategy statement to identify and mitigate work zone safety and mobility impacts during scoping, design, or major maintenance operations.
- Develop a Transportation Management Plan.
- Develop and obtain approval for WSP Task Orders.
- Collaborate with Bridge, Construction, Maintenance, Communications, Rail, Freight and Ports, Public & Active Transportation, local agencies, and others when applicable.
- Design and implement work zones for individual projects, including appropriate impact mitigation strategies with respect to region mobility and coordination.
- Submit work zone speed limit reductions and/or advisory speed request for approvals (Section 5-19) after obtaining Region Transportation Operations concurrence in advance.
- Obtain speed data from radar speed display signs & smart work zone systems and submit to Region Transportation Operations or State Work Zone Engineer upon request.
- Inspect traffic control operations; modify when necessary to address safety and mobility.

5-4.2 Typical WSDOT Region Transportation Operations Responsibilities

- Review and accept Work Zone Design Strategy Statements.
- Perform work zone traffic analysis (Section 5-9) to determine permitted closures, their permitted hours, and expected work zone mobility impacts and needed mitigation.
- Collaborate with TDGMO to determine interim liquidated damages (Section 5-14).
- Review and approve Transportation Management Plan Documents.
- Review, comment, and accept traffic control plans, unless delegated otherwise.
- Coordinate with Construction, Maintenance, and Communications departments for scheduling, implementing, and notifying the traveling public of high-profile closures.
- Assist other Divisions and local agencies upon request.
- Approve/review work zone speed limit reductions and advisory speeds (Section 5-19).
- Perform periodic review of active work zones.
- Perform FHWA work zone process reviews with HQ Transportation Operations, region Project Engineering Offices, Maintenance, other divisions, and other agencies as appropriate.

5-4.3 WSDOT State Work Zone Engineer Responsibilities

- Develop and update work zone-related policy, standards, and guidance.
- Provide work zone traffic control training to Regions.
- Lead the FHWA work zone process reviews with Region Transportation Operations.
- Maintain the WSDOT Typical Traffic Control Plan Library.
- Provide work zone traffic control & analysis assistance upon request.
- Determine & obtain State Traffic Engineer approval for unique work zone speed limit reductions.
- Perform work zone speed analysis & recommend regulatory work zone speed limit changes.

5-5 Work Zone Principles & Considerations

1. **Keep it simple** (one thing at a time).
2. **Separate decision points** (avoid closure tapers in curves or adjacent to on-ramps).
3. **Maintain consistency & expectancy** (not necessarily uniformity though). A lane closure in western Washington should be like one in eastern Washington.
4. **Guide all road users in a clear, positive, and safe manner through or around work zones** utilizing sufficient signage, delineation, and channelization. Work zones should be "self-explanatory" and "self-regulating" to road users the maximum extent feasible. Abrupt, unexpected changes in roadway geometrics should be avoided.
5. **Consider positive protection devices whenever practical** to enhance safety for both road users and workers (transportable attenuators or temporary barriers).
6. **Give equitable consideration of safety and mobility of all road users and work crews** when developing work zone traffic control strategies.
7. **Avoid reducing regulatory speed limit as much as practical.** Drivers reduce their speeds only if they clearly perceive the need to do so. Artificially low speed limits results in a work zone being under designed for the prevailing travel speeds while increasing speed variance which increases the potential for crashes. All regulatory speed limit reductions or advisory speeds shall be approved per Sections 5-18 & 5-19.
8. **Remove traffic control devices when they are no longer applicable**, otherwise they may be disregarded.
9. **Avoid placing traffic control devices within pedestrian or bicycle pathways** unless accommodations are provided. Maintain 48-inch width pedestrian facilities or use 7-foot mounting height for temporary signs and avoid placing signs in bicycle lanes.
10. **Manage overall adverse work zone impacts while balancing the need to efficiently, economically, and safely complete work**. Implementing high-impact closures over short durations can result in lower overall impacts and are justified by a significant reduction in working days, significant cost savings (even after factoring queue mitigation costs), and enhanced safety benefits for road users and workers. For high-impact closures, obtain Region management approval.

11. **Maintain effective public relations starting early in Design and lasting through Construction for projects utilizing high-impact closures.**
    - During planning, work closely with interested parties and local agencies to understand their concerns and needs during closures; obtain a priority list for major events.
    - Develop schematics to visually explain the closure and how to navigate through/around them to the public and media.
    - Explain anticipated work zone queuing and delays and when they are expected to peak; encourage carpooling and public transit usage and to travel off-peak hours.
    - Remind the traveling public their time of travel and focus while driving affects congestion.
    - Consider different outreach tools (news coverage, social media, WSDOT blogs).

5-6 Work Zone Mobility, Corridor, and Network Management

It is important to understand actual work hours can be significantly less than the permitted closure hours. For example, a 5-hour closure may only result in 2.5 working hours for Hot Mix Asphalt paving in the center lane due to time loss installing/removing the final lane closure, mobilization & demobilization, and work preparation and wrap-up.

Because traffic volumes are increasing faster than lane miles being added to the system, the traditional approach of permitting closure hours that result in minimal traffic impacts cause the available working hours to be so restrictive that work operations can no longer be completed in a practical or economical manner.

For the areas where reasonable duration of work shift is challenging to obtain with minimal congestion, it becomes necessary to extend closure durations or utilize long-term, high-impact roadway reconfigurations that result in work zone congestion (queues and delays) that need to be managed and mitigated.

Therefore, it is necessary to understand the following:

- When to avoid work zone congestion (Section 5-6.A)
- Work zone congestion management strategies (Section 5-6.B)
- Closure coordination along detours and alternative routes (Section 5-6.C)
- Detour route considerations (Section 5-6.D)

For detailed guidance for various extended closure strategies see the following:

- Extended Intermediate-Term Duration Closures (Section 5-7)
- Long-Term Duration Closures & Reconfigurations (Section 5-8)

5-6.1 When to Avoid Work Zone Congestion

Typical periods to avoid creating significant work zone congestion include:

- **During weekday AM/PM commutes & school hours**

  Road users have limited flexibility for alternative schedules and fewer discretionary trips, resulting in minimal traffic diversion and high sensitivity to traffic impacts. Morning and evening commute periods vary depending on location.

  Without the availability of better data or information, then assume the following:

  Urban & Suburban weekday commute hours:

  - AM Commute @ 4:00 a.m. to 10:00 a.m.
  - PM Commute @ 2:30 p.m. to 7:00 p.m.

  Rural weekday commute hours:

  - AM Commute @ 5:00 a.m. to 9:00 a.m.
  - PM Commute @ 3:00 p.m. to 6:30 p.m.

  School hours vary by location and by day-of week. Check with local school district.

  Also be aware of work shift changes at major corporations, school and daycare traffic, or short-term traffic surge events that may be localized but impactful.

- **During Friday afternoons and Sundays on recreational routes**

  Recreational routes (I-90 over Snoqualmie Pass) tend to experience much higher volumes on weekends, typically in the inbound direction Friday afternoons and the outbound direction on Sunday. Recreational periods vary significantly in time of year and time of week and are best determined with actual traffic volumes or field observations.

- **During major regional special events**

  Major sporting events, concerts, fairs, etc. generate significant traffic volumes increases, typically up to two hours prior going towards the event (inbound) and up to two hours after existing the event (outbound). In contrast, all-day events tend to see increased volumes spread out over the day but may have large increases at end of events or concerts.

- **During major statewide special events**

  Major special events can generate significant traffic across the state, such I-90 during Hoopfest going eastbound Thursday & Friday and westbound Sunday & Monday.

- **During significant local special events**

  Significant local special events can generate large, but localized traffic impacts that need to be considered. Such events include runs, bike rides, or festivals.

5-6.2 Work Zone Congestion Management Strategies

Region Transportation Operations will perform work zone traffic analysis needs to determine anticipated delays and queues (Section 5-9) when determining permitted closure hours. Based on the anticipated traffic impacts, additional work zone mobility, safety, and traffic demand management strategies may need to be considered such as:

- **Advanced Notification**

  Use a Portable Changeable Message Signs (PCMS), mini PCMS (mPCMS), or temporary sign to provide notice at least a three-day advance notification of high-impact closures.

- **Public Outreach**

  WSDOT Communications serves an invaluable role in reaching out to the traveling public and interested parties. They serve as the "front-line" spokesperson for WSDOT by working with news media, utilizing social media, and responding to citizen inquires.

- **Motorist Use of GPS Technology & Unsuitable Alternative Routes**

  GPS navigation provides optional alternative routes in real-time based on shortest travel time and effectively reduces work zone delays and queues by redistributing traffic across multiple corridors without having to add several PCMSs in the Contract.

  When expected delays exceed 30 minutes on freeways and multilane roadways in rural areas with limited alternative routes, contact HQ or Regional Communications at least two weeks in advance. Communications will submit requests to third-party vendors (such as Google Maps/Waze) with suggested edits or corrections to avoid the apps rerouting motorists onto unsuitable alternative routes (such as gravel forest roads or curvy & narrow highways) around the work zone. Note this is not guaranteed or the vendor may still post incorrect detour information. Alternative actions by WSDOT may be necessary.

  Connected sequential arrow boards and connected flagger paddles also communicate with these systems to provide real-time notifications of lane closures as well.

- **WSDOT Traffic Management Centers (TMCs)**

  At its discretion, Regional TMCs may provide supplement advance notification for significant closures and provide real-time information for major incidents and closure status on permanent variable message signs when not used for more critical messages.

  On Active Traffic and Demand Management corridors, lane usage symbols and speed limits can be displayed in real-time to supplement temporary traffic control closures.

  Provide TMCs at least a two week notice of upcoming of high-impact closures during Construction but inform TMC of this upcoming request during Design when feasible.

- **WSDOT Incident Response Team (IRT) During High-Impact Closures**

  During significant high-impact closures, consider placing IRT (supplemented with towing services under IRT's direction) at strategic locations in the event disabled vehicles need to be quickly towed into a staging area, moved into the lane closure, or moved onto the shoulder. IRT minimizes response times by collaborating onsite with WSDOT TMC, police and emergency agencies, and towing companies to relocate or remove the blocking vehicles quickly.

  In Design, verify necessary staff is available including details on how they will be requested and utilized. Ensure funding is available for reimbursement of services rendered via internal accounting methods. In Construction, provide at least a two week notice of needed services.

- **WSDOT Maintenance and Internal Staff Assistance**

  During major closures, advanced and closure notification signage may be necessary as far as 50 miles from the actual closure in isolated locations, such as week-long closure of the Hood Canal Bridge utilizing a 100+ mile detour route. In lieu of Contractors to provide such services, arrange for WSDOT Maintenance and/or IRT staff to perform advance notification/detour route signage duties in their own local areas.

  In Design, verify necessary staff is available including details on how they will be requested and utilized. Ensure funding is available for reimbursement of services rendered via internal accounting methods. In Construction, provide at least a two week notice of needed services.

- **WSDOT Signal Operations Assistance**

  During significant closures or detours, temporary adjustments to WSDOT-operated traffic signals may be necessary due to large increases in traffic along detour or alternative routes, especially at single left turn lanes with protected signal phases.

  In Design, verify necessary staff is available including details on how they will be requested and utilized. Ensure funding is available for reimbursement of services rendered via internal accounting methods. In Construction, provide at least a two week notice of needed services.

- **Local Agency Signal Operations Assistance**

  During significant closures or detours, temporary adjustments to Local Agency-operated traffic signals may be necessary.

  In Design, verify necessary staff is available including details on how they will be requested and utilized. Ensure funding is available for reimbursement of services rendered via internal accounting methods. In Construction, provide at least a two week notice of needed services.

  Include written agreements in the Transportation Management Plan Document.

5-6.3 Coordinate Closures along Detours & Alternative Routes During High-Impact Closures

It is critical to restrict concurrent lane or ramp closures on parallel, alternative routes during high-impact closures. In Design, Region Transportation Operations will determine what closure restrictions are necessary in the Contract Provisions during the high-impact closure.

During Construction, Region Transportation Operations still allow closures during these restrictions on case-by-case basis, but with reduced closure hours to account for the added traffic.

Example: A full closure of southbound Interstate 5 (SB I-5) is occurring overnight in Vancouver, Washington and lane closures on SB I-205 (parallel, alternative route) are delayed until its work zone capacity can handle the combined SB I-5 and SB I-205 traffic volumes acceptably. In addition, the SB I-5 to SB I-205 ramp is kept open during the SB I-5 closure along with any ramps along the SB I-5 detour or significant alternative routes.

5-6.4 Detour Route Considerations

Coordinate early in Design with local agencies, especially for significant road or ramp closures to obtain documented city council approval. Detour routes using local agency roadways require written detour agreements. Include documentation in the TMP Document. In Construction, coordinate with the local agency to prevent conflicting concurrent closures or restrictions along the detour route.

Consider rather the detour route can accommodate commercial vehicles (particularly oversized/overweight vehicles). If commercial vehicle travel restrictions are necessary, contact WSDOT Commercial Vehicle Services at least 7 days in advance (Section 5-15).

Consider typical detour route's capacity through signalized intersections during normal operations versus when signal is modified should be considered:

- Protected single left turn lane: 200 vehicles/hour (vph), 350 vph when signal modified to prioritize left turns—up to 700 vph overnight (saturated flow).
- Permissive-protective single left turn lane: 300 vph if oncoming traffic volumes are moderate, 400 vph if signal modified to prioritize left turns—up to 700 vph overnight.
- Protected double left turn lanes: 360 vph for both lanes, 700 vph when signal modified to prioritize left turns—up to 1200 vph overnight (saturated flow).
- Right turns: Rarely an issue unless detour volume exceeds 720 vph (or 1200 vph overnight). If right on red restrictions in place, reduce to 600 vph (800 vph overnight).

Be especially cautious of all-way stop intersections along a detour route as they have total capacities as low as 600 vehicles/hour (from all approaches).

For roadway closures with detour routes having left turns onto high-speed and/or congested corridors, consider adding a temporary traffic signal system to enhance road user safety.

Pedestrian and bicyclist detour routes should be short, in close proximity, and have accessibility features and grades comparable to the existing route to maximize their use. Provide advanced closure signage at decision points far enough in advance to allow the opportunity to utilize alternative routes without backtracking given that these users may have expended considerable physical effort reaching the closure and may not have access to check websites or other postings regarding upcoming work.

5-7 Intermediate-Term Duration Closures

Intermediate-term duration closures last 3 days or less, and include weekend-duration closures (Friday night to Monday morning). These closures range from daily/nightly shoulder & lane closures and lane shifts to more complex configurations such narrowed or shifted lanes including lane closures during weekend-duration closures. See *Design Manual* Chapter 1010 for more temporary traffic control and staged traffic strategies.

Typical closure hours result in no to minor work zone congestion by targeting closure hours where work zone capacity roughly matches or exceeds expected traffic volumes.

Extended closure hours extend the duration beyond typical closure hours and results in work zone congestion that needs to be targeted strategically as discussed in this section. Either Region Transportation Operations or Regional management shall concur, stakeholder acceptance recommended, and public outreach recommended.

Aggressive closure hours result in significant work zone congestion that requires Region management approval, stakeholder acceptance, and significant public outreach.

To utilize extended or aggressive closure hours is justified, Region Transportation Operations needs to perform work zone traffic analysis to determine permitted closure hours, anticipated delays and queues (Section 5-9), and needed queue mitigation strategies (Section 5-17).

In the Contract Provisions, list typical, extended, and aggressive permitted closure days and hours. For extended and aggressive closures, list the maximum number allowable and for what work operations for which they are allowed.

This Section includes traffic diversion rates that are determined by Region Transportation Operations in work zone traffic analysis. The ranges of static diversion and dynamic diversion are provided in this Section for informational purposes only and serves as guidance to be exercised with engineering judgement. Diversion rates depend on the quality and number of alternative routes available and their estimated spare capacity as a percentage of the expected hourly traffic volumes on the corridor in question.

Example: NB I-5 daytime lane closures (between the AM and PM commute) between Centralia and Olympia. Two 2-lane highways serve as potential alternative routes (Tilly/SR121, Sargent Rd-Littlerock Rd) and traffic volumes on each is light. Thus, we estimate each alternative route can serve an additional 300 vehicles/hour (600 vph total) satisfactory. If NB I-5 expected traffic volume is 2400 vph during the closure, then the expected diversion rate up to 600/2400 = 0.25 or 25%, which is a Moderate Dynamic Diversion.

How and when to target work zone congestion is dependent on when the closure occurs:

- Weekday closures (Section 5-7.1)
- Weeknights closures (Section 5-7.2)
- Friday night into Saturday morning closures (Section 5-7.3)
- Saturday night into Sunday morning closures (Section 5-7.4)
- Extended morning closures (Section 5-7.5)
- Weekend-duration lane closures (Section 5-7.6)
- Weekday-duration lane closures (Section 5-7.7)
- Road closures (Section 5-7.8)

5-7.1 Weekday Closures

In rural areas and recreational routes, traffic volumes may be low enough to perform closures during weekday daytime hours by managing congestion using closure duration limitations (reopening in the late morning or early afternoon) or with closure length restrictions (restricting distances between flaggers alternating traffic). Queues will dissipate when the closure is reopened. Avoid impacting AM & PM commutes. For rural corridors with no suitable alternative routes, use traffic diversion rate of less than 10% (Minimal).

Exhibit 5-1 Weekday Closure Guidance

	Targeted Delays	Diversion Rates
Typical Closure	≤ 10 minutes (Avoid Commutes)	Static: 0% Dynamic: None – Minimal
Extended Closure	≤ 30 minutes	Static: ≤ 15% Dynamic: Minimal – Moderate
Aggressive Closure	≤ 60 minutes	Static: ≤ 25% Dynamic: Minimal – Moderate

5-7.2 Weeknight Closures

Target PM hours for work zone congestion because decreasing traffic volumes allows queues to dissipate overnight (Thursday PM volumes tend to be higher later into evening).

Avoid impacting AM commute traffic (keep delays ≤ 5 minutes) because rapidly increasing traffic volumes minimizes dissipation of queues created. AM commute may be directional.

Exhibit 5-2 Weeknight Closure Guidance

	Targeted Delays	Diversion Rates
Typical Closure	PM: ≤ 10 minutes AM: ≤ 5 minutes	Static: ≤ 7% Dynamic: None – Aggressive
Extended Closure	PM: ≤ 30 minutes AM: ≤ 15 minutes[1]	Static: ≤ 25% Dynamic: Minimal – Aggressive
Aggressive Closure	PM: ≤ 60 minutes AM: ≤ 30 minutes[1]	Static: ≤ 40% Dynamic: Minimal – Aggressive

[1] On AM commute routes, target AM delays of 5 minutes or less.

5-7.3 Friday Night into Saturday Morning Closures

Target Friday PM hours for work zone congestion because decreasing traffic volumes allows queues to dissipate overnight. Target Saturday AM hours for work zone congestion since there is no morning commute and lane closures be extended into the morning before being reopened to dissipate traffic queues.

Exhibit 5-3 Friday Night into Saturday Morning Closure Guidance

	Targeted Delays	Diversion Rates
Typical Closure	Fri PM: ≤ 15 minutes Sat AM: ≤ 15 minutes	Static: ≤ 15% Dynamic: None – Aggressive
Extended Closure	Fri PM: ≤ 30 minutes Sat AM: ≤ 30 minutes	Static: ≤ 25% Dynamic: Minimal – Aggressive
Aggressive Closure	Fri PM: ≤ 60 minutes Sat AM: ≤ 45 minutes	Static: ≤ 40% Dynamic: Minimal – Aggressive

5-7.4 Saturday Night into Sunday Morning Closures

Target Saturday PM hours for work zone congestion because decreasing traffic volumes allows queues to dissipate overnight. Target Sunday AM hours for work zone congestion since there is no morning commute and lane closures be extended into the morning before being reopened to dissipate traffic queues.

Exhibit 5-4 Saturday Night into Sunday Morning Closure Guidance

	Targeted Delays	Diversion Rates
Typical Closure	Sat PM: ≤ 15 minutes Sun AM: ≤ 15 minutes	Static: ≤ 15% Dynamic: None – Aggressive
Extended Closure	Sat PM: ≤ 30 minutes Sun AM: ≤ 30 minutes	Static: ≤ 25% Dynamic: Minimal – Aggressive
Aggressive Closure	Sat PM: ≤ 60 minutes Sun AM: ≤ 45 minutes	Static: ≤ 40% Dynamic: Minimal – Aggressive

5-7.5 Extended Morning Closures

Work operations such as bridge inspections, tree felling, or maintenance operations without noise permits require daytime closure hours, even if it results in congestion.

On congested suburban/urban corridors utilize extended Saturday morning or Sunday morning closures. In more rural areas where the AM commute will not be significantly impacted, extended morning closures can also be used during weekdays.

Begin closures 1.5 hours before sunrise (times available for Seattle, Yakima, and Spokane) to install traffic control and mobilize during darkness with work beginning at first light (civil twilight). Then, extend closures extend into the day as much as feasible.

Use Guidance in Exhibit 5-3 for Saturday morning reopening hours, Exhibit 5-4 for Sunday morning hours (which are typically an hour later), and Exhibit 5-1 for weekday mornings.

5-7.6 Weekend-Duration Lane Closures

Weekend-duration lane closures (Friday evening to Monday morning commute) are practical solutions on congested, suburban/urban corridors for longer work operations when extended overnight closure hours still do not yield sufficient work durations.

Weekend traffic demand on commute routes are much more discretionary. With strong public outreach and major special event avoidance, motorists can plan to use alternative routes, travel early morning or later in evenings, carpool, or use public transit.

Avoid weekend lane closures on major recreational routes due to greater communication and outreach challenges, especially when traffic from different Regions is impacted. Consider performing these closures during the off-season or weekday-duration closures instead.

In general, two open lanes during daytime hours will be needed on the major suburban/urban corridors while one open lane may suffice in other areas. During nights, the roadway can be reduced to a single open lane (by 10:30pm on the heaviest corridors) through the night into the morning until traffic volumes reach approximately 1.5 lanes of capacity before reopening back to two lanes (allows the queue to dissipate before building into the afternoon).

Strategically closing on-ramps helps maximizes capacity and reduces traffic volumes the work zone needs to serve while also keeping queues from spreading onto other corridors.

Exhibit 5-5 Weekend-Duration Lane Closure Guidance

	Targeted Delays	Diversion Rates
Extended Closure	Evenings: ≤ 45 minutes Afternoons: ≤ 60 minutes	Static: ≤ 40% Dynamic: Minimal – Aggressive
Aggressive Closure	Evenings: ≤ 60 minutes Afternoons: ≤ 90 minutes	Static: ≤ 70% Dynamic: Conservative – Ultra Aggressive

5-7.7 Weekday-Duration Lane Closures

Weekday-duration lane closures (Sunday night to Friday morning) are practical solutions on major recreational routes (such as I-90 over Snoqualmie Pass) for longer work operations requiring multiday closures.

The weekday traffic volumes are often significantly less than weekend volumes on these routes (Monday volumes may be higher) but avoid major special events (e.g. Gorge Amphitheater concerts for I-90). Note rural corridors may have limited to no alternative routes available, which significantly reduces diversion rates in those areas.

Exhibit 5-6 Weekday-Duration Closure Guidance

	Targeted Delays	Diversion Rates
Typical Closure	≤ 15 minutes	Static: ≤ 5% Dynamic: None – Moderate
Extended Closure	≤ 30 minutes	Static: ≤ 15% Dynamic: Minimal – Moderate
Aggressive Closure	≤ 60 minutes	Static: ≤ 25% Dynamic: Minimal – Moderate

5-7.8 Road Closures

For critical work operations (deep fish passage culverts, bridge demolition/replacement) weekend-duration or week-day directional or roadway closures may be necessary

The main requirement is the availability of a viable detour route to accommodate increased traffic volumes, truck turning movements, and pavement integrity. Weekend traffic demand is more discretionary than weekdays. With significant public outreach and avoiding major special events, the traveling public can plan ahead and take alternative routes, travel earlier or later, carpool, use public transit, or simply avoid traveling through the area.

When it has been identified and utilizing long-term duration closures is justified, Region Transportation Operations needs to perform work zone traffic analysis to determine permitted closure hours, anticipated delays and queues (Section 5-9), and needed queue mitigation strategies (Section 5-17). High-impact road closures require Region management approval, stakeholder acceptance, and significant public outreach.

If commercial vehicle travel restrictions are necessary, contact WSDOT Commercial Vehicle Services at least 7 days in advance (Section 5-15). Section 512 provides FHWA notification requirements for closures or use restrictions on Interstate Highways or National Highway System.

For work zone traffic analysis assistance and feasibility of roadway closures, Region Transportation Operations can contact the State Work Zone Traffic Engineer.

5-8 Long-Term Duration Closures & Staged Traffic Configurations

Long-term duration closures and staged traffic configurations are defined as those lasting 4 days or more are necessary for major work operations where other traffic control approaches were found to be ineffective or impractical.

When utilizing long-term duration closures is justified, Region Transportation Operations needs to perform work zone traffic analysis to determine anticipated delays and queues (Section 5-9) and needed work zone queue mitigation strategies (Section 5-17). Exact work zone traffic control strategies and closures will be determined on a case-by-case basis and is site-specific.

High-impact closures require Region management approval, stakeholder acceptance, and significant public outreach. Regions should expect work zone congestion to be very heavy the first day or two, but then easing as the traveling public adjusts.

If commercial vehicle travel restrictions are necessary, contact WSDOT Commercial Vehicle Services at least 7 days in advance (Section 5-15). Section 512 provides FHWA notification requirements for closures or use restrictions on Interstate Highways or National Highway System.

In the Contract Provisions, clearly list permitted duration, maximum number allowable, and restrict which staged traffic or work operations are allowed to utilize the extended closures.

Fish passage projects or roundabouts, strategies may include:

- Highways: Two-way, one-lane temporary signal-controlled alternating traffic with distance between temporary signals minimized to the extent possible to maximize capacity. If congestion is too excessive, then utilize two-way, two-lane traffic bypasses.
- Divided multilane highways & 2-lane freeways: Two-way, two-lane traffic on one side of median to create directional closure. If congestion is too excessive, utilize temporary three-lane configurations with the road zipper system to alternate the center lane or construct a 2-lane temporary bridge or bypass.

On major roadway/bridge rehabilitation projects (such as PCCP crack-and-seat or bridge deck scarification/replacement), utilized narrowed two-staged temporary traffic configurations to allow work on other half plus 1-foot minimum overlap before swapping.

- 2-lane freeway: Reduce to one narrowed lane laterally shifted onto the shoulder. Alternatively, use a median crossover for two-way, one-lane traffic with narrow lane and shoulders. In congestion is too excessive, utilize a temporary three-lane configuration used with the road zipper system to alternate the center lane.
- 3-lane freeway: Reduce to two narrowed lanes and laterally shifted on the left half while work is completed on the right half before swapping sides. Alternatively, a directional roadway closure can be obtained via a median crossover to create twolanes in each direction that is typically separated by temporary barrier.

Alternatively, for overhead steel bridge painting projects lanes may be narrowed to fit down the middle of the bridge while leaving room for containment on both sides of bridge and overhead. Work operations performed with daily/nightly lane.

Some projects may require a roadway long-term with detour, such as deep fish culverts.

See *Design Manual* Chapter 1010 for more design information. See Sections 5-18 & 5-19 for regulatory work zone speed limit reductions and advisory speeds policy and approvals.

5-9 Work Zone Traffic Analysis

Work zone traffic analysis compares the expected work zone traffic volumes with its estimated capacity, measured in vehicles per hour. When traffic volumes exceed capacity, queues grow. When traffic volumes are less than capacity, queues dissipate.

Work zone traffic analysis is performed as follows:

Obtain traffic volumes (Section 5-9.A)

Correct traffic volumes for growth (Section 5-9.B).

Determine work zone's traffic capacity (Section 5-9.C & Section 5-9.D)

Determine typical, extended, and/or aggressive closure hours (Section 5-9.E)

Estimate expected work zone queues and delays (Section 5-9.F)

Region Transportation Operations should perform work zone traffic analysis but may delegate it to the Project Engineering Office. The WSDOT Transportation Data, GIS & Modeling Office (TDGMO) can assist as well.

Much of the same information used for work zone traffic analysis is also used by WSDOT TDGMO to determine maximum interim liquidated damage values (Section 5-14) and should be included in that submittal.

5-9.1 Obtaining Traffic Volumes

Obtain the most recent, intact traffic volume data available. Hourly traffic volumes are typically used; however, 15-minute volumes are preferred on urban & suburban freeways and major arterial corridors (for greater precision).

On suburban/urban freeway corridors, obtain mainline volumes between each interchange and each exit-ramp and on-ramp volume when possible. On other roadways, obtain volumes most representative of the volumes the work zone is expected to serve.

When feasible, obtain volumes from each day of the week closures are permitted during the time of year the closure is expected to occur. For construction projects, average mid-June thru mid-September volumes after screening out any significant special events or holidays that may significantly skew the average. For an even more thorough analysis, average each day of week volumes separately for each month.

In rural areas, traffic data stations with hourly volumes are limited. An estimate of hourly traffic volumes at nearby locations can be made by using the AADTs to prorate known hourly volumes; however, new counts should be used if work zone congestion expected.

Most roadways experience higher traffic volumes in summer and lower in winter (recreational routes experience significant fluctuations in traffic volumes seasonally). Similarly, work zone capacities also are higher in summer and lower in winter by similar amounts **usually eliminating the need for seasonal adjustments for work zone traffic analysis in most areas**.

The following resources may be used to obtain existing traffic:

- **WSDOT Traffic Count Database System**

  This database provides traffic station information statewide that can be accessed, including hourly volumes and AADT at some stations (C) and (W). Instruction tabs in Work Zone Traffic Analyzer Excel sheet, see below, provide detailed information on usage.

- **WSDOT ECM Portal**

  Additional hourly traffic counts are available in “Short Duration Count” and “Traffic Studies” under the “Search Documents” tab on left. Some of these studies are several years old and typically not accurate even after correcting for volume increases.

- **CDR Software (Northwest & Olympic Regions Only)**

  This software is exclusive to WSDOT staff to access Permanent Traffic Records on freeways and major arterial roadways, including mainline and ramps, for historical data that can be averaged for Day-of-Week to 15-minute or one-hour intervals. Instruction tabs in Work Zone Traffic Analyzer Excel sheet provide detailed information on usage.

- **WSDOT Transportation Data, GIS & Modeling Office (TDGMO)**

  Hourly volume, classification, speed, and weight data can be obtained, when available, from the TDGMO. This includes traffic count data from both the PTR network and short-duration mechanical counts conducted throughout the state. To obtain this data, complete and submit a Traffic Data Request Form to TDGMO.

  New traffic studies can be performed by the TDGMO upon request.

5-9.2 Correcting Traffic Volumes for Growth

When traffic volumes are more than a year old, then account for annual changes in traffic volumes. The growth rate of traffic is location specific and decrease during times of economic recession, especially during COVID (avoid using 2020 & 2021 volumes).

If needed, location specific growth rate estimates can be generated by contacting TDGMO or Region Transportation Operations. Without the availability of better data or information, a conservative growth rate of 3 percent per year may be assumed whereas 1.5 percent per year increase is typical (higher growth rate is more conservative).

Caution should be used when applying a constant growth rate across all hourly traffic volumes because congested corridors may experience much higher growth rates during early AM commute hours as motorists adapt to worsening congestion by beginning their commutes earlier, as early as 3:30 a.m.

5-9.3 Divided Multilane Highway Work Zone Traffic Capacities

The "rule of thumb" work zone capacity thresholds (vehicles per hour, vph) provided in this subsection include ranges based on the understanding that roadway conditions, roadway configurations, and work activity intensity all impact actual capacities; therefore, sound engineering judgement and Regional experience is still needed for accuracy.

Exhibit 5-7 Freeway & 4-Lane Divided Highways Stationary Work Zones Capacities

Stationary Closure Description	Capacity (vehicles per hour per open lane)
Typical Lane Closure	Urban: 1300-1500 Rural: 1150-1350
Single Open Lane Shifted onto Shoulder	Urban: 950-1100 Rural: 900-1050
• When temporary barrier separate travel lanes from work areas, increase by 50 vph/lane. • Except when HOV/ETL is the only lane open, assume open HOV/ETL capacity is 750 vph. • For steep upgrades (≥ 4% for ½ mile or more), reduce right lane's capacity by one-half.	

Exhibit 5-8 Freeway & 4-Lane Divided Highways Mobile Work Zones Capacities

Mobile Closure Description	Capacity (vehicles per hour)
1 Open Lane	Urban: 1100 Rural: 1000
2 Open Lanes	Urban: 2400 Rural: 2100
3 Open Lanes	Urban: 3800 Rural: 3300
• Except when HOV/ETL is the only lane open, assume no General-Purpose traffic uses it. • For steep upgrades (≥ 4% for ½ mile or more), reduce right lane's capacity by one-half.	

- **Freeway Ramp Closure Hours**

  When determining permitted closure hours for ramps, it is important to understand ramp closure hours are dependent on the excess capacity available along its entire detour route, including any intersections. Excess capacity increases into the evening, with maximum capacity overnight, before decreasing into the morning. Weekend detour capacity varies from that on weekdays, and on rural versus suburban/urban corridors.

  Exhibits 5-9 and 5-10 serve as guideline ramp volume thresholds to determine **nightly** ramp closure hours that work in many scenarios; however, verify *the entire detour route* can sufficiently handle the detoured traffic volumes (see Section 5-6.D). Pay particular attention to protected single left turns and all-way stop intersections. Ramp closure hours may be extended beyond these thresholds but need to be carefully evaluated.

  Daytime, weekend-duration, or long-term duration ramp closures need to be holistically analyzed for feasibility as detour route excess capacity does vary and may be limited or nonexistent during daytime hours, including along the detour route (see Section 5-6.D).

Exhibit 5-9 Nightly Ramp Closure Volume Thresholds (vehicles/hour)

	Sunday night - Thursday nights		Friday night & Saturday night	
Ramp Closure Beginning Time	Suburban & Urban Corridors	Rural Corridors	Suburban & Urban Corridors	Rural Corridors
7:00 p.m.	200	200	150	150
7:30 p.m.	250	225	175	175
8:00 p.m.	300	250	200	200
8:30 p.m.	375	300	250	225
9:00 p.m.	450	375	300	250
9:30 p.m.	525	450	375	300
10:00 p.m.	600	525	450	375
10:30 p.m.	700	600	525	450
11:00 p.m.	800	Any Volume	600	525
11:30 p.m.	900	Any Volume	700	600
11:59 p.m.	Any Volume	Any Volume	Any Volume	Any Volume

- "Any volumes" means ramp may closed regardless of volumes, excluding major special events).
- Ramp closures with volumes exceeding 1000 vph may need additional mitigations.

Exhibit 5-10 Nightly Ramp Reopening Volume Thresholds (vehicles/hour)

	Weekday mornings		Saturday morning		Sunday morning	
Ramp Reopening Time	Suburban & Urban Corridors	Rural Corridors	Suburban & Urban Corridors	Rural Corridors	Suburban & Urban Corridors	Rural Corridors
3:00 a.m.	Any Volume	Any Volume	Any Volume	Any Volume	Any Volume	Any Volume
3:30 a.m.	800	600	Any Volume	Any Volume	Any Volume	Any Volume
4:00 a.m.	600	500	Any Volume	Any Volume	Any Volume	Any Volume
4:30 a.m.	450	350	Any Volume	Any Volume	Any Volume	Any Volume
5:00 a.m.	Reopen	250	800	600	Any Volume	Any Volume
5:30 a.m.		150	600	500	Any Volume	Any Volume
6:00 a.m.		Reopen	450	350	800	600
6:30 a.m.			300	250	600	500
7:00 a.m.			200	200	450	350
7:30 a.m.			150	150	300	250
8:00 a.m.			Reopen	Reopen	200	200
8:30 a.m.					150	150
9:00 a.m.					Reopen	Reopen

- "Any volumes" means ramp may closed regardless of volumes, excluding major special events).
- "Reopen" means the nightly ramp closure should typically be reopened.
- Ramp closures with volumes exceeding 1000 vph may need additional mitigations.

5-9.4 Highway Work Zone Traffic Capacities

The "rule of thumb" work zone capacity thresholds (vehicles per hour, vph) provided in this subsection include ranges based on the understanding that roadway conditions, roadway configurations, closure length, and work activity intensity all impact actual capacities; therefore, sound engineering judgement and Regional experience is still needed for accuracy.

- **Undivided Multilane Closures**

  These lane closures maintain two-way traffic with at least one thru lane in each direction (no flaggers, pilot cars, temporary signals, etc.). Contraflow means two-way traffic is maintained by shifting one direction of travel into the opposing direction's closed left lane or into the closed two-way, left-turn lane.

Exhibit 5-11 Lane Capacities for Undivided Multilane Roadways

Closure Description	Capacity (vehicles per hour)	
Typical Lane Closure	Urban: 1000-1200	Rural: 1100-1300
Typical Lane Closure (Signalized Intersections)	Urban: 800-1100	Rural: 900-1200
Contraflow	Urban: 900-1100	Rural: 1000-1200
Contraflow (Signalized Intersections w/UPO)	Urban: 700-800	Rural: 700-800
• When temporary barrier separate travel lanes from work areas, increase by 50 vph. • For steep upgrades (≥ 4% for ½ mile or more), reduce right lane's capacity by one-half.		

- **One-Lane, Two-Way Alternating Traffic**

  Work zone capacities are significantly affected by the distance between flagger, AFAD, or temporary signal stations due to the lost time waiting to take turns; additional intersections, business accesses, and driveways farther decrease capacity. To maximize capacity, minimize the distance between flaggers, AFADs, and temporary signals.

  Pilot car operations increase capacity by guiding road users through the work zone more effectively (they can give pedestrians and bicyclists a ride). For temporary signals, use bicycle push-buttons (see TC340 or TC440) with a shared bicycle-vehicle lane to maximize capacity by extending the all-red clearance interval only when bikes are present.

Exhibit 5-12 One-Lane, Two-Way Alternating Traffic Work Zone Traffic Capacities

Distance b/w Flaggers, AFADs, Temp Signals	Total Capacity (vehicles per hour in all directions)			
	Flagger & AFAD [1]	Pilot Car Operation	Temp. Signal (Bike Lane/Shuttle) (Bike Push-Button)	Temp. Signal Shared Vehicle Bike Lane
200 feet	1200	N/A	1100	950
500 feet	950	975	875	675
800 feet	850	875	800	550
1000 feet	750	800	725	500
1500 feet	625	700	600	375
½ mile	500	625	475	275
1 mile	375	475	350	200
2 miles	225	300	225	115
3 miles	150	225	150	80

[1] If bicycle volumes are significant, use "Temp. Signal Shared Vehicle-Bike Lane" capacities.

Note: To determine total capacity for traffic holds, see Section 5-24.B.

5-9.5 Determine Typical Closure Hours

A Work Zone Closure Hour Analyzer Excel file is available to assist with determining typical closure hours for lane and ramp closures and is available in this folder for WSDOT staff. External staff may request the Excel file by emailing HQworkzone@wsdot.wa.gov.

Important: Do not modify files in the hyperlinked file, only the one copied on your desktop.

Copy and paste the **01_WZ Closure Hour Analyzer** file onto your desktop, then modify it. For examples and guidance, see the **01Example_WZ Closure Hour Analyzer** file. Input data into yellow cells (copy data with 123 "text-only)icon), results produced in blue highlighted cells.

There are five tabs in the Excel sheet:

- **WSDOT TCDS Converter**: Converts daily, hourly volumes from WSDOT Traffic Count Database System (Monthly) to average hourly traffic volumes by day-of-week.
- **Hour to Eq.Hourly15Min+Growth**: Converts averaged hourly traffic volumes by day-of-week and coverts it to hourly equivalent 15-minute volumes by day-of-week.
- **15Min to Eq.Hourly15Min+Growth**: Converts averaged 15-minute traffic volumes from CDR coverts it to hourly equivalent 15-minute volumes.
- **Closure Template, Night**: The total work zone capacity thresholds for lane closures are up at the top of sheet with their associated highlighted colors as determined from Section 5-9.C or Section 5-9.D. The ramp volume thresholds are already programmed and match Exhibit 5-9 and Exhibit 5-10.

  There are three template calculators: Mainline lane closure/shoulder shift (Columns B-I), nightly suburban & urban ramp closure (Columns K-R), and nightly rural (Columns T-AA). Do not input volume data into Columns B-AA, instead copy the needed template starting with Columns AE-AL and working to the right from there. Closure tables for manual input are provided in Rows 113 and below if desired.

  Input (via 123 paste) equivalent hourly 15-minute volumes and cells will automatically change color to reflect recommended closure hours based on thresholds at top for mainline. For ramp closure hours, cells will be shaded purple.

  The first row shaded in PM hours will be the recommended beginning closure time for each closure, at the 15-minute interval. The reopening time will begin the 15minute interval after the last row is highlighted. For example, if the Monday 4:45am row is highlighted purple for a ramp closure, closure goes till Mon 5:00am.
- **Closure Template, Day**: Workers just like the Night template except ramp templates are not included and the manual closure input tables at Row 113 and below are set up for daytime closures.

5-9.6 Estimate Expected Work Zone Queues & Delays

Dynamic Diversion Work Zone Traffic Analyzer Excel files are available to assist with estimating expected queues and delays for lane closure hours and are available in this folder for WSDOT staff. External staff may request the Excel file by emailing HQworkzone@wsdot.wa.gov. There are three files, 30_ for daytime, 31_ for nighttime, and 32_ for weekend-duration closures (Friday night to Monday morning):

- **30_Dynamic Diversion WZ Traffic Analyzer_Whole Week, Daytime Hours**
- **31_Dynamic Diversion WZ Traffic Analyzer_Whole Week, Nighttime Hours**
- **32_Dynamic Diversion WZ Traffic Analyzer_Weekend-Duration Hours**

Copy and paste the three files onto your desktop, then modify them. There are ##Example_ files that provide actual examples for guidance. Important: Do not modify files in the hyperlinked file, only modify the file copied on your desktop.

Each file contains an "Instructions" tab that provides detailed information on how to use the calculator along with information for using CDR or WSDOT Traffic Count Database System to get traffic volumes into the needed 15-minute volume format (*not the hourly equivalent 15-minute volumes used in the* **01_WZ Closure Hour Analyzer** *file)*.

The Analyzer is upgraded to include dynamic diversion, which automatically calculates the traffic diversion rate for each 15-minute interval of the week/weekend. The user must select the type of diversion as explained in the Instructions tab in Step 5 (Rows 6268).

Closure times are entered as ##:## am or #:## pm or as military time. Do not enter closure times as ##:##am (without the space) or Excel will not process it.

The Analyzer will provide average daily/nightly diversion rate and maximum queue (miles) and delays (minutes) for the AM and PM hours.

5-10 Permitted Closure Restrictions

List permitted closure restrictions in Contract Provisions based on work zone traffic analysis, experience, and sound engineering.

For multiyear projects, include Provisions allowing the Agency to adjust closure hours on an annual basis, typically limited by up to 30 minutes. Region Transportation Operations may expand permitted closure hours.

Closure hours are provided for all permitted closures such as shoulder, lane, sidewalk, bicycle lane, ramp, and roadway closures but may include extended or aggressive closure hours for specific work operations. On roadways with HOV or Express Toll Lanes, use separate closure hours for left and right lane closures.

Maintenance closure hours are determined by Region Transportation Operations.

5-10.1 Contractor Cooperation and Permitted Closure Restrictions Due to Other Projects

Contract PS&Es should provide an *Other Contracts or Other Work* section of anticipated projects, both State and local agencies, occurring adjacent to or within the limits of the project requiring coordination and cooperation between Contractors.

Additional restrictions on permitted closures may be specified during scheduled roadway closures, directional roadway closures, and weekend lane closures occurring on other projects. This is often used on significant alternative routes around major closures, such as restricting any lane closures on southbound I-205 when southbound I-5 is closed (south of the I-5/I-205 interchange) for an adjacent project in Vancouver, Washington.

Consider language requiring a minimum of 1 mile (1.5 miles on freeways) between lane closures on adjacent projects. Coordination may occur to for the downstream project or for Maintenance to continue lane closures downstream ("tagging onto the closure").

5-10.2 Holiday Restrictions for Permitted Closures

Region Transportation Operations will determine when permitted closures need to be restricted during specific holidays or holiday weekends (entire weekend restricted when the holiday occurs on Friday, Saturday, Sunday, or Monday) in the Contract Provisions. Typically, the restriction begins noon the day prior and may continue until noon the day after the restricted holiday or holiday weekend but is adjusted based on traffic flows.

Holidays are listed in the WSDOT *Standard Specifications* Section 1-08.5 but not all holidays may need to be restricted as some have minor traffic impacts. For projects near British Columbia, Canadian holiday restrictions should be listed and may include:

- Good Friday (Friday before Easter)
- Easter Monday (Monday following Easter)
- Queen's Birthday/Victoria Day (closest Monday to May 20)
- Canada Day/Dominion Day (always July 1)
- B.C. Day (first Monday in August)
- Thanksgiving Day (second Monday in October)
- Boxing Day (always December 26)

Contract Provisions need to list holiday weekend restrictions are when the entire weekend is restricted if a holiday falls on Friday, Saturday, Sunday, or Monday.

5-10.3 Special Event Restrictions for Permitted Closures

Contract Provisions may restrict permitted closures from occurring two hours prior to, during, and/or two hours following major special events based on engineering judgement. Events may have either statewide, regional, or local impacts.

Region Transportation Operations determines each special event, projected attendance thresholds when applicable, along with the restriction interval (prior, during, and/or after).

Some special events that are typically restricted may include but are not limited to:

- Annual Seafair Hydroplane Race Weekend
- Hoopfest Weekend 3-on-3 Basketball Tournament in Spokane
- Watershed Music Festival at the Gorge Amphitheater
- Seattle Seahawk and Washington Huskie home football games
- T-Mobile Park, Lumen Field, or Tacoma Dome significant events such as concerts
- Washington State Fair
- Skagit Valley Tulip Festival
- Issaquah Salmon Days

With the closure restrictions in place, the Region Transportation Operations may provide exceptions but are not obligated to do so. Example: A 7:10pm Mariner's game ends at 10pm the South I-5 restriction prohibits closures until midnight (2 hours after); however, Region Transportation Operations, at its discretion, allows a triple lane closure (5-lane section) to commence during normal hours but delays the fourth lane closure until 11:30pm to accommodate game traffic while allow Construction crews to still complete work.

5-11 Closure Notification Requirements

Contract Provisions include closure notification requirements, such as requiring the Contractor to notify the Engineer in writing at least:

- 5 calendar days in advance of any shoulder, lane, ramp, and sidewalk closure.
- 14 calendar days in advance of any roadway closure.
- 30 calendar days in advance of long-term lane or roadway closure (74 calendar days in advance is required for directional Interstate closures exceeding seven consecutive days).

Contract Provisions may require Contractors to provide a detailed traffic control closure schedule to Engineer for review and acceptance up to three weeks prior to implementing traffic control while including language that notifications do not imply approval.

Typically, public notification requirements are as follows:

- Furnish and install information signs providing advance notification of road closures and/or ramp closures at least seven calendar days prior to each closure.
- Notify Washington Patrol; local fire, police, emergency services, and city engineering departments; Medic 1 and local transit agency (when applicable); other transit companies; and affected school districts in writing at least seven calendar days in advance of each closure.
- Furnish and install PCMSs providing at least three-day notification in advance of the first work zone regulatory speed limit reduction per RCW 47.80.020.

5-12 FHWA Notification Requirements for Closures & Use Restrictions

In compliance with 23 CFR 658.11, WSDOT Region Transportation Operations will notify the Federal Highway Administration Washington Division (WADIV) of full closures or use restrictions on Interstate Highways or National Highway System routes via email to Washington.FHWA@dot.gov. Contact information for the FHWA Field Operation Engineers and their geographical area of coverage is available at this FHWA website.

Full closures: When all mainline travel lanes in one direction of travel or both directions of travel are closed to traffic due to construction activities, emergency closures, or for special events. An Interstate-to-Interstate interchange ramp closure is included in this designation. Detours onsite or otherwise are also included in this designation.

Use Restriction: Restriction in place that limits the vehicle type, load, or function of the facility. The most common use restriction would be closing a route to all commercial vehicles. WADIV approves use restrictions on the Interstate Highway System and National Highway System routes.

Exhibit 5-13 FHWA Notification Requirements for Closures

Closure Description and Duration	Required WSDOT Action/FHWA Role
Interstate directional closure or use restriction. **(7+ consecutive days)**	WSDOT: Send WADIV notification **60 calendar days** in advance and additional notifications as specific details are updated.
	WADIV sends recommendation of approval to FHWA HQ. FHWA HQ approval required.
Interstate directional closure or use restriction. **(48+ consecutive hours to 7 consecutive days)**	WSDOT: Send WADIV notification **14 calendar days** in advance and additional notifications as specific details are updated.
	WADIV concurrence required.
Interstate directional closure or use restriction. **(between 12 to 48 consecutive hours)**	WSDOT: Send WADIV notification **7 calendar days** in advance and additional notifications as specific details are updated.
National Highway System full closure/use restriction. **(7+ consecutive days)**	WSDOT: Send WADIV notification **7 calendar days** in advance and additional notifications as specific details are updated.

5-13 Work Zone Closure Coordination

Because performing several work zone closures concurrently can result in significant conflicts and adverse region-wide impacts to mobility, it is critical to coordinate closures. For example, if a roadway is closed at the same time its detour route is closed, that presents a serious issue. In addition, it is critical for different Regions to coordinate for highimpact closures impacting intrastate travel.

Contact Region Transportation Operations to determine how work zone closures are coordinated in each region. Except for Northwest Region, the WSDOT Work Zone Database is typically used to coordinate work zone closures. In the Northwest Region, the Construction Traffic & Coordination Office (CTCO) performs the coordination role.

5-14 Interim Liquidated Damages

Interim liquidated damages (ILDs) are monies assessed or withheld from the Contractor for failure to reopen roadway closures, lane closures, and ramp closures by the time specified in Contract Provisions.

Per the *Plans Preparation Manual* Section 700.01(17), the TDGMO has standardized methodology for calculating interim liquidated damage values and is the only office with the authority to compute them. WSDOT TDGMO determines maximum ILD values based on the calculation of societal costs resulting from travel delays.

To request interim liquidated damages, the Region Transportation Operations (Project Engineering Office if delegated) should complete the Interim Liquidated Damages Request Form (Form 312-001) and email it to the TDGMO at least two weeks in advance of when it is needed. Include the following information in the email:

- Permitted closure hours, including days of week.
- Work zone traffic control plans for each closure.
- Detour plan(s) for each roadway closure and/or ramp (when available).
- Vicinity map.
- Draft version of the interim liquidated damages section that will be included in the Contract PS&E, leaving the actual value amounts empty.

Region Transportation Operations will then assign the actual liquidated damage value for each closure based on the maximum allowable amounts determined by TDGMO.

5-15 Commercial Vehicle Considerations

Washington exported is the 5th largest exporter of goods in the United States at $60 billion in 2019. Each semi tractor-trailer carries about $30,000 in freight. In short, there is a lot of valuable cargo traveling through Washington and maintaining mobility is important.

Freight transportation systems, including bridges and highways, are critical for businesses in Washington to effectively compete in regional and global markets that support and grow jobs, increase regional domestic product, and developing a larger tax base.

A vast majority of roadway freight is carried by semi tractor-trailers (WB-67 design vehicle); however, larger categories of freight include Oversize and Superloads:

Large Truck Freight Category	Width (feet)	Length (feet)	Height (feet)	Weight (pounds)
Oversize	8.5 to 16	Varies to 125	14 to 16	105,500 to 200,000
Superload	> 16	> 125	> 16	> 200,000

Oversize and Superloads freight transport require permits controlled through WSDOT Commercial Vehicle Services (CVS). CVS publishes oversize and overweight restrictions and vertical clearance restrictions that freight are required to check before traveling. See *Washington Commercial Vehicle Guide* for additional information.

Some Oversize freight permits are for an annual basis, such as combine harvester transports (typically 14-foot widths). Oversized freight operators not checking restrictions too often show up unexpectedly in work zones, sometimes blocking a roadway for hours. On T-1 and T-2 freight corridors, use 16-foot temporary travel widths when practical.

Superload freight permitting is far more stringent. Typically, CVS will forward Superload permits to Regions for review and Superloads may be required to obtain permission at least 72 hours prior to transport through known work zones; however, be aware that Superloads can be sensitive to transport restrictions. Typically, Superload transport is restricted to 11pm to 3am on weeknights and 1am to 6:30am early Saturday and Sunday mornings west of Cascades with Superloads exceeding 20 feet in width restricted to early Saturday and Sunday mornings only. Actual Superload travel restrictions vary by Region.

Width of single lane roadways or ramps with temporary traffic barrier and/or guardrail on both sides are of particular concern on T-1 and T-2 freight routes. Lanes/ramps may need to be widened in horizontal curves to accommodate the difference in tracking width of the WB-67 design vehicle's rear trailer axles that "cut" into the curve.

Vertical clearance reductions of 15'-3" or less are of particular concern on T-1, T-2, and T-3 freight routes). It is recommended to post any reduced vertical clearances in work zones below 16'-6" on these freight routes.

There have been numerous impacts from oversized loads to both permanent and temporary structures, even when advanced warning signs and over-height warning systems are in place. See WSDOT *Design Manual* Chapter 720 for more information.

If Construction or Maintenance narrows the traveled way to less than 16 feet or reduces the vertical clearance, contact CVS at least 7 calendar days in advance. For reductions in place for three consecutive days or more on T-1, T-2, or T3 freight corridors, a 30-calendar day notice to CVS is required along with communication with freight industry interested parties.

Oversized truck freight example; modular home straddling both lanes on Interstate 90 at a bridge rehabilitation work zone with a reduced traveled way.

Source: WSDOT

Superload truck freight example; Boeing B1 bomber 131 feet long, 29+ feet wide, and 15 feet high.

Source: WSDOT

5-16 Work Zone Queue Mitigation Strategies

Five motorists killed in a Kansas City work zone by semi tractor-trailer rear-ending queued traffic at high-speed.

Source: Seattle Times

Large trucks account for nearly 60% of fatal rear-end work zone crashes.

Nearly 90% of work zone fatalities occur on freeways & 45+ mph roadways.

Per ARTBA, Washington has averaged about 6 work zone fatalities over the last decade (1 worker fatality hit by DUI motorist exceeding three times the legal limit). The accident shown in the photo above involved a semi-truck and trailer crashing into queued traffic killing 5 motorists; thus, work zone queue mitigation is extremely important.

At 65 mph, it takes nearly 10 seconds and 550 feet for a fully loaded, 80,000-pound semi-truck to stop on level terrain in dry weather. Thus, it is critical for semi-trucks not to be surprised by queues, especially on downgrades steeper than 4% where it is very difficult for fully-loaded semi-trucks to stop at highway speed.

Work zone queue mitigation has reduced these high-speed rear-end collisions by 45% according to this FHWA-sponsored report, a significant safety benefit for a minor cost increase that is more than offset by construction savings from extended closure hours.

It is a standard practice to implement work zone queue mitigation on roadways 45 mph or higher when queues exceed ½ mile, except during emergencies.

5-16.1 Usage of Queue Mitigation Strategies Guidance

The four typical queue mitigations and guidance for their use is provided in the table below. In the sections that follow, each strategy will be discussed in detail:

PCMS (2 or 3 Phases)	3-Mile Queue Warning System	6-Mile Queue Warning System	Smart Work Zone System
Intermittent Queues ≤ 1.5 miles	Intermittent Queues ≤ 3 miles	Intermittent/Reoccurring Queues ≤ 6 miles	Reoccurring Queues 6+ Miles
Any Duration	Daily/Nightly Weekend-Duration Up to 2 Weeks	Daily/Nightly Weekend-Duration Up to 2 Weeks	2+ Weeks Stationary Closures
Easy setup Adjustable	Easier setup Moveable	Advanced setup Moveable	Complex setup Difficult to Relocate
~ $6/hour per PCMS	~ $100/hour + $6/hour per PCMS	~ $150/hour + $6/hour per PCMS	2-3 Weeks: $200/hour Const Season: $75/hour + $6/hour per PCMS

5-16.2 PCMS (2 or 3 Phases)

Per MUTCD, PCMSs are optional and meant to supplement traffic control setups. Most PCMSs have a modem that allows their messages to be remotely updated.

When used for queue mitigation, PCMSs are ideally positioned ½ mile in advance of queues to inform motorists of slow traffic is very effective when the message is relevant.

"SLOW TRAFFIC AHEAD" shall only be displayed when traffic queues are verified hourly to be present. Otherwise, motorists soon disregard the message even when relevant.

"WATCH FOR SLOW TRAFFIC" is appropriate when traffic queues may or may not be present but are expected.

Traffic backups are expected

PCMS	
1	2
WATCH FOR SLOW TRAFFIC	NEXT # MILES
2.0 SEC	2.0 SEC

⟷

Traffic backups are confirmed to be present

PCMS	
1	2
SLOW TRAFFIC AHEAD	NEXT # MILES
2.0 SEC	2.0 SEC

or

PCMS		
1	2	3
RIGHT LANE CLOSURE	SLOW TRAFFIC AHEAD	NEXT # MILES
1.5 SEC	1.5 SEC	1.5 SEC

Alternatively, a truck-mounted PCMS may be utilized as it can be more easily maneuvered up and down the shoulder and is particularly suited for rolling slowdowns on freeways or mobile closures on roadways when the right paved shoulder is 8 feet or wider.

5-16.3 3-Mile Queue Warning System (QWS)

Consisting of two PCMSs and two traffic speed sensors, this system is programmed by a QWS Technician to provide real-time messaging to motorists that are automatically updated based on the presence and location of the traffic queue.

This QWS is an excellent mitigation for intermittent 3-mile queues that grow and dissipate in work zones during extended daily/nightly and weekend-duration lane closures. Because it is easily installed and removed by the traffic control personnel, it can be used for lane closures that relocate daily/nightly but may be used for longer durations.

Typical Traffic Control Plans and General Special Provisions are available.

5-16.4 6-Mile Queue Warning System

Like the 3-mile Queue Warning System, but with 4 PCMSs and 4 traffic sensors (TC150s). This 6-mile QWS is typically used for long-duration lane closures that only need queue warnings without travel time delay or zipper merging instructions. 6-mile QWS may be used for extended daily/nightly lane closures, but the setup is quite involved.

Typical Traffic Control Plans (TC150s) and General Special Provisions are available.

5-16.5 Smart Work Zone System (SWZS)

SWZS provide real-time messaging for travel time delay, zipper merging instruction, and queue warning using multiple PCMSs and traffic sensors with a side-fire traffic sensor collecting traffic volume and speed data and travel time readers to determine delays. SWZS may be connected to variable regulatory speed limit with electronic numeric displays on downgrades 4% or steeper to change the speed limit based on the presence of queues.

This complex system is programmed and operated by an independent Technician coordinating with the Traffic Control Supervisor. Traffic control crews install, adjust, and remove the system. SWZS Technician collects historical information that is useful in determine when queues dissipate in evenings to determine aggressive closure hours.

Typical Traffic Control Plans (TC160s & TC170s) and General Special Provisions are available. A 6-mile and 9-mile system is available, but SWZS systems may be simplified to one PCMS with real-time travel time delay or expandable up to a 20-mile SWZS.

SWZS is used for stationary long-term staged traffic configurations with reoccurring queuing as it is complex and not easily moved like a 3-mile QWS. SWZSs takes a week to get fine-tuned.

5-17 Work Zone Safety Management

WSDOT employees are directed to make the safety of workers and the traveling public our highest priority during roadway design, construction, maintenance, and related activities.

Equitable consideration of safety and mobility of all road users and work crews is important while acknowledging reducing the regulatory speed limit shall be avoided as much as practical and be limited to specific locations with restrictive features. This avoids increasing speed variance and the potential for crashes as drivers will reduce their speeds only if they clearly perceive the need to do so per the MUTCD. See Section 5.17-B for more information.

See Section 5-18 for policy and Section 5-19 for approval procedures, required documentation, and required notifications for reduced work zone speed limits and advisory speeds.

In lieu of just relying on regulatory speed limit reductions, it is more effective to enhance work zone traffic control with strategies such as but not limited to:

- Using channelizing devices larger than 28-inch traffic cone required by MUTCD.
- Reducing channelizing spacing to less than required by MUTCD (tighter spacing).
- Using transportable attenuators or protective vehicles behind work crews.
- Separating work crews & vehicular traffic via temporary barrier on 2+ week projects.
- Utilizing radar speed display signs for motorist feedback.
- Improving flagging station safety via AFADs and portable temporary rumble strips.

All the engineering countermeasures and enhancements alone cannot make work zones completely safe and mitigate all the recent disturbing behavior trends.

5-17.1 Work Zone Statistics

National work zone statistics (ARTBA, 2022 & FHWA, 2018):

- 96% of fatalities occur to road users (4% to workers).
- 90% all fatal crashes occur on freeways & 45+ mph highways.
- 31% of fatalities involve large trucks.
- 8% of fatalities involve pedestrians & bicyclists, 3.5% involve workers

Washington work zone statistics (ARTBA, 2022):

- 5 fatalities occurred to road users, of which 1 involved large trucks.
- 0 fatalities involving a worker (1 worker killed in last decade was a flagger standing on passenger side of dump truck struck by motorist testing three times the legal limit).
- 0 fatalities involving pedestrians.

Thus, queue mitigation on freeway and arterial roadways with posted speed limits of 45 mph or higher are critical to reduce work zone fatalities from rear-end crashes that are overrepresented by large trucks per FHWA.

5-17.2 Effectiveness of Regulatory Speed Limit Reductions

It is a common misunderstanding that lowering speed limits automatically make work zones safer because drivers slow down; however, research shows motorists do not slow down until they perceive the need to do so (motorists do not go 5 or 7 mph over the posted speed limit by default), as concluded by a 1997 FHWA Report "*Effects of Rising and Lowering Speed Limits on Selected Roadway Sections*".

WSDOT performed a detailed work zone speed analysis on an Interstate Highway project where a 50-mph regulatory speed limit was implemented during construction in both directions in an existing 60-mph zone. The findings were as follows:

- During preconstruction (60 mph), the median speed was 67 mph and 85thpercentile speed was 73 mph in both directions.
- Northbound configuration was relatively unchanged with a 50-mph regulatory speed limit. The speeds were 1 mph slower (versus 10-mph speed limit reduction).
- Southbound reconfigured with restrictive Scurve chicane with a 50-mph regulatory speed limit. Within the S-curve chicane, the speeds were 7-8 mph slower but was unchanged ½ mile prior to the curve even though it was within the 50-mph zone.
- Thus, regulatory speed limit reductions alone result in negligible speed reductions, but a restricted roadway reconfiguration significantly reduces motorists' speeds.

Two important issues with designing a work zone based on an artificially low speed limit:

The work zone is being under designed for the prevailing speeds when motorists fail to perceive the need to reduce their speeds and speed variance increases.

Motorists receive insufficient warning signs with realistic advisory speeds when encountering restrictive roadway configurations than they otherwise would.

According to TRB's NCHRP Synthesis 482 "*Work Zone Speed Management*" report, work zone speeds will be in greatest compliance with posted speed limits when workers are present and actively working, double fine signs are posted, radar speed display signs are used, and police are actively enforcing the work zone speed limit.

5-18 Work Zone Speed Limit Reduction & Advisory Speed Policy

Equitable consideration of safety and mobility of all road users and work crews is important while acknowledging reducing the regulatory speed limit shall be avoided as much as practical and be limited to specific locations with restrictive features to avoid increasing speed variance and the potential for crashes as drivers will reduce their speeds only if they clearly perceive the need to do so per the MUTCD.

WSDOT categorizes speed limit reductions and advisory speeds for work zones as follows:

- **Continuous regulatory speed limit reductions** are in place 24 hours a day for four or more consecutive calendar days for restrictive roadway geometrics, features, or conditions exceeding ½ mile in length in most scenarios.
- **Intermittent regulatory speed limit reductions** are in place only during temporary lane closures for active work operations without temporary barrier separation. Existing or continuous regulatory speed limit maintained otherwise.
- **Advisory speeds**, associated with a warning sign, are used for a restrictive roadway geometrics, features, or conditions ½ mile or less such as restricted sight distance, a median crossover, or temporary roadway realignments. Advisory speeds are based on the reduced design speed or ball-banking and may be in place either continuously or intermittently. Advisory speeds may be used when existing speed limit is maintained.

Length of regulatory speed limit reductions shall be minimized beginning no more than ½ mile prior to restrictive roadway geometrics, features, or conditions with the existing speed limit restored within 500' ± afterwards, except when within 1 mile of existing reduced speed zones.

Duration of regulatory speed limit reductions shall be minimized to only when restrictive, temporary roadway geometrics, features, conditions exceeding ½ mile in length, or temporary lane closure when active work operations are present. Restore the existing speed limit as soon as practical afterwards or when directed by Region Transportation Operations.

Regulatory speed limits shall be black on white background, advisory speeds black on orange. Speed limit reduction ahead (W3-5, orange background) signs are required for regulatory speed reductions of 10 mph or greater. For speed limit reductions 20 mph or greater, a twostep reduction should be used (60 → 40 → 25) with separate W3-5 and R2-1 signage.

All continuous and intermittent regulatory speed limit reductions and advisory speeds shall be approved along with required documentation and notices per Section 5-19.

5-18.1 Continuous Regulatory Speed Limit Reduction Policy

The Region Traffic Engineer, or Region Transportation Operations if delegated, may order the existing speed limit to be maintained. The Region Traffic Engineer may approve continuous regulatory speed limit reductions down to the thresholds listed or described for scenarios below; otherwise, State Traffic Engineer approval thru State Work Zone Engineer is required:

1. For freeways and divided multilane highways with restrictive, temporary roadway geometrics and alignments exceeding ½ mile in length that cannot be practically designed for the existing speed limit:

Existing Speed Limit	Continuous Regulatory Speed Limit
65 mph or higher	60 mph
60 mph or lower	5 mph reduction

2. For freeways & divided multilane highways with lane/shoulder width reductions (regardless of length) as listed below to complete needed work operations, the continuous regulatory speed limit may be reduced further beginning no more than ½ mile prior to the narrowed roadway configuration and existing speed limit restored within 500'± afterwards:

Temporary Lane Width (feet)	Temporary Shoulder Widths (feet)	Continuous Regulatory Speed Limit
11.0 or wider	2.0	60 mph
11.0	1.0	55 mph
10.5	1.0	50 mph
10.0 – 10.5	0.5	45 mph

3. For undivided highways with restrictive, temporary roadway geometrics and alignments that cannot be practically designed for the existing speed limit during roadway widening, slope stabilization, fish culvert construction, drainage improvement, roundabout construction, or similar roadside projects:

Existing Speed Limit	Continuous Regulatory Speed Limit (More Than ½ Mile)	Continuous Regulatory Speed Limit (½ Mile or Less)
45 mph or higher	10 mph reduction	15 mph reduction
40 mph or lower	5 mph reduction	25 mph

4. One-lane, two-way alternating traffic operating under temporary traffic signal control:

Existing Speed Limit	Continuous Regulatory Speed Limit
30 mph or higher	25 mph [1]
25 mph or lower	Maintain existing speed limit

[1] When temporary signals more than 1500 feet apart, use a 35-mph continuous regulatory speed limit with separated pedestrian/bicycle pathway or shuttles.

5. Bituminous surface treatment (BST) operations on highways after chip seal placement but before completion of the final brooming, the continuous regulatory speed limit cannot exceed 35 mph on the section of roadway with loose gravel conditions.

6. An existing reduced speed zone may be extended to the beginning of a continuous regulatory speed limit zone if within 1 mile. When the continuous regulatory speed zone is higher than the existing reduced speed zone, then the continuous regulatory speed zone will begin at the end of the existing reduced speed zone.

7. Emergencies such as disasters and long-term incidents, the Region Traffic Engineer will determine continuous regulatory speed limit reductions.
8. Significant level of active transportation exposure, the Region Traffic Engineer will determine the appropriate continuous regulatory speed limit reduction, if any.

5-18.2 Intermittent Regulatory Speed Limit Reduction Policy

Consider intermittent regulatory speed limit reductions for lane closures in place for 3 days or less for active work operations with workers, equipment, and/or materials adjacent to traffic without temporary barrier separation whenever workers have no means of escape from motorized traffic (tunnel, bridges, etc.), workers are actively present within one-half lane width of adjacent open lane(s) not protected by barrier, or 45 mph or higher speeds combined with high traffic volumes are anticipated.

The Region Traffic Engineer, or Region Transportation Operations if delegated, may order the existing speed limit to be maintained. The Region Traffic Engineer may approve intermittent regulatory speed limit reductions down to the thresholds listed or described for scenarios below; otherwise, State Traffic Engineer approval thru State Work Zone Engineer is required:

1. Lane closures on freeways or multilane highways when lanes are not shifted laterally to conflict with the existing or temporary pavement markings.

Existing Speed Limit	Optional Intermittent Regulatory Speed Limit
45 - 75 mph	10 mph reduction

Radar speed display signs with associated R2-1 sign are optional.

2. Lane closures on freeways or divided multilane highways when a single open lane is laterally shifted onto the paved shoulder necessitated by work operations (HMA/PCCP rehabilitation/expansion joint replacements with work area extending up to open lanes).

Existing Speed Limit	Required Intermittent Regulatory Speed Limit	Work Crew Advisory Speed
45 - 75 mph	15 mph reduction	40 mph

Radar speed display signs with associated R2-1 sign required for Construction & optional for Maintenance.

3. For freeways and divided multilane highways during hot mix asphalt (HMA) rehabilitation projects when both planed bituminous pavement and short-duration temporary pavement markings present during nonworking hours within open lanes:

Existing Speed Limit	Intermittent Regulatory Speed Limit
65 mph or higher	60 mph
60 mph or lower	Maintain existing speed limit

Reduced speed zone is only within planed bituminous pavement area.

4. For significant level of active transportation exposure, the Region Traffic Engineer will determine the appropriate intermittent regulatory speed limit reduction, if any.

Intermittent regulatory speed limit reductions are prohibited for the following:

- Intermediate/short-duration shoulder closures
- Flagger-controlled alternating one-lane, two-way traffic
- AFAD-controlled alternating one-lane, two-way traffic
- Mobile shoulder or lane closures

5-18.3 Advisory Speed Policy

The Region Traffic Engineer may approve advisory speeds based on the reduced design speed or ball-banking for restrictive roadway geometrics, features, or conditions ½ mile or less.

The advisory speed with associated warning sign shall be located 1000' ± prior to the restricted feature on freeways and at "X" temporary sign spacing in advance on highways.

For advisory speeds within 10 mph of the posted speed limit, a single warning sign with advisory speed supplemental plaque is acceptable. For advisory speeds 15 mph or more lower than the posted speed limit, a warning sign with a supplemental distance plaque followed by a second warning sign with the advisory speed plaque should be used in advance.

5-19 Work Zone Speed Limit Reduction & Advisory Speed Approval, Required Documentation, and Required Notification Policy

5-19.1 Approval Policy

All continuous regulatory speed limit reductions, intermittent regulatory speed limit reductions, and advisory speeds shall be approved through Region Transportation Operations with the required documentation and notices listed below included in the submittal. It is recommended to obtain Region Transportation Operations' concurrence in advance as early as practical.

Region Traffic Engineer, or Region Transportation Operations if delegated, may order the existing speed limit to be maintained. Region Traffic Engineer may approve continuous regulatory speed limit reductions for down to the thresholds for scenarios described listed in Section 5-18.A, intermittent regulatory speed limit reductions down to thresholds for scenarios described listed in Section 5-18.B, and advisory speeds per Section 5-18.C.

For continuous or intermittent regulatory speed limit reductions not explicitly described or below thresholds listed in Section 5-18.A or 5-18.B, State Work Zone Engineer shall determine the appropriate regulatory speed limit and/or advisory speed based on free-flow traffic conditions and if outside Region Traffic Engineer approval authority, the State Traffic Engineer will approve. Required documentation is submitted to HQworkzone@wsdot.wa.gov thru Region Transportation Operations.

5-19.2 Required Documentation

The following documentation is required and shall be submitted to Region Transportation Operations for preliminary review and comments prior to obtaining any signatures.

Templates are hyperlinked but are also available by emailing HQworkzone@wsdot.wa.gov.

1. **Speed Limit Reduction Memorandum**

   For Region Traffic Engineer approvals, memorandum usage is at their discretion. If used, Region Traffic Engineer will sign the memorandum to indicate approval.

   A memorandum is required for State Traffic Engineer approvals. Region Traffic Engineer will initial to indicate concurrence and to signify an official request by the Region. State Traffic Engineer will sign the memorandum to indicate approval.

   Memorandum template. Copy the template file to desktop before modifying.

2. **Work Zone Speed Reduction Request Worksheet**

   A completed speed limit reduction worksheet is required for any continuous or intermittent regulatory speed limit reduction approval. Use of this worksheet is at the discretion of the Region Traffic Engineer when only advisory speeds are approved.

   For Region Traffic Engineer approvals, the Project Engineer will sign this worksheet for concurrence and the Region Traffic Engineer will sign to indicate approval.

   For State Traffic Engineer approvals, the Project Engineer will sign this worksheet for concurrence and the State Traffic Engineer will sign to indicate approval.

   Worksheet template. Copy the template file to desktop before modifying.

   Information needed to complete the worksheet can be found at WSDOT State Highway Log, Traffic Data GeoPortal, or WSDOT Traffic Count Database System.

3. **Vicinity Map**

   If available, including a project vicinity map is recommended.

4. **Traffic Control Plan or Staged Traffic Plan**

   A temporary traffic control or staged traffic plan accepted by Region Traffic Engineer is required, except for Design-Build projects. The Region Traffic Engineer may delegate this authority to Region Transportation Operations. Plans to include the following:

   - Location of speed limit reduction ahead (W3-5) and regulatory speed limit signs.
   - Location of advisory speed signs that are associated with warning signs.
   - Location of regulatory speed limit signs to resume the existing speed limit.
   - Specifications and requirements to cover/remove all conflicting existing signage.

   WSDOT typical traffic control plans may be used in the submittal.

5-19.3 Required Notification

The following notifications are required and shall be submitted to Region Transportation Operations for preliminary review and comments prior to obtaining any signatures.

Templates are hyperlinked but are also available by emailing HQworkzone@wsdot.wa.gov.

1. **Public Notice of Reduced Regulatory Speed Limit**

   In a newspaper of general circulation, publish a Notice for continuous and intermittent regulatory speed limit reductions in accordance with RCW 47.48.020.

   Continuous and intermittent speed limit reduction notice templates with examples are available, but copy the needed template file to desktop before modifying.

   At least 72 hours prior, use PCMS to inform motorists of an upcoming regulatory speed limit reductions (modify “60” and day/dates as appropriate):

PCMS	
1	**2**
60 MPH WZ SPEED LIMIT	BEGINS MONDAY JUNE 2
2.0 SEC	2.0 SEC

2. **Notice to District Office of the Washington State Patrol**

   For continuous or intermittent speed limit reductions, also send a public notice to the Washington State Patrol district office Traffic Enforcement & Incident PIO contacts including any plans to coordinate speed enforcement. A follow-up notice is required to confirm dates or other details as needed.

3. **Notice to State Work Zone Engineer**

   For continuous or intermittent regulatory speed limit reductions approved by the Region Traffic Engineer, the region needs to a notice to the State Work Zone Engineer (HQWorkZone@wsdot.wa.gov) with an electronic copy of the following:

   - Approved speed limit reduction request worksheet.
   - Traffic control plans or staged traffic plans.

   Notice is not necessary for advisory speeds.

5-20 Washington Patrol Work Zone Enforcement and Assistance

Using enhanced active speed enforcement by Washington State Patrol (WSP) is a highly effective strategy to combat aggressive, impaired, and distracted driving while also controlling excessive speeding in WSDOT work zones versus police vehicles passively sitting with their blue and yellow warning lights flashing. Routine enforcement by WSP in WSDOT work zones is always welcomed and needs no special agreement.

This General Special Provision (GSP) allows Regions to define specific WSP activities and the number of hours provided by WSDOT at no cost to the Contractor on projects, but also allows Contractors to request additional hours for those specific WSP activities at a 50/50 shared cost with WSDOT if allowed by the Engineer. Usage of this GSP requires approval from Region ARA for Construction.

Using WSP should be determined in Design and included in the TMP Document. A Task Assignment agreement is needed for each project utilizing WSDOT-provided WSP.

Regional Maintenance divisions may establish a standing Task Assignment agreement to allow quick response by WSP when needed.

Enhanced Active Speed Enforcement:

During enhanced active speed enforcement, WSP Trooper(s) typically actively patrol the work zone for several hours a few to several times a week to enforce traffic laws. WSP Troopers pull over violators and issue citations at their discretion.

WSP Troopers may also coordinate speed enforcement with a stationary WSP trooper within the work area informing WSP Troopers downstream of motorists violating traffic laws. Those downstream WSP Troopers pull over violators and issue citations at their discretion.

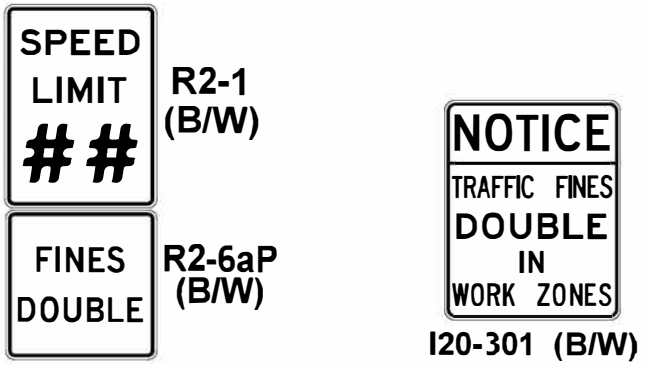
Temporary Traffic Control Assistance:

For Maintenance, WSP assists traffic control by participating in rolling slowdown operations, intersection traffic control, or mountain pass chain enforcement.

For Construction, Agency-provided WSP is used to actively enforce traffic laws. WSP shall not passively sit in work zones with red/blue lights activated or be in advance of traffic control crews installing or removing closures. See Section 5-21 for Contractor-provided uniform police officer duties for other traffic control assistance that may include WSP.

Double Fines in Work Zones:

Per RCW 46.61.527, traffic fines are doubled in work zones and do not require I20-301 or R26aP signs; however, WSP encourages using these signs to highlight the law and increase driver awareness.



5-20.1 Procedure for Incorporating Use of WSP Enforcement & Assistance

GCB 3957 WSDOT-WSP Interagency Agreement is a legal document allowing WSDOT to reimburse WSP for costs associated with assigning troopers for work zone enforcement or assistance.

The Task Assignment, WSDOT Form 130-020, is completed for each Construction project utilizing Agency-Arranged Law Enforcement and Region Maintenance divisions to assign specific work zone activities to WSP and connects WSDOT reimbursement to a specific work order.

Task Assignment Steps:

The Task Assignment should be completed, approved, and processed prior to the advertisement of a Construction project to establish a WSP reimbursement work order.

Regions will assign a Task Management Manager for each Construction project or Maintenance division who performs the following:

- Develop a preliminary cost estimate using $175 per hour per WSP trooper including vehicle. The minimum WSP shift is two hours.
- Request a Task Agreement number from HQ Transportation Office Fiscal Manager via email. Include project name, route number, Contract/Work Order number (if known), and preliminary cost estimate.
- With assigned Task Agreement number, complete WSDOT Form 130-020 and obtain signatures from Construction Project Engineer, WSP Agency Agreement Manager, and WSDOT Fiscal Manager for approval. Separate original copies required for WSDOT & WSP.
- Submit signed WSDOT Form 130-020 to WSDOT Headquarters Budget Office with copies sent to Region Program Management, Construction Project Engineering Office, Region Accounting office, and Region Transportation Operations.
- The Region Accounting Office reimburses WSP per the Task Assignment Agreement.

5-20.2 Procedure for Requesting Use of WSP Enforcement & Assistance

Requests for WSP officers may occur after the Task Assignment Agreement is approved.

WSP requests should be made at least two weeks in advance for major weekend-duration closures needing multiple troopers; make other requests at least one week in advance. Each of the 8 WSP districts has an Overtime Coordinator to whom requests are made.

Troopers are not guaranteed and are subject to availability. WSP responds to emergencies and incidents in work zones without the need of an Agreement.

5-20.3 Procedure for Using WSP Enforcement & Assistance

Invite WSP District Captain or their designee to pre-construction meetings to discuss needed WSP activities, hours of use, and provide needed contact information.

For Construction, the WSDOT Engineer provides direction to the WSP Trooper, preferably in collaboration with the Contractor's traffic control manager. The Contractor does not direct the Agency-provided WSP Trooper. By end of shift, the WSP trooper completes WSDOT Form 421-045 that the Engineer obtains and is kept on file at the Construction Project Engineering Office and available to Region Transportation Operations upon request.

For Maintenance, the Superintendent will delegate who provides field direction to the WSP Trooper. By end of shift, the WSP trooper completes WSDOT Form 421-045 that is kept on file at the Maintenance Office and available to Region Transportation Operations upon request.

5-21 Contractor-Provided Uniform Police Officer Usage in Work Zones

Uniform Police Officer (UPO) is an all-inclusive term for any sworn active police officer from local law enforcement agencies or Washington State Patrol. This explicitly excludes any retired police officer or a private security guard.

Using UPOs is limited to traffic control assistance duties where and when shown in accepted traffic control plans including controlling traffic at intersections, enforcing roadway or ramp closures (especially in locations at high risk of errant motorist intrusion), participating in rolling slowdowns or traffic holds.

UPO usage shall not include active speed enforcement, passively sitting in work zones with shoulder or lane closures or positioned in advance of traffic control crews installing/removing closures. Police presence is not a substitute for proper traffic control.

This General Special Provision requiring Contractors to provide, direct, and monitor UPOs having jurisdiction to control traffic in accordance with the Contract Plans. WSDOT will reimburse the Contractor via an hourly bid item.

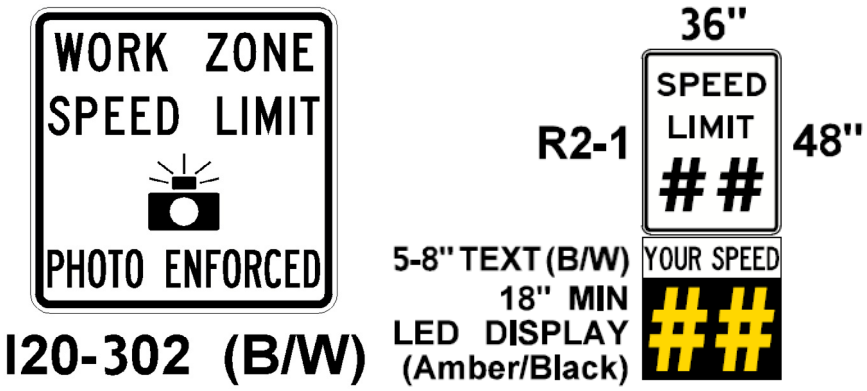
The Contractor develops a project specific agreement with each policy agency for use and payment. It is desirable for the UPO to attend the Contractor's Pre-Activity Safety meeting, or similar. The UPO does not complete WSDOT Form 421-045.

5-22 Speed Safety Camera Systems Enforcement for Work Zones

Per RCW 46.63.200 Speed Safety Camera Systems (SSCS) may occur when workers are present. The SSCS program is managed by HQ Transportation Operations thru a Vendor.

When the SSCS is in use, I20-302 sign(s) will be posted as a portable temporary sign by the Vendor or Class A construction sign(s) by the Contractor per the Contract Plans.

A radar speed display sign (RSDS), with an attached R2-1 regulatory speed limit sign, should be placed in advance of the SSCS vehicle when feasible.



Coordination with either Contractor's traffic control manager or Maintenance includes:

- Closure details including its time and location.
- When will workers be present?
- Are or will existing conflicting speed limit signs be covered?
- Is Contractor or Vendor installing/removing I20-302 signs?
- Will a radar speed display sign (with R2-1) be on site and what is its location?

5-23 Rolling Slowdowns

A rolling blockade of vehicles occupying each lane traveling at slow speeds creates a gap in traffic to enable completion of work activities requiring exclusive access across the freeway or divided four-lane highways. Use traffic holds on other roadways (Section 5-24).

Avoid rolling slowdown durations exceeding 15 minutes (18 minutes on 70 mph freeways). Target rolling slowdown speeds 40 mph less than the posted speed limit when feasible but may be slower with Region Transportation Operation's concurrence. Traffic should not be stopped except as a last resort due to unique circumstances or in emergencies. Detours around the rolling slowdown are unnecessary. Close freeway-to-freeway on-ramps with standard traffic control devices and temporarily block other onramps until the rolling blockade passes. Exit-ramps may remain open.

It is critical no traffic gets between the rolling blockade and work area. Enhance the blockage with UPO vehicles for enforcement if vehicles attempt to bypass the blockade. A chase vehicle follows the slowest vehicle to verify the roadway is clear up to the work area, where it watches for errant vehicles approaching and warn workers when needed.

Concurrent freeway rolling slowdowns in multiple directions is allowable when work operations occurring over all lanes in multiple directions but a Traffic Control Coordinator and UPO Coordinator should be positioned near work area for coordination purposes.

See TC182 Rolling Slowdown Typical Traffic Control Plan for guidance and reference.

On urban or suburban corridors, rolling slowdowns are limited to 11:00 p.m. to 4:00 a.m. during weeknights and 11:59 p.m. to 6:00 a.m. on weekends unless approved otherwise by Region Transportation Operations.

Region Transportation Operations may require, as a condition of the rolling slowdown traffic control plan acceptance, that a meeting with all necessary interested parties to define responsibilities and ensure activities required for successfully executing a rolling slowdown will be followed.

Work activities that typically necessitate a rolling slowdown include:

- Utility line installation or removal spanning over directional roadway.
- Existing sign structure removal spanning over directional roadway.
- Modifying temporary traffic control by reopening lane closures that is not feasible or safe otherwise during directional roadway lane reconfigurations or installation of permanent traffic recorder lead-ins needing to be completed in one shift across all lanes.
- Providing construction vehicle ingress/egress in locations resulting in minimal adverse traffic impacts and delays when accepted by Region Transportation Operations.
- Emergency roadway or bridge repairs having short work durations (≤ 10 minutes).
- Additional work activities such as mobilizing large equipment (cranes, drilling rigs, etc.) across the freeway that otherwise would lead to considerable delays and increased costs.

A directional roadway closure shall be used for work operations such as:

- Setting new bridge girders.
- Demolishing overhead bridge spans.
- Installing/removing structural falsework components spanning across all lanes.
- Installing a new sign structure across all lanes.

5-23.1 Rolling Slowdown Equations & Calculations

Known Variables:

T_{CLEAR} = Clear time needed at work area [minutes]

V_{RS} = Rolling slowdown target speed [mph]

$V_{TRAFFIC}$ = Slowest Vehicle Speed Expected [mph], typically the posted speed limit

Variables to be Determined:

D_{RS} = Minimum rolling slowdown distance needed [miles]

T_{RS} = Rolling slowdown duration [minutes]

Equations:

$$D_{RS} = \frac{T_{CLEAR} \times V_{RS} \times V_{TRAFFIC}}{60 \times (V_{TRAFFIC} - V_{RS})}$$

$$T_{CLEAR} = \frac{60 \times (V_{TRAFFIC} - V_{RS}) \times D_{RS}}{V_{RS} \times V_{TRAFFIC}}$$

$$T_{RS} = \frac{60 \times D_{RS}}{VRS}$$

$$V_{RS} = \frac{60 \times D_{RS}}{T_{RS}}$$

5-23.2 Rolling Slowdown Example #1

Scenario: Utility wire crossing over South I-5 @ Milepost 145.78. Crews need 10 minutes of clear time. The posted speed limit is 60 mph.

Step 1: Determine the minimum rolling slowdown distance needed & its starting location.

T_{CLEAR} = 10 minutes

V_{RS} = 60 – 40 = 20 mph (Typically 40 mph less than posted speed limit)

$V_{TRAFFIC}$ = 60 mph (Typically the posted speed limit)

$$D_{RS} = \frac{T_{CLEAR} \times V_{RS} \times V_{TRAFFIC}}{60 \times (V_{TRAFFIC} - V_{RS})} = \frac{10 \times 20 \times 60}{60 \times (60 - 20)} = \frac{12000}{2400} = 5.0 \text{ miles}$$

Since rolling slowdown is in southbound direction (mileposts go down), 5.0 miles prior to MP145.78 (back north where mileposts increase) would be MP 150.78.

Note, the rolling blockade will enter the freeway via on-ramp about 1-2 miles prior to starting point where all lanes can be occupied by blockade vehicles and traffic slowed down safely via gentle braking prior to the starting point (MP 150.78).

Verify posted speed limit remains 60 mph within rolling slowdown limits or VTRAFFIC will needs to be prorated based on distance with another reiteration of calculations completed.

Step 2: Determine the rolling slowdown duration.

$$T_{RS} = \frac{60 \times D_{RS}}{V_{RS}} = \frac{60 \times 5.0}{20} = \frac{300}{20} = 15 \text{ minutes}$$

Step 3: Determine on-ramps within limits of the rolling slowdown that need to be temporarily blocked between MP 150.78 to MP 145.78:

- SR516 → I-5 South (MP 149.07)
- S 272nd St → I-5 South (MP 146.71)

5-24 Rolling Slowdown Example #2

Scenario: For a bridge project, a large crane needs to cross West I-82 @ Milepost 38.16. Crews need 7 minutes of clear time. The posted speed limit is 70 mph (trucks 60).

Step 1: Determine the minimum rolling slowdown distance needed & its starting location.

T_{CLEAR} = 7 minutes

V_{RS} = 70 – 40 = 30 mph (Typically 40 mph less than posted speed limit)

$V_{TRAFFIC}$ = 60 mph (Based on truck speed limit)

$$D_{RS} = \frac{T_{CLEAR} \times V_{RS} \times V_{TRAFFIC}}{60 \times (V_{TRAFFIC} - V_{RS})} = \frac{7 \times 30 \times 60}{60 \times (60 - 20)} = \frac{12600}{2400} = 5.25 \text{ miles}$$

Since rolling slowdown is in westbound direction (mileposts go down), 5.25 miles prior to MP 38.16 (back east where mileposts increase) would be MP 43.41.

Verify posted speed limit remains 70 mph (trucks 60) within rolling slowdown limits or $V_{TRAFFIC}$ will needs to be prorated based on distance with another reiteration of calculations completed.

Step 2: Determine the rolling slowdown duration.

$$T_{RS} = \frac{60 \times D_{RS}}{V_{RS}} = \frac{60 \times 5.25}{20} = \frac{315}{20} = 15.75 = 16 \text{ minutes}$$

Step 3: Determine on-ramps within limits of the rolling slowdown that need to be temporarily blocked between MP 43.41 to MP 38.16:

- Yakima Valley Highway → I-82 West (MP 40.14)

5-24.1 Rolling Slowdown Example #3

Scenario: A rolling slowdown is needed to reconfigure a triple lane closure from lefts to rights on East I-90 starting at MP 5.58 thru MP 7.25, 2.91 miles east of the I-5 & I-90 interchange. The posted speed limit is 60 mph east of I-5.

Step 1: Determine the rolling slowdown target speed.

D_{RS} = 2.91 miles (to keep rolling slowdown east of I-5/I-90 interchange)

$V_{TRAFFIC}$ = 60 mph (Based on speed limit)

T_{RS} = Assume maximum 15-minute duration used to maximize clear time

$$V_{RS} = \frac{60 \times D_{RS}}{T_{RS}} = \frac{60 \times 2.91}{15} = 11.64 = 11 \text{ mph}$$

Step 2: Determine maximum clear time available at work area.

$$T_{CLEAR} = \frac{60 \times (V_{TRAFFIC} - V_{RS}) \times D_{RS}}{V_{RS} \times V_{TRAFFIC}} = \frac{60 \times (60 - 11) \times 2.91}{11 \times 60} = \frac{8555.4}{660} = 13 \text{ minutes}$$

Step 3: Determine on-ramps without limits of the rolling slowdown that need to be temporarily blocked between MP 2.91 to MP 7.25:

- Southbound Rainer Ave → I-90 East (MP 3.34)
- Northbound Rainer Ave → I-90 East (MP 3.79)

5-25 Traffic Holds

A traffic hold is a traffic control strategy using flaggers and/or uniformed police officers (UPOs) to stop traffic in all directions to enable completion of work activities requiring exclusive access across or over the roadway that would otherwise present significant risks to road users or workers.

Traffic holds are prohibited on freeway mainlines or divided four-lane highways when rolling slowdowns (Section 5-23) are applicable.

Traffic holds also may be used on roadways with flagger-controlled traffic, particularly in areas where there are no alternative routes and work is being completed in a narrow area requiring traffic to be held in all directions.

For flagger-controlled traffic holds, reduce each approach down to a single open lane using standard traffic control devices and advanced warning signage. It is optional to place a UPO vehicle with emergency lights activated at the work area after the flaggers to help block and reinforce the short-term roadway closure via traffic hold.

When holding traffic at or near signalized intersections, the traffic signal must be turned off or set to all-way red flashing mode per WAC 468-95-3015.

5-25.1 Traffic Hold Guidance

Consider the following guidance when implementing traffic holds:

- Duration of traffic holds determined case-by-case (depending on work operations, traffic volumes, expected queues and delays) with Region Transportation Operations acceptance based on work zone traffic analysis using total capacities described in Section 5-24.B.
- For 15-minute traffic holds, provide advance notice to the public at least 3 days prior to and during traffic holds to alert motorists of queued traffic:

mPCMS		
1	2	3
15MINUTE TRAFFIC HOLDS	AUGUST 17-20 MON-THUR	NIGHTLY 11PM TO 4:30AM
1.5 SEC	1.5 SEC	1.5 SEC

FIELD LOCATE NEAR UPCOMING TRAFFIC HOLD LOCATION FOR 3+ DAYS PER STD. SPEC. 1-10.3(3)C.

→ and →

mPCMS	
1	2
15MINUTE TRAFFIC HOLDS	EXPECT STOPPED TRAFFIC
2.0 SEC	2.0 SEC

STRATEGICALLY FIELD LOCATED IN ADVANCE OF EXPECTED TRAFFIC QUEUES PER STD. SPEC. 1-10.3(3)C.

- For 30-minute traffic holds, provide advance notice to the public at least 7 days prior to and during traffic holds. Specify in public notifications that traffic is released at top (#:00) and bottom (#:30) of the hour. An additional mPCMS should be used to alert motorists of queued traffic:

mPCMS		
1	2	3
30MINUTE TRAFFIC HOLDS	AUGUST 17-20 MON-THUR	NIGHTLY 9:30AM - 2:30PM
1.5 SEC	1.5 SEC	1.5 SEC

FIELD LOCATE NEAR UPCOMING TRAFFIC HOLD LOCATION FOR 7+ DAYS PER STD. SPEC. 1-10.3(3)C.

→ and →

mPCMS		
1	2	3
30MINUTE TRAFFIC HOLDS	TRAFFIC RELEASED AT THE	TOP AND BOTTOM OF HOUR
1.5 SEC	1.5 SEC	1.5 SEC

STRATEGICALLY FIELD LOCATED IN ADVANCE OF EXPECTED TRAFFIC QUEUES PER STD. SPEC. 1-10.3(3)C.

- If bicyclists present, recommend releasing motorists first then allow bicyclists to proceed.
- If one-lane, two-way alternating traffic between traffic holds do not have sufficient total capacity to clear queues between traffic holds, then utilize shoulder closure for work area to allow flaggers to release traffic in both directions concurrently to increase total capacity.
- Inform Washington State Patrol, transit agencies (if applicable), and local police, fire and local emergency service agencies at least 3 days in advance of non-emergency traffic holds.

5-25.2 Determining Total Capacities for Traffic Holds

The total capacity for one-lane, two-way alternating traffic from Exhibit 5-12 is multiplied by the ratio traffic is released divided by the total traffic hold duration.

Example #1: A 15-minute traffic hold where traffic is held for 10 minutes, and alternating traffic is released for 5 minutes with flaggers 500 feet apart will have a total capacity of:

Traffic Hold Total Capacity = 950 vehicles/hour * (5/15) = 317 vehicles/hour

Thus, traffic delays will be up to 10-minutes plus the 5-minute clear time, or 15 minutes if traffic volumes in all directions is 317 vehicles/hour or less.

If substantially higher traffic volumes are expected, then choose either the following:

- Delay traffic holds to when traffic volumes are lower.
- Increase the time each cycle traffic is released; shorten work duration.
- Change the lane closure into a shoulder closure and release traffic in both directions concurrently.

Example #2A: A 30-minute traffic hold where traffic is held for 22 minutes, and alternating traffic is released for 8 minutes with flaggers 800 feet apart will have a total capacity of:

Traffic Hold Total Capacity = 850 vehicles/hour * (8/30) = 227 vehicles/hour

Thus, traffic delays will be up to 22-minutes plus the 8-minute clear time, or 30 minutes if traffic volumes in all directions is 227 vehicles/hour or less.

If substantially higher traffic volumes are expected, then choose either the following:

- Delay traffic holds to when traffic volumes are lower.
- Increase the time each cycle traffic is released; shorten work duration.
- Change the lane closure into a shoulder closure and release traffic in both directions concurrently.

Example #2B: A 30-minute traffic hold, traffic held 22 minutes and released in both directions for 8 minutes with flaggers 800 feet apart will have a total capacity of:

Traffic Hold Total Capacity = (2*1300 vehicles/hour/lane) * (8/30) = 693 vehicles/hour

Thus, traffic delays will be up to 22-minutes plus the 8-minute clear time, or 30 minutes if traffic volumes in all directions is 693 vehicles/hour or less.

If substantially higher traffic volumes are expected, then choose either the following:

- Delay traffic holds to when traffic volumes are lower.
- Increase the time each cycle traffic is released; shorten work duration.
- Mitigate queues with a queue warning system in advance of flaggers and utilize public information outreach of the work operations.

5-26 WSDOT Approval, Acceptance, & Review Protocol for Local Agencies

When within WSDOT jurisdiction, the traffic control plans (TCPs) shall be consistent with WSDOT standard work zone practices and policy in addition to applicable state and federal laws. These requirements may exceed those set forth in the *Manual on Uniform Traffic Control Devices* (MUTCD). Each WSDOT Region Transportation Operations will determine standard work zone practices within their Region.

WSDOT has authorization to accept work zone TCPs only within the boundaries of WSDOT Right of Way, including all Interstate Highways and WSDOT Limited Access (RCW 47.52).

The following conditions require WSDOT approval, acceptance, or review even when within local agency jurisdiction including:

- Review TCPs involving a full highway closure (RCW 47.48.010)
- Review TCPs that may impact state highway, freeway, or the Interstate Highway System
- Accept TCPs affecting a WSDOT owned or operated traffic signal along a State Route (RCW 47.24.020, Section 13).
- Approve temporary regulatory work zone speed limit reduction and advisory speeds along a State Route per Section 5-18 and Section 5-19.
- Approve the installation of all traffic signals, both permanent and temporary, along a State Route (RCW 47.24.020, Section 13)

Local agencies may request WSDOT to *review* TCPs outside of WSDOT jurisdiction, but acceptance is still the local agency's responsibility.

The Memorandum of Understanding of "City Streets As Part of State Highways" provides an agreement between Cities and WSDOT for responsibilities regarding construction, operation, and maintenance for city streets that also function as state highways. Note the population thresholds listed in MOU is out of date, see RCW 47.24.020 for current population thresholds. By understanding these responsibilities, it is then known who accepts the associated TCPs.

Washington City and Town Profiles webpage provides current city population information.

The following information is needed to determine the appropriate TCPs acceptances or reviews by WSDOT and local agencies:

- WSDOT TCP Acceptance & Review Stamp Protocol (Section 5-25.A)
- Right-of-Way & WSDOT Limited Access Information (Section 5-25.B)
- Local Agency Boundary Information (Section 5-25.C)
- State Highway Traffic Signals within Local Agencies (Section 5-25.D)

5-26.1 Traffic Control Plan Acceptance and Review Stamp Protocol

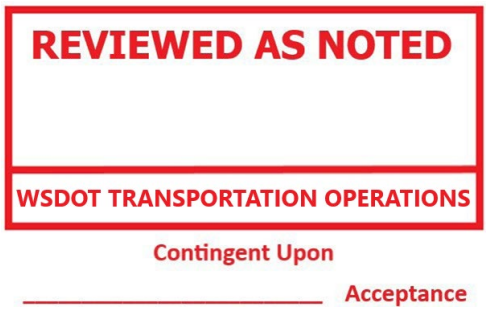
Document traffic control plan acceptance or review via stamps (including signature and date) on each sheet. Acceptance authority will be determined by each WSDOT Region Transportation Operations.

This subsection provides protocol for four types of traffic control plan stamps, which may still use WSDOT TRAFFIC OPERATIONS until replaced:

- Traffic control plan accepted and is entirely within WSDOT Right-of-Way and/or WSDOT Limited Access:

- Traffic control plan accepted within WSDOT jurisdiction but also needs to be accepted for portion within the local agency's jurisdiction ("dual acceptance"):

- Traffic control plan reviewed by WSDOT, at local agency's request, but must still be accepted by the local agency:



- Traffic control plan not accepted; consider providing comments and explanation of what needs to be addressed on the traffic control plan:

5-26.2 Right-of-Way and WSDOT Limited Access Information

WSDOT Right-of-Way plans, which also show WSDOT Limited Access boundaries, are the most useful way to determine which agency has jurisdiction for traffic control plan acceptance.

For general information regarding WSDOT Limited Access boundaries, see Exhibits in WSDOT *Design Manual* Chapter 530.

There are three typical ways to find specific boundaries of Right-of-Way and Limited Access:

- WSDOT Plans and Document Archive webpage provides a library for Right of Way Plans to determine these limits at each interchange or intersection and includes right of way plans.
- Contact WSDOT Region Right-of-Way staff for further assistance.

5-26.3 Local Agency Boundary Information

WSDOT GeoPortal has a "Political Boundaries" feature that displays the city, county, tribal land boundaries overlaid on a map of Washington.

5-26.4 State Highway Traffic Signals within Local Agencies

WSDOT has approval or acceptance authority of traffic control plans within the limits of signalized intersections on State Highways when the traffic signal is WSDOT owned or operated, even when within local agency limits exceeding the population thresholds specified in RCW 47.24.020, Section 17. The local agency has approval authority outside the limits of the signalized intersection within their jurisdiction.

Contact WSDOT Region Transportation Operations to determine which agency owns or operates State Highway traffic signals within the limits of local agencies.