Updated Work Zone Positive Protection Toolbox

Developed by the American Traffic Safety Services Association

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List of Acronyms, Abbreviations, and Symbols

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AFAD	Automated Flagger Assistance Device
ATSSA	American Traffic Safety Services Association
CFR	Code of Federal Regulations
DOT	Department of Transportation
FHWA	Federal Highway Administration
IT	Intermediate Term
LT	Long Term
LOS	Level of Service
M	Mobile
MPH	Miles Per Hour
PV	Protection Vehicle with Attenuator
FHWA Rule	Temporary Traffic Control Devices Rule
SD	Short Duration
SHA	State Highway Administration
ST	Short Term
TMA	Truck- or Trailer-Mounted Attenuator
TTC	Temporary Traffic Control
TTCP	Temporary Traffic Control Plan
WAPM	Work Area Protection Manual (Virginia DOT)

Background on This Publication

This document is part of a series of products developed under the 2023 Federal Highway Administration (FHWA)-sponsored American Traffic Safety Services Association (ATSSA) Work Zone Safety Grant. This document provides an update to a prior 2009 publication and describes the use of positive protection as a safety feature for roadway construction and maintenance projects, along with the types of devices that can be used, their typical locations, and common project characteristics. It also provides information on the decision to use positive protection and other exposure control or traffic control measures. This document is based on the 2024 FHWA update to the Temporary Traffic Control Devices Rule (23 CFR 630 Subpart K).

The Need for Positive Protection

Positive protection devices contain or redirect vehicles in accordance with applicable crash testing criteria such as the Manual for Assessing Safety Hardware (MASH), preventing workers from being struck by vehicles. These devices also protect motorists from hazards such as edge drop off conditions and non-recoverable or non-traversable slopes. The potential for a vehicle to leave the travelway in a temporary traffic control (TTC) zone, especially on high-speed roadways, presents potential safety impacts to the user and to workers on foot in the work space. High-speed roadways also experience the largest percentage of severe injury and fatality crashes. In addition, though incidents can happen on projects of any duration, the longer the project duration, the greater the potential exposure to roadway departure incidents.

Even though positive protection devices are crashworthy, practitioners may also develop strategies to eliminate the potential risk of a vehicle impacting the device itself. For example, prior to considering positive protection, practitioners may consider exposure control measures as a strategy to remove or lessen the risks of exposure to the devices. Exposure control measures are traffic management strategies to avoid crashes involving workers and motorized traffic by eliminating or reducing traffic through the affected area or diverting traffic away from the work space. In addition to removing risks through exposure control strategies, there are several countermeasures that can improve TTC zone safety as noted below:

Exposure Control Measure Examples:

- Full road closures
- Ramp closures
- Median crossovers
- Full or partial detours or diversions
- Rolling roadblocks
- Off-peak or night work
- Accelerated construction techniques

- **Keeping vehicles on the roadway –** Properly installed temporary traffic control provides clear and positive guidance to road users and may include elements such as nighttime lighting and required retroreflective devices, temporary rumble strips, and highly visible temporary pavement markings and markers. They may also include positive protection devices that redirect vehicles away from areas temporarily under construction. Such devices have delineators that match the pavement marking colors and may include barrier panels or lights on top of the device.

- **Providing for safe recovery –** If a vehicle leaves the intended travelway within a TTC zone, a forgiving design ensures that adequate recovery area exists through elements such as properly maintained clear zones and use of a proper longitudinal buffer space where applicable. If workers remain vulnerable to errant vehicles, positive protection devices may be used to prevent vehicle intrusion into the work space. These devices also prevent motorists' exposure to construction equipment and other hazards in the work space. In addition, policies on proximity of drop-off conditions to traffic can also help determine when positive protection may be required.
- **Reducing crash severity –** If a vehicle leaves the travelway, crashworthy devices such as barrier or protection/shadow vehicles and crash attenuators reduce the severity of the crash. Crashworthy devices reduce the potential impact to anyone that inadvertently strikes the device.

Design of TTC zones involves careful consideration of all the project factors and needs to ensure maximum levels of safety and mobility. Designers can achieve high levels of safety by following the Safe System Approach – or one that first seeks to eliminate potential conflicts and specific high-risk conditions by separating workers and other road users.[1] Secondly, the Safe System Approach involves implementing design features and speed management strategies that minimize impacts, including reduction in impact forces to reduce serious injuries and fatalities should a crash occur. As noted in Figure 1, the focus on first considering how to control exposure through various traffic management strategies and then evaluating the need for positive protection can foster safer TTC zone design. By following a process for effectively determining when to use positive protection devices (based on policy or an engineering study), practitioners can ensure that the devices used are necessary, practical, applicable, and perform as intended.

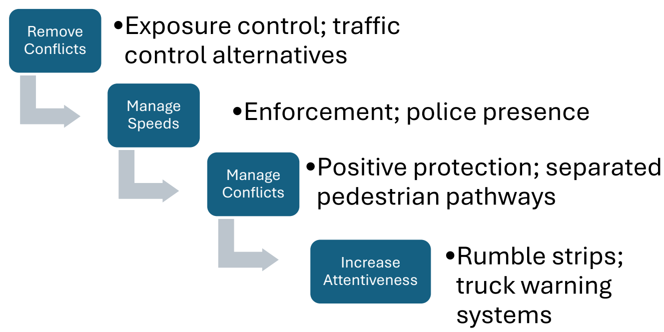

Figure 1. Safe System Approach Example Considerations for TTC Zone Design

Background on the Temporary Traffic Control Devices Rule

Amendments to 23 CFR 630 Subpart K (2024)

In 2024, FHWA amended the Rule on Temporary Traffic Control Devices (Rule), also referred to as 23 CFR 630

> "At a minimum, agencies shall use positive protection devices in work zones with high anticipated operating speeds that provide workers no means of escape from motorized traffic intruding into the workspace unless an engineering study determines otherwise." §630.1108(a)

[1] https://highways.dot.gov/sites/fhwa.dot.gov/files/2024-01/Safe_System_Roadway_Design_Hierarchy.pdf

Subpart K in the Code of Federal Regulations.[2] This Rule applies to projects using Federal funding and is designed to facilitate improved agency guidelines backed by engineering research for proper use of positive protection and other strategies.

The amended Rule notes that positive protection devices shall be used in work zones with high anticipated operating speeds (e.g., 45 miles per hour or greater) that provide workers no means of escape. The Rule also notes that positive protection devices shall be considered in other situations that place workers at increased risk from traffic. Examples include work zones that occupy a location for 2 weeks or more, those with high traffic volumes especially when combined with high traffic speeds, where workers are placed within one lane width of open travel lanes, and drop-off conditions or unfinished bridge decks that remain overnight or longer.

While agency policies may cover other situations, some examples of locations with high posted speeds where workers may have no means of escape include:

- Multi-lane bridges while performing maintenance, utility, or construction work where traffic is maintained in adjacent lanes
- Projects with work in close proximity to a median barrier
- Two-lane bridges with limited shoulders where other exposure control measures improve safety
  - Flaggers must position at the approach to bridges to ensure escape routes exist
  - Where only one lane is open to two-way traffic on a short- or intermediate-term bridge project, pedestal-mounted portable traffic signals are used in place of flaggers since there would be no safe escape route
  - Automated flagger assistance devices (AFADs) are considered a safety enhancement because they minimize exposure by allowing the flagger to control the AFAD from an area away from direct traffic exposure
- Near guardrail that protects motorists from non-recoverable slopes
- Tunnels where the work space is adjacent to live traffic
- Work performed on lifts or bucket trucks or while performing bridge inspections or maintenance using snooper trucks

The Rule states that agency processes, procedures, or guidance shall address the use of positive protection devices and allows agencies to define the high-speed threshold and no means of escape criteria for their jurisdictions. The Rule also notes that agencies shall update their policy for use of positive protection devices no later than December 31, 2025. States may request a variance from FHWA on a project-by-project basis, such as for those that are in the later stages of development around the compliance date.

There are several other temporary traffic control measures that can be considered in combination with the exposure control strategies and positive protection devices described in this document. Examples of other temporary traffic control measures, in addition to those previously mentioned,

[2] https://www.federalregister.gov/documents/2024/11/01/2024-25065/work-zone-safety-and-mobility-and-temporary-traffic-control-devices

include the use of warning flags and lights on signs (required by some agencies), speed trailers, speed safety cameras, and intelligent transportation systems.

Engineering Study Definition and Example Factors for Consideration

An engineering study can be used to evaluate project-level positive protection needs, or agency policies can support program-level guidance on the use of positive protection devices. The Rule notes in Section 630.1104 that an engineering study means the analysis and evaluation of available pertinent information, and the application of appropriate principles, provisions, and practices for the purpose of determining the choice and application of positive protection devices, exposure control measures, or other temporary traffic control measures to safely manage TTC zones. Section 630.1106 also notes that an engineer, or an individual working under the supervision of an engineer shall perform an engineering study through the application of procedures and criteria established by the engineer. The person conducting the engineering study shall document such study.

> Temporary traffic control plans that include positive protection devices based on an agency's policies, with documentation of an engineering study, provide an example of how to meet the intent of the Rule.

The strategies or positive protection devices to be used may be determined by a project-specific engineering study or determined from agency guidelines. These guidelines should be developed from an engineering study and indicate when positive protection devices or other strategies and approaches are to be used based on project and highway characteristics and factors. An engineering study may include documented benefit-cost analyses, decision matrices, decision tree analyses, or other appropriate engineering decision-making tools.

Some example characteristics and factors for an engineering study for the application of positive protection devices include:

- Project scope and duration
- Anticipated operating conditions including traffic volume, vehicle mix, and speeds
- Anticipated traffic safety impacts that the project may cause
- Type of work (as related to worker exposure and crash risks)
- Distance between traffic and workers and duration of worker exposure
- Escape paths available for workers to avoid a vehicle intrusion into the work space
- Time of day (e.g., work that impacts peak hours versus off-peak work)
- Work space restrictions (including impact on worker exposure)
- Consequences from/to road users resulting from roadway departure incidents
- Potential hazard to workers and road users presented by the device itself and during device placement and removal
- Geometrics that may increase crash risks (e.g., poor sight distance and roadway curvature)
- Access to or from the work space
- Roadway classification (e.g., principal arterials, collector roadways, other high-speed roadways)
- Impacts on project cost and duration

Analysis results may also indicate that positive protection is not warranted in various situations. The Rule requires that an engineering study be used in the decision not to use positive protection for projects with high anticipated operating speeds where workers have no means of escape.

FHWA supported the development of a framework for a data-driven approach that includes the following steps:[3]

- Predict the number of work space intrusions if no positive protection is used
- Predict the number of crashes with positive protection, if used
- Estimate differences in expected severity and crash cost of intrusions versus the expected severity and cost of crashes involving positive protection
- Estimate incremental costs of providing positive protection

Some agencies use data-driven processes to evaluate the potential for a roadway departure incident, the potential impacts to crashes from the barrier itself, the project location and facility characteristics, the duration of the project, the length of the work space and other supporting information. By using local data to evaluate the potential risks, agencies can make informed decisions about the project and update overall program-level policies and standards. In addition, tools such as the Roadside Safety Analysis Program (RSAP) are available to assist with predictive analysis of crashes and crash costs to support the assessment of longitudinal barrier and other positive protection applications.

Without conflicting with the Rule, there may also be situations where agency policies include blanket exceptions for positive protection use. These situations include examples such as recently placed asphalt where the protection vehicle may damage the surface material or work at signalized intersections where protection vehicles and other positive protection devices may not be practical due to limited space. In such cases, other exposure control strategies may be used to improve safety.

Types of Positive Protection Devices

Several types of crashworthy positive protection devices are currently available to enhance worker and motorist safety in TTC zones. They include several different types of barriers along with shadow vehicles with or without attenuators. Each device has unique characteristics, and there are different site situations that can benefit from the use of one or more devices. Designers consider the width of the barrier, the location used, protective features, and dynamic deflection (how far the barrier will move laterally when impacted). The working width of the device includes the width of the barrier along with the lateral deflection to ensure that the device adequately shields the roadside condition or situation that warrants its use.

> Connected longitudinal barriers are crash tested using a specific length (anchorage) upstream and downstream of the impact point. This length is necessary to ensure proper redirection of the impacting vehicle.

[3] workzonesafety-media.s3.amazonaws.com/workzonesafety/files/documents/training/fhwa_wz_grant/msu_data_driven_webinar.mp4

Portable Concrete Barrier

One of the most commonly used types of longitudinal barrier is the portable concrete barrier. This type of barrier includes a set of freestanding, precast concrete segments ranging from 8 to 30 feet in length with built-in connecting devices. A variety of specific designs can be used to protect the work space or protect users from a drop-off condition that typically occurs on construction projects. Design considerations include barrier flare rate, shielding the blunt end with a crash cushion if it falls within the clear zone, lateral deflection, anchoring for limited deflection, offset from traffic, joint connection details, and crashworthiness. Portable concrete barriers may deflect from 2 to 4 feet or more, with smaller deflection if the device is anchored to the pavement on the traffic side. Portable concrete barriers continue to be widely used to shield the work space and protect workers by redirecting errant vehicles. As shown in Figure 2, a common type of portable concrete barrier is the F-shape layout, which provides a different design of the expected impact area compared with the traditional Jersey Barrier. The base design translates horizontal momentum into vertical rise to dissipate the energy of the impact when redirecting a vehicle.

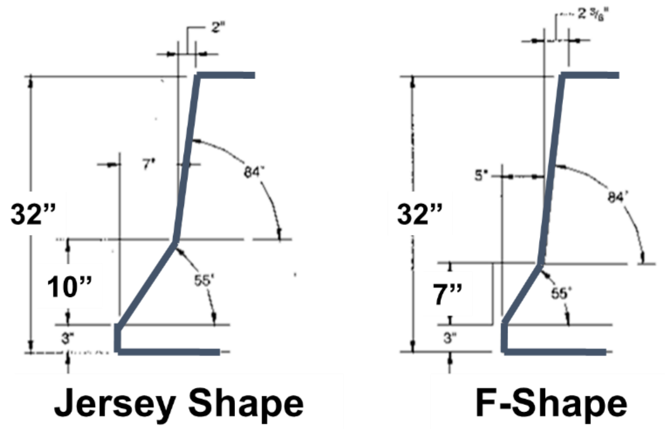

Figure 2. Portable Concrete Barrier Cross Section Comparison (Image Courtesy of ATSSA)

Moveable Concrete Barrier

Moveable concrete barriers typically consist of approximately 3-foot-long segments of barrier connected by steel pins to form a wall that is moved laterally with a barrier transfer vehicle. These systems may be used to reverse lanes to provide peak hour directional capacity (such as on a bridge). As shown in Figure 3, moveable concrete barriers may also be used to provide a lane within the work space for truck and equipment movement during off-peak traffic periods. A 1-mile section of moveable barrier can be transferred laterally the width of a travel lane in approximately 15 minutes. These proprietary barrier systems provide for protection of the transfer vehicle during the movement operation and have similar deflection rates as unrestrained portable concrete barriers.

Figure 3. Moveable Concrete Barrier Expanding Work Space Access (Image Courtesy Barrier Systems, Inc.)

Steel Barrier

There are two types of steel barrier that are commonly used for protection of the work space. Their use is dependent on the type of work activity, the project duration, and the overall protective needs of the work operation.

Figure 4. Positive Protection on a Bridge Segment Using Temporary Steel Barrier (Image Courtesy of Hill and Smith, Inc.)

Temporary steel barriers function like portable concrete barriers and are configured to remain in place for the duration of the work operation. Figure 4 shows an example of work space protection using temporary steel barrier on a bridge where workers might otherwise have no means of escape and where traffic is protected from potential hazards. The image shows lifting points on top of the barrier to aid in placement and removal and anchor slots at the base that are used to limit deflection. Some types of temporary steel barrier are anchored from every few feet up to 35 feet (depending on the manufacturer) to achieve minimal deflection values. Typically, 750 feet of temporary steel barrier can be hauled to a site on one truck trailer, while approximately 1,500 feet can be installed in 1 hour.[4]

Figure 5. Moveable Steel Barrier Reconfigured Using a Front Loader Attachment (Image Courtesy of ATSSA)

Moveable steel barriers can be reconfigured daily, such as for a series of short-term night work operations. An example of this type of operation is nighttime bridge painting where workers close a lane at night and open it back to traffic during daytime hours. A moveable steel barrier can be moved into place to protect the nighttime operation that might otherwise only use channelizing devices to separate traffic and the work space. Moveable steel barrier sections are typically 30 to 50 feet in length and include wheels for ease of movement into place. Once in the desired location, operators use a handle to raise the wheels and lower the section down onto a friction pad that meets the surface below. Workers connect each section with hooks when lowered down from the trailer and next to an adjacent section. In addition, personnel can transport more linear feet on one truck versus portable concrete. Temporary steel barriers may be anchored to the pavement for limited deflection, while moveable steel barriers can be reconfigured with a front loader or towed into place. Figure 5 shows

[4] https://www.workzonebarriers.com/work-zone-barriers-examples-types.html

an example of moveable steel barrier being reconfigured while separating traffic from the work space.

Ballast-Filled Barrier

Figure 6. Ballast-Filled Barrier Configured with Pedestals (Image Courtesy of ATSSA)

Ballast-filled barriers may be used as positive protection devices when configured appropriately as a protective feature based on manufacturer's instructions. These devices include longitudinal, segmented, polyethylene plastic shells and may be used in one configuration for pedestrian channelization (not for protection) or in a different configuration for positive protection. When used as a protective device, the sections may include a steel framework around the length of barrier and are typically filled with water based on manufacturer's instructions. Depending on the unit, they may also be placed on pedestals (see Figure 6) and connected with metal straps as a crashworthy positive protection configuration. Ballast is typically water but may also be sand. Consideration must be given to potential for water to freeze, additives that may be required, and draining the water after use. Workers can place each device by hand due to lower weight during installation when unfilled. Ballast-filled barriers will have larger lateral deflection as compared with other types of positive protection devices. Typically, if used as a pedestrian channelizing device, they are not designed to provide protection. When crash tested as a positive protection device, they are designed to contain vehicles but may deflect 6 to 23 feet when impacted and depending on the type and configuration.

Shadow/Protection Vehicles and Other Positive Protection Devices

Figure 7. Protection Vehicle Used on a Flagging Operation (Image Courtesy of ATSSA)

Mobile work moves intermittently or continuously, and short duration work occupies a location up to one hour. These operations require additional consideration for positive protection devices that are practical to use. Protection vehicles, also referred to as shadow vehicles, may be used to protect workers on foot within the work space or to protect a mobile operation. On roadways with higher speeds, protection vehicles may be required by agencies in some situations and a truck-or trailer-mounted attenuator may also be attached to the protection vehicle. The vehicle protects workers while the attenuator protects motorists that strike the rear of the protection vehicle. An example of a proper taper, buffer space, flagger position, and protection vehicle is shown in Figure 7. The temporary traffic control layout in the image accounts for sight distance to the flagger location based on the vertical curvature on the two-lane roadway.

Guidance from the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide notes that protection vehicles are those with greater than 10,000 pounds in gross vehicle weight. Protection vehicles may be stationary without a driver in the vehicle or may be moving continuously or intermittently. Some agencies note that a mobile operation that stops for more than 15 minutes should be set up as a stationary operation using appropriate temporary traffic control. In addition, some agencies have standard drawings for what they consider to be "very short-duration operations" such as those lasting less than 5 minutes. AASHTO also provides additional guidance on when shadow vehicles are recommended or highly recommended by location and project type.

Another proprietary device that provides portable positive protection is the mobile barrier. This device provides a trailer that protects the work space during certain activities including maintenance operations. This device allows workers to perform work behind the trailer and is especially useful where a median barrier wall may inhibit means of escape.

Characteristics and Typical Uses of Positive Protection Devices

While varying types of positive protection devices exist, the material used (e.g., concrete, steel, polyethylene, rubber) affects the overall performance of the device. For example, devices made from certain types of materials will perform based on crash tests and available deflection data, and the performance determines where the device should be used. Table 1 compares various positive protection devices by type and characteristics including typical deflection distances.

Table 1. Comparison of Positive Protection Devices and Decision-Making Factors

Positive Protection Device	Uses and Characteristics by Project Type	Relative Costs and Benefits	Other Considerations
Portable Concrete Barrier	Long-term projects where agency policy requires protection; areas where worker exposure and risks are high	Larger installation and removal costs; lane closures are necessary during installation and removal; greater benefits for long-term stationary work zones	Crash cushions are used to shield blunt ends within the clear zone; may require openings for access to the work space; unanchored systems may deflect 2 to 4 feet or more
Moveable Concrete Barrier	May be used to reconfigure the work space for internal vehicle movements during off-peak times or for projects with uneven directional traffic volumes	Higher relative cost for longitudinal barrier; provides traffic flow benefits and provides more room for equipment and vehicle movements within the work space	Reconfiguration of the barrier typically takes 15 minutes to move 1 mile of barrier; attenuators are a proprietary design for the moveable barrier
Temporary Steel Barrier	Long-term projects where agency policy requires protection; areas where worker exposure and risks are high	Potentially lower transportation costs due to lengths hauled on one truck and stackable design	Potentially larger lateral deflection (varies by manufacturer) as compared with unanchored portable concrete barrier; may be anchored
Moveable Steel Barrier	Projects with a series of short-term operations, such as night work where traffic control is removed daily	Similar to temporary steel barrier with added benefit of ease of movement	Can be towed into place or moved laterally with a front loader with specially designed attachment
Ballast-Filled Barrier	Lower speed locations due to larger deflection; require additional connection devices to perform as a positive protection device	Potentially lower placement and removal costs as they can be placed by hand and then filled; may deflect 6 to 22 feet depending on the system used and type of crash test	May be filled with water or sand; require consideration for non-freeze chemicals and emptying; in many situations only channelize but do not provide protection (such as pedestrian applications)
Protection/ Shadow Vehicles	May be stationary or moving and used in locations where barrier may be impractical and for relatively short work spaces (no longitudinal protection provided)	Agency standards may require an attenuator in high-speed applications	Adequate roll ahead distance is required to protect workers while limiting risks to workers (may be 25 to 175 feet ahead of the work space depending on the crash test)

Mobile Barrier	Projects with a short work space (approximately 100 feet)	Quick relocation and interchangeable right/left configurations	Various project types including those that may not have escape routes for workers

Agency Practices and Policies for Controlling Exposure and Using Positive Protection

The Rule notes that positive protection shall be used on projects with high anticipated operating speeds where workers have no means of escape. The Rule also encourages consideration of positive protection in all situations. To meet the definition of an engineering study when determining when to use positive protection, some agencies have developed a detailed analysis process based on agency policy. There are also electronic tools and accompanying training that agencies may use to assist with the decision-making process. In addition, a study performed by the Kansas Department of Transportation (DOT) documented positive protection policies and guidance from 25 transportation agencies across the United States and proposed a policy and practice for Kansas DOT.[5] Another study by the Minnesota DOT surveyed State agencies to support development of a manual on use of positive protection.[6]

The examples provided in this section represent a variety of analysis techniques based on agency policies for assessing the need for positive protection. They are summarized here in limited format to match the level of detail presented in this document. Interested agencies will find additional analysis tools and may research other agency policies and examples as needed to fully implement the Rule.

California Guidelines on the Use of Positive Work Zone Protection and Mitigation Measures

The California Department of Transportation (Caltrans) published "Design Information Bulletin 91 – Guidelines on the Use of Positive Work Zone Protection and Mitigation Measures" to provide implementation guidance and policy on use of positive protection.[7] The Caltrans guidance includes engineering risk analysis process steps and consideration of mitigation measures and treatments for other non-motorized road users such as pedestrians and bicyclists. All public works projects are required to include a completed form (CEM-1302) that documents the positive protection engineering analysis and results for each project. There are project types that may require positive protection, including:

- Falsework protection (structures that support concrete forms)
- Bridge widening and bridge rail replacement
- Protection of fixed objects within 15 feet of the edge of an open lane of traffic or excavations with a near edge within the same distance to traffic
- Locations where material or equipment is stored within 15 feet of the edge of a traffic lane

[5] Synthesis of Work Zone Positive Protection Practices: https://rosap.ntl.bts.gov/view/dot/25731
[6] Use of Positive Protection in Work Zones: https://mdl.mndot.gov/_flysystem/fedora/2023-01/trs1703.pdf
[7] Caltrans DIB-91: https://dot.ca.gov/-/media/dot-media/programs/design/documents/dib-91-02--a11y.pdf

- Locations within 15 feet of an open lane where excavations create a drop off greater than 0.15 feet (except where a tapered notch edge is used)
- Locations where pedestrian or bicycle traffic is in close proximity to fast-moving traffic (guidelines note posted speeds greater than 45 mph as high operating speed)

As shown by the example in Figure 8, Caltrans' electronic Work Zone Engineering Risk Analysis Rating form provides fields that users can complete in a fillable Portable Document Format (PDF) that calculates a rating for the project. Fields include activity duration, worker exposure, pre-construction posted speed limit, traffic volume and level of service (LOS), and location of work. Caltrans guidance notes that a total score of 36 or more on the completed form is high risk and positive protection is required, while lower score range results may be low to moderate risk and require either mitigation measures or application of positive protection devices. There is also a project exception documentation section on the form. For traffic measures, the Caltrans guidance is based on potential for increased crash risk and severity. For example, LOS D provides a higher score rating than other LOS values due to the unstable conditions and potential for erratic maneuvers when conditions reach capacity.

WORK ZONE ENGINEERING RISK ANALYSIS RATING

WORK ZONE INFORMATION

WORK ZONE NUMBER	ROUTE	DIRECTION	BEGIN POSTMILE	END POSTMILE	DURATION (Days)
	LOCATION		WORK ACTIVITY		STAGE/PHASE NUMBER

For each factor, choose which condition best describes the work area based on your assessment

	FACTOR 1 - DURATION OF SPECIFIC CONSTRUCTION WORK ACTIVITY	POINTS	FACTOR POINTS
CHOOSE ONE CONDITION	☒ LONG-TERM STATIONARY WORK DURATION GREATER THAN 6 MONTHS	10	10
	☐ LONG-TERM STATIONARY WORK DURATION OF 3 TO 6 MONTHS	8	
	☐ LONG-TERM STATIONARY WORK DURATION MORE THAN 3 DAYS AND LESS THAN 3 MONTHS	6	
	☐ INTERMEDIATE STATIONARY WORK	3	
	☐ SHORT-TERM STATIONARY, SHORT DURATION AND MOVING CLOSURES	0	
	FACTOR 2 - WORKER EXPOSURE	**POINTS**	**FACTOR POINTS**
CHOOSE ONE CONDITION	☐ WORKERS ARE EXPECTED TO BE WITHIN THE WORK CLEAR ZONE (0-6 feet)	10	3
	☐ WORKERS ARE EXPECTED TO BE OUTSIDE THE WORK CLEAR ZONE (>6-15 feet) BUT WITHIN THE CONSTRUCTION CLEAR ZONE (>6-15 feet)	6	
	☒ WORKERS ARE EXPECTED TO BE OUTSIDE OF THE CONSTRUCTION CLEAR ZONE (>15 feet) BUT WITHIN THE AASHTO CLEAR ZONE (>15-30 feet)	3	
	☐ WORKERS ARE EXPECTED TO BE OUTSIDE OF THE AASHTO CLEAR ZONE (30 feet)	0	
	FACTOR 3 - POSTED SPEED LIMIT (Prior to Construction)	**POINTS**	**FACTOR POINTS**
CHOOSE ONE CONDITION	☐ POSTED SPEED LIMIT IS 55 MPH OR GREATER	10	6
	☒ POSTED SPEED LIMIT IS 40 MPH - 50 MPH, OR PILOT CAR OPERATION REGARDLESS OF POSTED SPEED	6	
	☐ POSTED SPEED LIMIT IS 30 MPH OR 35 MPH	3	
	☐ POSTED SPEED LIMIT IS 25 MPH OR LESS	0	
	FACTOR 4 - TRAFFIC VOLUME	**POINTS**	**FACTOR POINTS**
CHOOSE ONE CONDITION	☐ LEVEL OF SERVICE F	6	10
	☒ LEVEL OF SERVICE E	10	
	☐ LEVEL OF SERVICE D	6	
	☐ LEVEL OF SERVICE C	3	
	☐ LEVEL OF SERVICE A OR B	0	
	FACTOR 5 - LOCATION OF WORK	**POINTS**	**FACTOR POINTS**
CHOOSE ONE CONDITION	☐ BRIDGE STRUCTURE, DROP-OFFS 2 FEET OR GREATER, FILLS OR CUTS GREATER THAN 2:1, OR CONFINED AREAS WITH NO ESCAPE ROUTE FOR WORKERS	10	3
	☐ AREAS WITH BARRIERS OR OTHER IMPEDIMENTS THAT HAVE A REASONABLE ESCAPE ROUTE FOR WORKERS	6	
	☒ AREAS THAT HAVE A VIABLE ESCAPE ROUTE FOR WORKERS	3	
	☐ OPEN AREA WITH MULTIPLE ESCAPE ROUTES FOR WORKERS	0	
		TOTAL SCORE:	32

Figure 8. Example Caltrans Engineering Risk Analysis Rating (Image from Caltrans Website)

Maryland State Highway Administration (SHA) Temporary Traffic Barrier in Work Zones Policy

Maryland Process:

- Preliminary Investigation and Early Project Screening
- Engineering Study During Detailed Design
- Waivers and Documentation
- Requirement for Additional Safety Strategies Where Barrier is Required But Not Feasible
- Documentation in the Transportation Management Plan for Significant Projects
- Broad Internal Stakeholder Involvement

The Maryland SHA developed a policy for the use of temporary traffic barriers as positive protection in work zones. The policy notes that temporary barrier is required for all work on high-speed facilities (posted speed limit greater than or equal to 45 miles per hour) under two conditions. First, where the operation occurs on the roadway or shoulder, or is within 10 feet of the edge of an open travel lane, and the duration of work is expected to be at least 2 weeks without change to the limits of the work location. Secondly, where there is no means of escape for workers from motorized traffic under the same duration and location conditions noted above. When positive protection is warranted, the Maryland SHA policy notes that plans should detail where and when it is to be used, and the appropriate pay items should be included in the contract documents. The updated rule applies to all durations unless engineering study documentation indicates otherwise.

The Maryland SHA policy also states that if an engineering study determines that barrier protection is not feasible, a waiver justifying the reasoning is required, and that positive protection should still be considered for all projects. The policy also includes references to exposure control measures and requires consideration of full closure as a first alternative to separate workers from motorized traffic. Where temporary barrier is required but not deemed feasible, the policy requires use of additional safety strategies such as law enforcement, warning flags and lights on signs, reduced channelizing device spacing, protection vehicles with attenuators, and other technologies and devices.

Ohio Department of Transportation Revised Policy and Analysis Tools

In late 2025, Ohio DOT developed a Subpart K compliance plan and implementation variance request document that outlines requirements for use and references several positive protection decision-making resources. The ODOT Traffic Engineering Manual (TEM) includes a work zone positive protection analysis tool and flowchart. The policy also outlines specific situations that require positive protection, including:

- Location(s) where drop-off protection is needed (SCD MT-101.90)
- Location(s) where existing positive protection devices must be removed, or are otherwise taken out of service, to perform the work
- Location(s) where material, vehicles or equipment is stored within the clear zone
- Location(s) where fixed objects are within the clear zone, that are new or existing and become closer to the traveled way

- Work occurring between a travel lane and a barrier
- Work occurring within a tunnel
- Work occurring on a bridge
- Work performed from lifts or bucket trucks
- Work encroaching into an open lane of travel (e.g., TA-6)

In the ODOT policy, no means of escape is defined as “the presence of bridges, steep slopes, retaining walls or other physical obstructions that prevent workers from rapidly moving to a safer location to evade an errant or encroaching vehicle.” Positive protection is required for work that utilizes any portion of Federal-aid funds, is located on a roadway with a preconstruction posted speed limit of 45 mph or greater, and where workers have no anticipated means of escape from motorized traffic intruding into the work space.

A work zone positive protection analysis form is used to determine whether positive protection is required based on an engineering study rating system.

In addition, a work zone positive protection device exception is necessary for cases where work zone positive protection devices will not be provided but are required either by standard or due to an engineering risk analysis total score of 46 or more. An excerpt from the rating tool is shown in Figure 9.

WORK ZONE POSITIVE PROTECTION ANALYSIS FORM (TEM Form 696-8)

Engineering Risk Analysis for Work Zone Positive Protection Device Use		
For each factor based on your assessment, choose which condition best describes the analysis scenario.		
FACTOR 1– DURATION OF SPECIFIC WORK ZONE ACTIVITY	**POINTS**	**RATING**
Long-Term Stationary Work Duration >6 Months	**10**	
Long-Term Stationary Work Duration of ≥3 Months to ≤6 Months	**8**	
Long-Term Stationary Work Duration >3 Days to <3 Months	**6**	
Intermediate-Term Stationary Work *(occupies a location >1 daylight period to ≤3 days, or nighttime work lasting >1 hour)*	**3**	
Short–Term Stationary Work *(daytime work occupying a location for > 1 hour within a single daylight period)*, Short Duration Work *(occupies a location ≤1 hour)*, and Mobile Work *(moves intermittently or continuously)*	**0**	

Figure 9. ODOT Rating Tool for Positive Protection Use (Image from ODOT Policy Publication)

Texas Department of Transportation Guide for Usage of Positive Protection Devices

The Texas DOT policy defines high speed as "preconstruction speeds that are 50 mph or greater, even if speed is reduced by minute order for construction." The policy also notes that no means of escape includes "worker(s) in or near a project that have no or very few routes to evade an errant vehicle approaching the work area either laterally or longitudinally." Examples include workers adjacent to a vertical obstruction such as a wall, locations with vehicles or materials near the work space that obstruct escape routes, bridge work, or work in a closed lane surrounded by open lanes.

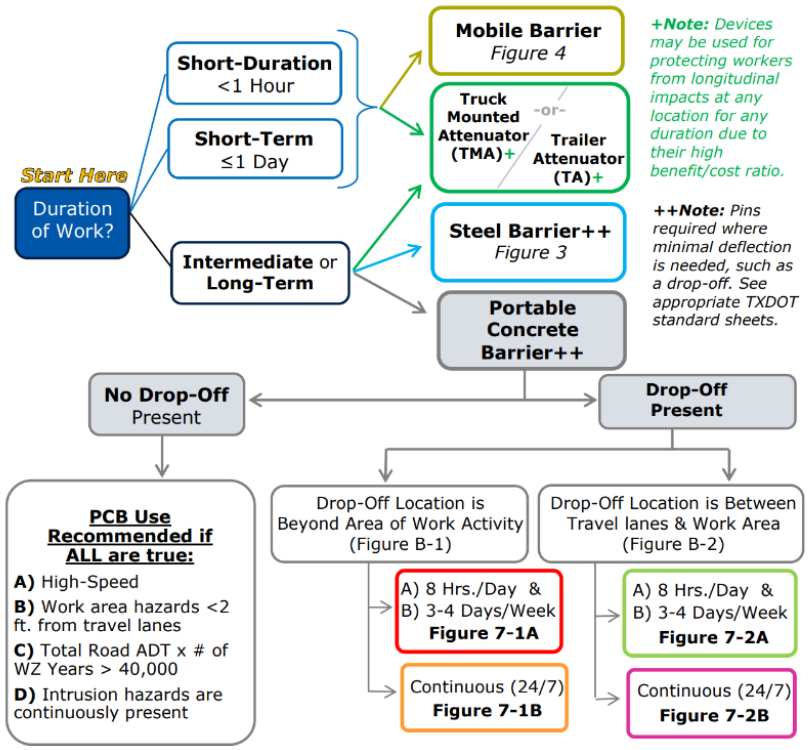

Figure 10. Texas DOT Decision Tool for Positive Protection Use (Image from Texas DOT Work Zone Safety and Mobility Guidelines)

Texas DOT's Work Zone Safety and Mobility Guidelines also include a decision tool for determining use of positive protection devices based on project duration, traffic speeds, and drop-off conditions as shown in Figure 10.

Other Approaches to Assessing the Need for Positive Protection

Agencies may evaluate the costs associated with use and compare the potential benefits when determining whether to use positive protection devices in judgment-based situations, as was used in a Texas Department of Transportation study.[8] The Texas study analyzed the benefits and costs of using portable concrete barrier (PCB) for positive protection in work zones. In addition, the DOT analyzed and developed:

- The benefits and costs associated with the use of moveable and portable barrier technologies that can be more quickly deployed and removed at work sites than traditional PCB.
- The benefits and costs of non-positive protection devices that can be used to improve safety and reduce work zone intrusion events in work zones.
- Implementation guidelines for these various technologies. Agencies may also establish an internal review process to gather input on positive protection policies and needs.

[8] https://library.ctr.utexas.edu/hostedpdfs/tti/0-6163-1.pdf

Examples of Rule Implementation

In addition to the engineering study and policy examples provided, agencies have developed specific definitions for high speed, no means of escape, and project durations that require protective features such as longitudinal barrier or protective vehicles with attenuators. These examples are part of the agency policy updates during the December 31, 2025 implementation timeframe required by the updated Temporary Traffic Control Devices Rule. The information is included below as examples of updated agency policies and guidelines as a result of the amended Rule (in alphabetical order by agency). Note that each policy would require an engineering justification to include a duration threshold, as the updated Rule applies to all project durations.

Georgia Department of Transportation

- High operating speed is defined as posted speeds during construction that are greater than 45 mph.
- An escape route is an unobstructed route by which a worker in a temporary traffic control zone can rapidly move to a safe location.
- Escape area shall be free of physical barriers and significant drop-offs which would prevent a highway worker from safely moving out of the path of an intruding vehicle.
    - For work at night, the escape route should be illuminated.

Illinois Department of Transportation

- For multi-lane highways, protective vehicles with TMAs are required when establishing stationary lane closures and prior to workers in locations where standard stationary lane closure plans are not used.
- For projects on multi-lane highways with high speeds and workers near a traffic lane, temporary longitudinal traffic barrier is required where the normal posted speed limit is 45 mph or greater, the project duration is two weeks or more, and workers are present within one lane width of traffic (except for locations with less than 100 vehicles per hour).
- Mobile operations on two-lane highways require protective vehicles with TMAs.
- For projects lasting more than 24 hours on multi-lane highways, temporary longitudinal traffic barrier is required.
- For projects lasting more than 4 days on two-lane highways, temporary longitudinal traffic barrier is required.
- Locations with no means of escape from motorized traffic are defined based on engineering judgment (e.g., tunnels, bridges, bridge painting, narrow medians, etc.).

Indiana Department of Transportation

- High speed is defined by policy as 50 mph or greater and includes the regulatory speed prior to construction.
- No means of escape is defined as “conditions where workers lack an open and accessible path to retreat from encroaching motorized traffic.
- A comparison table outlines positive protection and mitigation strategies by MUTCD work durations, drop-off depth and duration, lateral buffer distance, and posted speed limit.

- For high-speed locations with drop-off depths greater than 5 inches, temporary traffic barrier is required when occupying a location continuously for 14 days or longer or when workers have no means of escape.
    - For the same situation, when using channelizing devices, protective vehicles with attenuators are required when workers are present.
- On high-speed, high-volume roadways where the lateral buffer is less than 12 feet, use of the mobile barrier may be considered.

Massachusetts Department of Transportation:

- A roadway with a posted speed limit of 50 mph or greater is considered high speed.
- An escape route is an unobstructed, designated path from an active work zone that leads workers to a safer area away from unexpected hazards, such as an errant vehicle entering a work area.
- Areas with no means of escape include:
    - Work that utilizes an aerial lift or similar device that is located within the clear zone on a high speed roadway.
    - Long-term stationary, intermediate-term stationary, and short-term stationary work in 500' or longer tunnels or on 500' or longer bridges, regardless of the length of work area.
    - Other locations based on engineering judgment.

North Carolina Department of Transportation:

- Work zones with a pre-construction posted speed limit of 45 mph of greater are considered to have high anticipated operating speed.
- No means of escape is defined as no unimpeded path exists to escape an errant approaching vehicle. A viable means of escape must be available at all times.

Pennsylvania Department of Transportation

- High operating speed includes confirmed and documented travel speeds equal to or greater than 55 mph.
- An escape path is a clearly identifiable, unobstructed route by which a worker in a temporary traffic control zone can rapidly move to a safe location to avoid being struck by an errant vehicle.
- Areas defined as those with no escape route include tunnels, bridges longer than 250 feet, work along obstructions higher than 36 inches, working in any lift equipment and embankments greater than 1V:4H (vertical to horizontal).
- Pennsylvania DOT policy also references long term projects, work operations that place workers within one lane width of active travel lanes, and consideration of positive protection when evaluating and implementing applicable mitigation measures.

Summary

The FHWA Rule includes information on exposure control and the use of positive protection devices. The Rule notes that, at a minimum, agencies shall use positive protection devices in work zones with high anticipated operating speeds that provide workers with no means of escape from motorized traffic intruding into the work space unless an engineering study determines otherwise. Agencies were required to update policies by December 31, 2025, as a result of the updated Rule and may continue to refine applicable policies and guidelines. Some agencies also have engineering analysis tools and techniques in practice that other agencies may benefit from. The corresponding agencies created these analysis techniques prior to publication of the Rule in 2024 and will likely update the guidance in the future as a result.

In addition to the device examples provided, the transportation agency decision process examples noted in this document include examples such as the **Caltrans** risk-based rating system that evaluates a total score and the **Maryland SHA** standalone policy for use of temporary traffic barrier in work zones. Other approaches include crash cost comparisons and typical positive protection uses based on work type and project duration. Several examples of agency policies for compliance with Subpart K of the Temporary Traffic Control Devices Rule (high-speed, no means of escape, and other requirements for positive protection use) are also included.

This document provides information to assist agencies in consistent interpretation and implementation of the Rule across all transportation agencies that use Federal-aid highway funds. Agencies should ensure that updated policies clearly define high anticipated operating speeds, no means of escape, and engineering study procedures to support consistent application of the Rule.

Resources for Practitioners

The following table outlines resources for use by practitioners, including how the resource supports Rule implementation. Some of the resources provided were developed prior to the 2024 Rule update but continue to contain information that may assist agencies with expanded positive protection consideration and implementation.

Table 2. Summary of Resources for Practitioners

Resource	How the Resource Supports Implementation of the Updated FHWA Rule
Best Practices for Mitigating, Controlling and Minimizing the Effects of Work Zone Intrusions (2024)	Provides practical strategies to reduce work zone intrusions and improve worker protection, helping agencies evaluate when positive protection devices may be appropriate.
Caltrans Memorandum on Work Zone Positive Protection (2023)	Establishes agency policy and decision-making criteria for determining when positive protection should be used on construction projects.
Caltrans Work Zone Positive Protection Determination Fillable Form (2023)	Provides a documented process for evaluating positive protection needs and recording engineering decisions.
Field Guide for the Use and Placement of Shadow Vehicles in Work Zones (2010)	Assists practitioners in selecting and positioning shadow vehicles as an exposure-reduction measure when barrier is not feasible or practical.
Data-Driven Approaches to Improve Work Zone Safety Webinar (2024)	Demonstrates how agencies can use crash, exposure, and operational data to identify locations and activities that may benefit from positive protection.
Expanding Use of Positive Protection for Work Zone Safety (2024)	Discusses benefits, challenges, and implementation considerations associated with expanding the use of positive protection devices in work zones.
Federal Highway Administration Work Zone Positive Protection Resources (Ongoing)	FHWA's central repository for positive protection guidance, research, tools, and implementation resources.
FHWA Work Zone Rule Language (2024)	Contains the regulatory requirements and applicability provisions for temporary traffic control devices and positive protection.

Resource	How the Resource Supports Implementation of the Updated FHWA Rule
Guidance: Use of Work Zone Clear Zones, Buffer Spaces, and Positive Protection Deflection Distances (2017)	Assists practitioners in evaluating barrier placement, clear zone considerations, and deflection requirements when using positive protection devices.
Guidelines for Work Zone Designers: Positive Protection (2009)	Provides design-focused guidance for determining when positive protection should be considered and how it can be incorporated into traffic control plans.
Highway Barriers for Work Zone Safety (2024)	Provides examples of work zone barrier applications and discusses the advantages and limitations of various barrier systems.
Idaho Transportation Department Positive Protection Guidance (2013)	Provides agency-specific procedures and decision-making frameworks for evaluating positive protection needs in work zones.
Illinois DOT Positive Protection Safety Engineering Policy Memorandum (2024)	Documents agency policy and engineering considerations for implementing positive protection. Note that agency engineering justification is required for project duration thresholds.
Implementing the Proven Safety Countermeasures in Work Zones (2024)	Describes FHWA proven safety countermeasures, including positive protection, and provides implementation examples and lessons learned.
Installing and Maintaining Crashworthy Work Zone Traffic Control Devices (2024)	Provides field guidance on selecting, installing, inspecting, and maintaining crashworthy temporary traffic control devices, including barrier systems.
Kansas DOT Proposed Positive Protection Guidance and Synthesis of Work Zone Positive Protection Devices and State of Practice (2015)	Summarizes positive protection practices used by transportation agencies and provides recommendations for implementation.
North Carolina DOT Positive Protection Guidelines (2016)	Provides procedures and decision-making criteria for evaluating positive protection needs during project development and construction.
North Carolina DOT Design Bulletin: Guidelines on the Use of Positive Protection Devices in Work Zones (2018)	Documents agency policy, design considerations, and application guidance for positive protection devices.

Resource	How the Resource Supports Implementation of the Updated FHWA Rule
Original Work Zone Positive Protection Toolbox Publication (2009)	Provides a structured toolbox of engineering, operational, and policy considerations for selecting and implementing positive protection.
Safe System Roadway Design Hierarchy (2024)	Supports application of Safe System principles by prioritizing engineering treatments that reduce crash severity and protect vulnerable road users and workers.
Texas Department of Transportation Work Zone Positive Protection Guidelines (2010)	Provides guidance on selecting, evaluating, and implementing positive protection devices based on project conditions and risk factors.
Texas Department of Transportation Work Zone Safety and Mobility Guidelines (2026)	Assists agencies in integrating safety, mobility, and operational considerations into work zone planning, including evaluation of positive protection needs.
Work Zone Safety Information Clearinghouse (Ongoing)	Comprehensive source of work zone safety publications, training materials, case studies, and technical resources related to positive protection and worker safety.

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