Work Zone Operations Best Practices Guidebook (Third Edition)

Addendum #1

FHWA-HOP-13-012

December 2017

U.S. Department of Transportation

Federal Highway Administration

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Technical Report Documentation Page

1. Report No. FHWA-HOP-13-012	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Work Zone Operations Best Practices Guidebook (Third Edition) Addendum #1		**5. Report Date** December 2017 **6. Performing Organization Code**	
7. Authors Subin Daniel, Mansur Elahi, Erin Flanigan, Katherine Blizzard		**8. Performing Organization Report No.**	
9. Performing Organization Name and Address Daniel Consultants, Inc. 8950 Route 108 East, Suite 229 Columbia, Maryland 21045 Under contract to: Cambridge Systematics, Inc. 3 Bethesda Metro Center, Suite 1200 Bethesda, MD 20814		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH61-12-D-00048, T-14004	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Highway Administration Office of Operations 1200 New Jersey Avenue, SE Washington, D.C. 20590		**13. Type of Report and Period Covered** Best Practices March 2014 to December 2017 **14. Sponsoring Agency Code** HOP	
15. Supplementary Notes Government Task Manager: Todd Peterson, FHWA Office of Operations			
16. Abstract This report contains new entries to the Federal Highway Administration (FHWA) report: "Work Zone Operations Best Practices Guidebook (Third Edition)" (FHWA-HOP-13-012). The new entries are intended to function as a supplement to the Guidebook, however, the code in the upper right-hand corner of each new entry (e.g. "A1-1") uses the organizational scheme from the Third Edition Guidebook to show where the new entry would fit within the Guidebook's structure. Holders of the print version of the Guide are invited to print this document and insert the new Best Practices in the applicable locations in their binder.			
17. Key Words Work zone, best practice, safety, mobility, guidebook, construction, maintenance, road rehabilitation, policy, planning, design, traffic analysis and modeling, construction methods, contracting, traveler and traffic information, traffic management planning, work zone management, worker safety, work zone ITS.		**18. Distribution Statement** No restrictions. This document is available to the public.	
19. Security Classif. (of this report)	**20. Security Classif. (of this page)**	**21. No. of Pages** 50	**22. Price** N/A

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**.

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BEST PRACTICE:

Traffic Control Oversight Committee

DESCRIPTION:

A Traffic Control Oversight Committee is generally responsible for providing agencies with recommendations for improvements to work zone education and safety. For example, the Washington State Traffic Control Oversight Committee is an interagency council that works to promote work zone safety specifically by establishing minimum qualification and training requirements for State traffic control flaggers and traffic control supervisors. The committee also provides recommendations for specific improvements on work zone education and safety to the Washington State Department of Transportation (WSDOT) through the Washington Work Zone Safety Task Force, and communicates information on work zone safety issues and education to interested individuals within the roadway construction and maintenance industry through discussions and outreach.

The committee consists of members from multiple organizations including the WSDOT, the Washington State Labor and Industries Department, the State Board of Technical and Community Colleges, employer and employee representatives, utility companies, the Washington State Association of Counties, the Association of Washington Cities, and flagging instruction and traffic control supervisor providers. The committee meets quarterly to discuss work zone traffic control training and potential safety issues.

REASON(S) FOR ADOPTING:

The committee was established to centralize the administrative oversight of the State's current training certification programs for traffic control flagger and traffic control supervisor to develop consistent work zone safety practices for all road workers.

PRIMARY BENEFIT(S):

Increases consistency for work zone safety certification requirements statewide and communicates the latest information on work zone safety issues and best work zone safety practices to various offices within the State and with external partners.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

All roadways and projects.

STATE(S) WHERE USED:

Oregon, Washington

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Public Relations, Education, and Outreach → State/Contractors/ Workers	B4-7

BEST PRACTICE:

Work Zone Supervisor Certification Training Program

DESCRIPTION:

To ensure compliance with the Federal Highway Administration's (FHWA) Work Zone Safety and Mobility Final Rule, Virginia established a multidisciplinary Work Zone Safety Training Committee (WZSTC) comprised of State representatives. The WZSTC has direct responsibilities for processing, evaluating, and approving the work zone traffic control course material; documenting all students' course training in the VDOT virtual campus; and prescribing work zone traffic control training requirements for State employees and any other persons performing work within the State Highway System right-of-way.

REASON(S) FOR ADOPTING:

Since problematic work zones are often attributed to inexperience or insufficient knowledge of work zone practices, these training programs help establish clear and detailed standards for traffic control supervisors on every project statewide.

PRIMARY BENEFIT(S):

Work zone traffic control training programs help ensure that State employees are compliant with all current State and Federal mandates. These certifications also provide State agencies with confidence knowing that road workers are equipped with accurate and current information that can be applied immediately.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

All roadways statewide.

STATE(S) WHERE USED:

Florida, Maryland, Pennsylvania, Virginia

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Modeling and Impact Analysis → Impact Identification and Mitigation	C2-3

BEST PRACTICE:

Work Zone Mobility Impact Assessment Decision Tree

DESCRIPTION:

The Work Zone Mobility Impact Assessment Decision Tree is a standardized diagram that promotes work zone safety by working to mitigate the effects of road work projects on traffic mobility and to protect road work personnel and motorists within or around the work zone. The diagram initially determines the potential impact a road work project may have on motorist movement through the work zone by inquiring about particular project details relevant to motorist mobility in a few "Yes or No" questions. The decision tree subsequently determines whether a Transportation Management Plan, a Temporary Traffic Control Plan, or no plan should be developed to best mitigate the specific traffic mobility-based safety concerns a road work project may occur.

To facilitate the use of this decision tree, each district or local road authority should develop and implement a general traffic delay restriction policy for their jurisdiction. This policy should include restrictions by time-of-day, day-of-week, and seasonal or special events; and may specify allowed durations or exceptions.

REASON(S) FOR ADOPTING:

To identify potential impacts a project may have on mobility through work zones and to provide guidelines for developing strategies to minimize these impacts.

PRIMARY BENEFIT(S):

The Mobility Impact Assessment Decision Tree simplifies selection of mitigation strategies and helps determine whether a Transportation Management Plan or Temporary Traffic Control plan is to be used based on best practices.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

The Work Zone Impact Assessment Decision Tree can be used for all road projects impacting mobility for more than three days.

STATE(S) WHERE USED:

Maryland, Minnesota, New Jersey

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Project Development and Design → Project Specific Traffic Management Planning	E3-5

BEST PRACTICE:

Internal Traffic Control Plans for Work Zones

DESCRIPTION:

An Internal Traffic Control Plan (ITCP) is a tool that project managers can use to coordinate and control the movement of construction workers, vehicles, and equipment in the activity area. The activity area is the section of the highway where the work activity takes place and is comprised of the work space, traffic space, and the buffer space. ITCPs intend to promote the safety of roadway construction personnel at a road work site by assessing and providing countermeasures for the various hazards within the work zone. Such countermeasures can include signing internal to the activity area; specific protocols for construction vehicle ingress/egress or movement of traffic within the activity area; designation of areas prohibited to workers on foot; and provisions to ensure communication between parties operating within the activity area. ITCPs are typically developed by contractors and should be part of the project's safety plan. It should be prepared after the contract is awarded but prior to the start of construction.

REASON(S) FOR ADOPTING:

The primary motive for the adoption of an ITCP is to reduce and prevent work zone related injuries and fatalities.

PRIMARY BENEFIT(S):

The main benefit of the ITCP is increased worker safety due to better management of worker-equipment interactions in the activity area. Important secondary benefits include enhancing a contractor's ability to communicate protocols for safe movements in the activity area during pre-construction and project safety meetings as well as the possible optimization of efficiency in the activity area. Use of the ITCP in daily safety meetings is necessary to make all project personnel aware of how to perform their jobs safely.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

All types of facilities.

STATE(S) WHERE USED:

Michigan

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Construction Methods	G1-10

BEST PRACTICE:

Portable LED Tower Lighting

DESCRIPTION:

High-efficiency light emitting diode (LED) flood lamps mounted on portable trailers or moving equipment provide improved visibility within nighttime work zones. LED units have significantly reduced power demands, have a longer lifespan, and are more easily configurable to reduce glare for traffic operating adjacent to the work zone. They are cost effective as compared to high intensity discharge lamps, and parts availability for on-site maintenance is improving as distributors are increasingly expanding into LED products. LED tower lights are lightweight relative to incandescent lighting units and can be mounted between 14 and 16 feet high and aimed down directly on the work zone surface area, reducing glare and spillover.

REASON(S) FOR ADOPTING:

LED fixtures offer significant advantages over traditional work zone lighting in terms of ease of use, durability and maintenance requirements, and greater control over lighting quality. Alternative lighting solutions utilizing incandescent fixtures, such as balloon lighting, require high-power ballasts (up to 4000 watts) and fragile metal halide or high pressure sodium bulbs which require special care in transport and setup, and frequent replacement. They also generate significant heat which can be problematic in some construction environments and requires adequate cool-down prior to removal and storage. Additionally, studies have also shown that typical balloon lighting frequently exceeds glare thresholds, which can impede motorist visibility while traveling through a work zone area. Balloon lighting also distributes light in all directions, including places where it is not useful or warranted (e.g., the roadside or sky); LED fixtures provide better control of light distribution by individual luminaires which can improve lighting in the work zone while reducing spillover and glare. LED lamps offer a more cost-effective and practical alternative to these traditional work zone lighting methods.

PRIMARY BENEFIT(S):

Portable LED Tower Lighting can provide a higher quality of work zone lighting for lower cost. LED luminaires also offer greater durability and less susceptibility to inclement weather than traditional incandescent lighting methods.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Portable LED lighting is suitable for most short-term and intermediate-term lane or road closures. Their use is discouraged during long-term closures due to daily setup requirements.

STATE(S) WHERE USED:

Indiana, New Jersey, New York

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-15

BEST PRACTICE:
Non-Redirective Crash Cushion

DESCRIPTION:
Attaching Non-Redirective Crash Cushions—modular narrow water filled crash cushions—to permanent or temporary concrete barriers protects drivers and increases safety for workers in work zones where road workspace is limited. They are intended to reduce the damage to structures, vehicles, and motorists resulting from a motor vehicle collision (for a collision angle between 0^o and 20^o). Non-Redirective Crash Cushions will either capture the impact vehicle or allow it to pass through when hit along its face (called gating), while meeting American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH) TL-3 crashworthiness test and evaluation criteria.

REASON(S) FOR ADOPTING:
Non-Redirective Crash Cushions are used to protect workers and to safely contain an errant vehicle. They are simple, fast and temporary type of installations. These crash cushions are easy to maintain and have low initial cost to deploy.

PRIMARY BENEFIT(S):
Primary benefits include anchorless installation, resistance to cold weather (by adding deicing agents to filled water), quick deployment and recovery after impact, easy maintenance, low initial cost, and ease of use for contractors. Since the system uses uniform modular components, these crash cushions have multiple transition configurations for attachment to a variety of industry standard and proprietary barrier products.

MOST APPLICABLE LOCATION(S)/PROJECT(S):
Non-Redirective Crash Cushions can be used at highway construction zones, city and municipal construction zones, bridge decks, road sides, exits, wide medians, edges of road locations or where other non-redirective or partially redirective systems are often used (especially where road workspace is limited). The designer should verify that a clear run out area with sufficient length is available behind the device.

STATE(S) WHERE USED:
Colorado, Maryland, Ohio, Oregon, Virginia and Washington

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-16

BEST PRACTICE:

Temporary Portable Rumble Strips

DESCRIPTION:

Temporary rumble strips supplement roadside warning devices by causing tactile feedback to drivers through physical variations in the roadway surface. As temporary devices, they may be installed, relocated, or removed relatively easily and without damage to the road surface such as would occur following the removal of permanent rumble strips by grinding or abrasion. Temporary rumble strips afford a method to improve driver awareness in areas with sudden changes in roadway configuration or traffic patterns due to work zones.

REASON(S) FOR ADOPTING:

Temporary portable rumble strips increase driver alertness and they provide advanced warning of changing conditions within the work zones. They are durable, capable of withstanding traffic impacts and weathering elements. As temporary devices they are well suited to work zones.

PRIMARY BENEFIT(S):

The lightweight plastic-based material allows for quick installation and removal. Rumble strips provide audible warning and physical vibration to alert motorists. They help in reduction of crashes with distracted drivers by alerting them to reduce speeds and notice that they are near a work zone.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Portable rumble strips are suitable for locations that have temporary lane closures, changes in alignment, new merge patterns and visual obstructions. These can be used in locations with high crash rates and/or night time work zones.

STATE(S) WHERE USED:

Colorado, Maryland, Ohio, Oregon, Texas, Virginia, Washington

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-17

BEST PRACTICE:

Temporary Detectable Warning Mats

DESCRIPTION:

Temporary detectable warning mats provide a detectable warning for visually challenged pedestrians at points where an accessible path leads into active traffic lanes, such as at the foot of curb ramps at intersections or mid-block crossings. These devices incorporate an array of raised bumps as a tactile clue to aid in the detection of the transition between the sidewalk and the street.

REASON(S) FOR ADOPTING:

Detectable warning surfaces are a component of ADA-compliant accessible routes. Temporary detectable warning mats provide a mechanism to maintain accessible routes during construction, where pedestrian detours or other temporary pedestrian accommodations may be in use.

PRIMARY BENEFIT(S):

Benefits include easy installation, superior durability, re-usability and all weather performance. These mats are generally non-skid, water resistant and crush resistant.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Temporary Detectable Warning Mats are suited for any project where pedestrian accessible routes exist, and especially for maintaining accessibility along temporary pedestrian routes.

STATE(S) WHERE USED:

Maryland, Virginia, Washington

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-18

BEST PRACTICE:

Longitudinal Channelizing Devices in Work Zones

DESCRIPTION:

Longitudinal Channelizing Device (LCD) units are used to channelize vehicular and pedestrian routes in the vicinity of work zones. LCDs help address work zone safety by creating a continuous, physical barrier between the work zone and traffic or between vehicular and pedestrian traffic. The use of LCDs is beneficial at major decision points such as lane closures, exit ramps, driveways, and crossovers. These devices may be used instead of a tapered line of cones, drums, or barricades, which are also commonly used to define a travel path. Typical applications of LCDs include defining travel paths for pedestrians and conforming to the Americans with Disabilities Act (ADA) requirements. LCDs are similar in function to barriers that fall within the category of "positive protection," although positive protection barriers are often better suited to redirecting traffic (as opposed to delineating pathways) than LCDs.

REASON(S) FOR ADOPTING:

Longitudinal Channelizing Devices (LCD) are lightweight, mobile, difficult to knock down, and highly-visible to motorists.

PRIMARY BENEFIT(S):

LCDs help to separate traffic from the work area and can enhance both motorist and construction crew safety. LCDs create a continuous, physical separation between travel lanes or between accessible pedestrian routes and motorized traffic when temporary pedestrian routes are used to facilitate sidewalk closures. Additionally, these devices improve traffic flow by alerting motorists to construction activity ahead and by giving them ample time to react to changes in travel patterns. These devices are used extensively in work zones to warn drivers of work activities on or near the traveled way, to protect workers in the area, and to guide drivers and pedestrians safely through and around the work zone.

These devices provide more path guidance information, especially in continuous line applications, by preventing drivers and pedestrians from going between devices and entering the work zone. LCDs are more resistant to getting knocked over, and thus, may require less maintenance. Their larger size may command more respect from drivers, thereby reinforcing guidance to drivers to avoid encroaching on temporary pedestrian routes. Additional benefits include all weather durability and crush resistance. LCDs are lightweight, deformable devices that are highly visible, have good target value, and can be linked together. Empty barrier sections can be placed by hand without the need for any heavy lifting equipment, thus permitting LCD use where heavy equipment may be impractical or impossible.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

These devices are most applicable in long term work zones where cones, drums, and barricades are inappropriate and continuous separation between motorists and pedestrians is needed.

STATE(S) WHERE USED:

Maryland, Ohio, Virginia

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-19

BEST PRACTICE:

Automated Flagger Assistance Devices

DESCRIPTION:

Automated Flagger Assistance Devices (AFAD) are mechanically operated temporary traffic control devices that function under the same operational principles as traditional flagging. AFADs minimize flaggers' direct exposure to traffic by allowing them to control the device in an area safely away from traffic, such as behind a guardrail. Personnel should still be traditionally trained and available to step in as a manual flagger in case of a technology malfunction or driver intrusion. One type of AFAD recognized by the Manual on Uniform Traffic Control Devices (MUTCD) uses a remotely controlled red and yellow lens with a mechanical gated arm mounted to a portable trailer.

REASON(S) FOR ADOPTING:

AFAD systems increase the safety of construction workers by removing flaggers from the flow of traffic, whereas traditional flagging practices require workers to stand in the road. Additionally, motorist compliance is higher with AFAD systems than it is with traditional, human flaggers and AFAD systems may even reduce labor force requirements over time.

PRIMARY BENEFIT(S):

The primary benefit of AFAD systems is the removal of human flaggers which directly improves worker safety. Driver compliance has also been found to be higher with AFAD systems over human flaggers. AFAD systems may also reduce labor force requirements over time. Ease of installation and operation have also been cited as AFAD system benefits.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

AFAD systems are suitable for most short-term or intermediate-term lane or road closures such as bridge maintenance, haul road crossings, guardrail repair, and pavement patching. Their use is discouraged during long-term closures. When used at night, AFADs must be illuminated in accordance with Section 6E.08 of the MUTCD.

STATE(S) WHERE USED:

Alabama, Florida, Illinois, Kansas, Minnesota, North Carolina, Ohio, Oregon, Virginia, Washington, Wisconsin

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-20

BEST PRACTICE:

Mobile Barrier Systems

DESCRIPTION:

A Mobile Barrier System (MBS) is an all-in-one protection system integrated into a trailer unit configuration, creating a protected space for workers behind a barrier wall on the side of the MBS unit adjacent to traffic. The MBS is designed to be driven into place and put in use while remaining attached to the tractor unit. The MBS may be equipped with crane, hauler, lights, power and air tools, carrying materials, and supplies for workers. A crash attenuator may be integrated into the MBS unit or may be provided on a separate vehicle behind the MBS trailer. Some MBS systems can expand in length once on-site, providing space for longer work zone activity areas where needed.

REASON(S) FOR ADOPTING:

An MBS provides a simplified approach for setup and removal of temporary work zone positive protection in conditions where space is constrained and maximizing traffic capacity is a priority. An MBS also aids constructability, as work zone protection areas are quicker to set up and dismantle which reduces setup/takedown times and increases construction windows. An MBS operator navigates the truck into the work zone area where the MBS trailer itself provides the desired protection against vehicular incursion into work zones. The MBS can thereby facilitate mobile work zones by its ability to move forward slowly as workers advance along the road. When the job is completed, the operator simply pulls away once workers are cleared from the protected area.

PRIMARY BENEFIT(S):

Benefits of an MBS include rapid setup and removal, improved protection to roadway crews, increased productivity, reduced distraction, reduced glare, and more flexibility in lane closure staging for short-term work zones. These systems further protect roadway crews by limiting their exposure during setup and removal times, and may also allow some work activities to be performed closer to live traffic lanes, reducing the number of lanes that need to be closed and improving traffic flow. These potential efficiencies help to reduce costs.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

An MBS is ideally suited to short-term work zones on higher-speed facilities where the work being performed can be contained within the physical dimensions of the mobile barrier, and where rapid deployment and takedown or mobile operations are desirable.

STATE(S) WHERE USED:

California, Colorado, District of Columbia, Texas, Virginia

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-21

BEST PRACTICE:

Glare Screen Systems

DESCRIPTION:

Glare screen systems are vertical blades used to clearly mark both temporary and permanent medians as well as block out headlight glare from oncoming traffic during night time applications. These devices are made of polymeric materials designed to fit into a base rail system positioned on top of median barriers.

REASON(S) FOR ADOPTING:

Glare screens serve as a guiding marker, enhancing visibility of the median and helping to create a clear path of travel for motorists. These devices help reduce traffic jams in work zones by limiting cross-median visibility while providing fast and easy installations.

PRIMARY BENEFIT(S):

The screen systems obscure the view of construction work to reduce rubbernecking. They may be made from recycled materials and are easily mounted to both concrete median barriers and steel guardrail systems. The lightweight plastic materials also serve as a deterrent for pedestrian cross-overs and protect debris from entering the work zone.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Screen systems are typically used in the median of divided highways but may be used in other applications where a specific problem exists or is anticipated. Depending on the State, glare screen use is justified based on traffic volumes and median widths in unlighted sections, and based on traffic volumes and the number of lanes in lighted sections.

STATE(S) WHERE USED:

California, Iowa, Michigan, New Jersey, New York, Ohio, Pennsylvania, Vermont, Virginia

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-22

BEST PRACTICE:

Audible Information Devices

DESCRIPTION:

Audible information devices are designed to maintain accessible pedestrian routes during construction-induced sidewalk closures. Their function is to warn visually impaired pedestrians of upcoming sidewalk closures and will provide detailed navigation instructions for temporary pedestrian route detours. Devices are positioned no more than 100 feet prior to the defined sidewalk closure. As pedestrians approach, they hear a unique locator tone familiar to the visually impaired. Pedestrians may then locate Braille instructions or the push button feature to activate the voice module to hear or read the navigation instructions.

REASON(S) FOR ADOPTING:

Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk or footpath. Where pedestrians who have visual disabilities encounter work sites that require them to cross the roadway to find an accessible route, instructions should be provided using an audible information device. Providing adequate warning for pedestrians with vision and mobility disabilities in urban and suburban work zone locations helps ensure that work zones meet ADA compliance during construction.

PRIMARY BENEFIT(S):

The ADA-compliant devices also help maintain separation between pedestrians and traffic as well as accessibility to businesses, residences, and other facilities while minimizing the length of the temporary route so it is not much longer than the original route.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Audible warning information devices are applicable for temporary traffic control zones in urban areas, however they may also be applied in suburban and rural work zones with existing pedestrian facilities.

STATE(S) WHERE USED:

California, Iowa, Massachusetts, Minnesota, Texas

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-23

BEST PRACTICE:

Sequential Warning Lights for Lane Closures

DESCRIPTION:

Sequential Warning Lights are wireless Light Emitting Diode (LED) lights that flash in a sequence to delineate transition tapers, specifically during nighttime hours. They are designed to improve driver recognition of lane closures by providing clear directional guidance and to enhance the visibility of work zone entrances/exits.

REASON(S) FOR ADOPTING:

These wireless devices are useful for facilitating early merging at night work zones. By encouraging early merging, the work zone has a lower risk of being struck by a vehicle, making the work zone safer for both workers and drivers.

PRIMARY BENEFIT(S):

The benefits of Sequential Warning Lights include an increase in early merging and greater visibility of work zones at night.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Work zones that are active at night and that involve a lane closure, lane shift, or other traffic pattern change are the most applicable locations for Sequential Warning Lights.

STATE(S) WHERE USED:

California, Indiana, Iowa, Kentucky, Massachusetts, Missouri, New York, Ohio

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-24

BEST PRACTICE:

Direction Indicator Barricades (DIB)

DESCRIPTION:

A DIB displays an arrow with conventional diagonal reflective stripes in a single barricade unit. DIBs are placed in a series along a roadway to visually direct motorists through a transition taper into an adjacent lane. These devices can also be reversed to allow for inside and outside applications. To avoid the risk of flying debris from the barricade, DIBs fall flat and remain down when they are struck.

REASON(S) FOR ADOPTING:

These barricades provide better clarity for drivers when a lane is closed, ensuring the drivers know what changes have been made to the traffic pattern from a greater distance.

PRIMARY BENEFIT(S):

Direction Indicator Barricades are very simple to install and remove. They provide clear channelization for drivers, reducing confusion over new traffic patterns.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Work zones that require changes to the standard traffic pattern are the most applicable locations for DIBs. DIBs are often used to accompany the tapered merge areas of work zones requiring a lane closure. The simple installation and removal makes them ideal for short-term work zones. DIBs should be crash tested as longitudinal channelizers per the AASHTO Manual for Assessing Safety Hardware.

STATE(S) WHERE USED:

Colorado, Florida, Illinois, Kansas, Minnesota, Missouri, Texas, Virginia, Wisconsin

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Traffic Control	G4-25

BEST PRACTICE:

Detectable Pedestrian Barricades

DESCRIPTION:

Detectable Pedestrian Barricades are lightweight interlocking devices that are designed for temporary use in work zones to provide separation between work zone activity areas and accessible pedestrian routes adjacent to the activity area. They may also be used for delineating accessible pedestrian detour routes. They are compliant with ADA (Americans with Disabilities Act) requirements; they are approximately waist height and have no protrusions or other tripping hazards on the exterior side, they have continuous guides along the base compatible with cane users, and also provide a smooth continuous hand rail near the top surface.

REASON(S) FOR ADOPTING:

These barricades are useful for guiding pedestrians around work zones, ensuring they will not accidentally walk into a restricted or unsafe area. Accommodating pedestrian routes around work zones can involve complex phasing which is facilitated by temporary barricades that are easily relocated for different project stages.

PRIMARY BENEFIT(S):

Detectable Pedestrian Barricades are specially designed to be detectable even by visually impaired pedestrians using canes to assist navigation, ensuring they remain safe when walking near work zones. They are also sturdy enough to be bumped into by pedestrians without falling over or allowing the pedestrian to accidentally enter the work zone.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Work zones that are adjacent to or within areas frequented by pedestrians, such as sidewalks, are the most applicable locations for these barricades. Locations with little to no pedestrian traffic may be better served with a different type of barricade.

STATE(S) WHERE USED:

California, Delaware, Florida, Minnesota, Missouri, New York, North Carolina, Ohio, Texas

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Worker Safety/Productivity	G5-6

BEST PRACTICE:

Work Zone Intrusion Alarms

DESCRIPTION:

Work zone intrusion alarms are impact-activated safety devices that warn work zone personnel of errant vehicles entering a protected work zone area. There are four main types of intrusion alarms: microwave, infrared, pneumatic tubes, and kinematic. Microwave and infrared models are mounted on traffic drums or cones and use microwave signals or beams of infrared light to connect units. When a vehicle crosses into the work zone and interrupts the signal or beams, a high-pitched alarm is sounded near the workers. The pneumatic tube model is placed on the ground, with the tubes laid perpendicular to traffic. When a vehicle drives into the area and over the tubes, the alarm sounds. The kinematic models are mounted on a traffic cone (or other similar hardware) and sound the alarm when a change in the orientation angle of the cone indicates that it has been tipped over. This system assumes an errant vehicle has knocked over the hardware and has entered the work area.

Additional alert mechanics from commercially available products include flashing lights, strobe lights, and personal safety devices. Personal safety devices are meant to be attached to a worker's clothing. When the alarm has been tripped, these devices can wirelessly notify the worker via vibration and/or through a head set. These devices do not require any electrical power and have been accepted as Federal Highway Administration National Cooperative Highway Research Program Report 350 Category II work zone traffic control devices.

REASON(S) FOR ADOPTING:

The primary motive for the adoption of these alarms is to reduce potential work zone collisions and injuries resulting from errant vehicles.

PRIMARY BENEFIT(S):

Intrusion alarms do not require electrical power to function, allowing faster mobile setups and the audible/visual alarms provide workers additional time so that they can react in order to avoid potential collisions.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

These devices are most applicable in any work zone where sight distance and worker visibility is limited.

STATE(S) WHERE USED:

Iowa, Kansas, Maryland, Minnesota, Montana, Ohio, Oregon, Pennsylvania, Washington

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Construction/Maintenance Materials, Methods, Practices, and Specifications → Worker Safety/Productivity	G5-7

BEST PRACTICE:

Construction Vehicle Blind Spot Warning Systems

DESCRIPTION:

Construction vehicle blind spot warning systems consist of sensors and video cameras mounted on the back of construction vehicles and are designed to detect and view obstacles in the operator's blind spot that would otherwise require a guide outside of the vehicle to avoid. These sensors may use radar or ultrasound to detect objects and relay the range to the operator. The sensors detect both moving and stationary objects in a pre-defined coverage area and can report the distance of the closest object via visual range indicators (display) and an audible signal (display or buzzer) to the vehicle operator.

REASON(S) FOR ADOPTING:

The primary motive for the adoption of these systems is to reduce the number of workers struck by construction equipment during backing operations due to blind spots.

PRIMARY BENEFIT(S):

The cameras in these systems provide an actual view of the blind area near the truck and allow a method for the operator to check the source of any alarms. At the same time, the radar sensors in these systems will prompt the operator to check the video monitor so that the potential for a collision does not go unnoticed.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

These systems are applicable for all types of highway work zones involving large mining and hauling equipment that produce blind spots for vehicle operators.

STATE(S) WHERE USED:

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Traveler and Traffic Information → Traffic Information Management	H2-5

BEST PRACTICE:

Work Zone Performance Monitoring (WZPM) Tool

DESCRIPTION:

The Maryland State Highway Administration (SHA) and the University of Maryland Center for Advanced Transportation Technology Laboratory (CATT Lab) developed a real-time performance monitoring tool known as the Work Zone Performance Monitoring (WZPM) tool within the Regional Integrated Transportation Information System (RITIS) platform. The tool aggregates work zone information from many sources, including the SHA Coordinated Highway Action Response Team (CHART) system, and determines a user delay cost based on measured average daily traffic (ADT), speed reduction factors, heavy truck percentages and delays developed from the RITIS live feeds. This tool helps measure work zone performance and validates incremental changes made to work zone practices.

REASON(S) FOR ADOPTING:

This system is useful for real-time monitoring of work zone performance and can also be used for higher-level review of work zone management policy or practice. It can also be used to verify that new policies or practices are effective in reducing congestion around work zones. The use of this system can be used to meet the requirements in the Final Rule on Work Zone Safety and Mobility for data driven management of work zone impacts. Additionally, the results of this system provide tools for discussion between agencies and the public.

PRIMARY BENEFIT(S):

The benefits of the WZPM tool include quantifiable information about work zone impacts on traffic and the tools to identify problematic aspects of work zones.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Work Zone Performance Monitoring can be used on any highway work zone that could impact traffic flow, though it is most useful for projects that generate congestion delays big enough to be picked up by probe data used by the live data feed.

STATE(S) WHERE USED:

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Enforcement → Organizational Strategy	I1-5

BEST PRACTICE:

Automated Speed Enforcement Programs

DESCRIPTION:

Automated Speed Enforcement (ASE) systems—consisting of speed-activated photo radar devices—are used to enhance enforcement of speed limits. ASE systems typically include advisory signage that is placed well before the speed camera installation, indicates that ASE systems are in use, specifies the posted speed limit in effect through the work zone, and displays speed feedback informing drivers of their measured speed as they approach the enforcement area. Drivers who exceed the posted speed limit by a certain amount are then issued citations in the mail. Temporary ASE systems in work zones function similarly to permanent ASE systems that jurisdictions often install near schools or roads with high crash or fatality rates. Important differences include the permanence of the equipment and, in most cases, the requirement that vehicle mounted work zone ASE systems be continuously manned during operation.

ASE programs that extend the use of ASE systems in work zones throughout a jurisdiction further enhance the benefits of ASE systems, further increasing driver awareness, driver compliance, and safety for both drivers and workers. An illustrative example of an ASE program is the Maryland SafeZones ASE program. The program was piloted from October 2009 to spring 2010 through a collaboration among the Maryland State Highway Administration, the Maryland Transportation Authority, and the Maryland State Police. The long-term program began July 2010. Maryland SafeZones mobile enforcement vehicles rotate among eligible work zones throughout the State. The program issues warnings to violators for the first three weeks of long-term work zones and after that begins issuing citations. For short-term work zones, warnings are not issued but advisory signage is implemented three weeks in advance to notify drivers of the incoming ASE set-up. In Maryland, ASE systems in work zones fine drivers exceeding the speed limit by 12 miles per hour (mph) or more in work zones along controlled access roadways with a 45 mph or higher speed limit; the fine is $40 with no points assessed against the violator's license (Maryland SafeZones Facts, http://www.safezones.maryland.gov/mdsafezones.html).

REASON(S) FOR ADOPTING:

Maryland found that four out of five crash-related injuries in work zones are suffered by motorists. An ASE program, therefore, was adopted to slow drivers down in work zones, making work zones safer for drivers, passengers, and workers. The implementation of a long-term ASE program also extends and enhances the benefits of using individual ASE systems in work zones on a more ad hoc basis.

PRIMARY BENEFIT(S):

Implementations of long-term ASE programs for work zones significantly increase compliance with posted speed limits and, in turn, increase safety for drivers, passengers, and workers by decreasing the number of work zone crash-related injuries and fatalities. In Maryland, the long-term deployment of the SafeZones ASE program

has resulted in an 80 percent reduction in speeding violations, while work zone related crash injuries and fatalities are at their lowest in more than a decade (Maryland SafeZones – Automated Speed Enforcement in Work Zones, http://www.safezones.maryland.gov/).

MOST APPLICABLE LOCATION(S)/PROJECT(S):

ASE programs and systems are most applicable in long-term work zones on expressways or controlled access highways (speed limit of 45 mph or higher) in situations where workers are exposed or there are motorist hazards and where there are no significant obstructions to the line of sight for the speed camera.

STATE(S) WHERE USED:

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Enforcement → Speed Management	I2-3

BEST PRACTICE:

Automated Speed Enforcement Systems

DESCRIPTION:

Automated Speed Enforcement (ASE) systems are used to enhance enforcement of work zone speed limits. ASE systems consist of speed-activated photo radar devices that capture the image of license plates for vehicles exceeding the speed limit. Violators are identified in coordination with the State motor vehicle division, based on vehicle ownership and a quality review of radar/photo data. This information is then used to process citations which are issued to drivers through the mail.

ASE systems typically include advisory signage that is placed well before the speed camera installation, clearly indicates that ASE systems are in use, specifies the posted speed limit in effect through the work zone, and frequently incorporates the speed feedback display function informing drivers of their measured speed as they approach the enforcement area.

ASE systems in work zones function similarly to permanent speed camera installations used in many jurisdictions to enforce speed limits through automatic citations. These permanent setups are unmanned and often installed near schools or roads with high crash or fatality rates. Important differences include the permanence of the equipment and, in most cases, the requirement that vehicle mounted work zone ASE systems be continuously manned during operation. Additionally, the permanent installations are often used in lower speed settings, while the work zone ASE systems are only recommended for roadways with a posted speed limit of 45 miles per hour (mph) or higher.

REASON(S) FOR ADOPTING:

Work zones can be a challenging environment for enforcement of posted speeds due to greater physical constraints including narrowed lanes and shoulders, and physical barriers preventing safe areas for law enforcement vehicles to dwell or to pull over violators. Enforcement is greatly enhanced by the ability to identify and cite speeders without a physical traffic stop. Use of ASE systems is especially beneficial at work zones in high-speed areas where speed limit compliance is desired but where traditional traffic stops are operationally challenging.

PRIMARY BENEFIT(S):

ASE systems offer the dual benefit of capturing driver attention as well as encouraging compliance with posted speed limits as they enter the work zone, enhancing both motorist and construction crew safety. These systems have been shown to significantly reduce the number of drivers exceeding the posted speed limit, the number of crashes in the work zone, and the number of injuries and fatalities due to crashes in the work zone. Implementations of an ASE program have resulted in a significant increase in

compliance with work zone speed limits and corresponding improvements in work zone safety. In Maryland, long-term deployment of ASE systems has resulted in an 80 percent reduction in speeding violations, while work-zone fatalities have dropped by half in the three years since the Maryland program's inception.

While there has been occasional public backlash against the use of speed cameras in some locations, the use of ASE systems in work zones is widely supported by the agencies that use them. Overall, these systems have proven to be very effective at obtaining voluntary compliance to the speed limits from most drivers.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

These systems are most applicable in long-term work zones on expressways or controlled access highways (speed limit of 45 mph or higher) in situations where high compliance with posted speeds is desired but geometric constraints prevent speed enforcement by a live law enforcement presence.

STATE(S) WHERE USED:

Maryland, Illinois, Washington

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ITS and Innovative Technology → Traffic Monitoring and Management	J1-5

BEST PRACTICE:

Variable Speed Limits

DESCRIPTION:

Variable Speed Limit (VSL) systems in work zones typically consists of sensors, Portable Changeable Message Signs (PCMS), and a processing system that calculates prevailing speeds for traffic in and approaching the work zone. As congestion begins to form, measured downstream speeds are used to determine desirable posted speed limits upstream, resulting in smoother transition from "free flow" speeds further upstream to lower speeds in the vicinity of the work zone. Supplementary notification of the reduced speed limits can be provided further upstream via PCMS units. Variable speed limits may be advisory or regulatory depending on agency preference, enabling legislation, and the availability of a mechanism for enforcement.

REASON(S) FOR ADOPTING:

VSL systems can help reduce speed variation through work zones. They can also help reduce speeds when workers are present, work activity near travel lanes has increased, or weather conditions are unfavorable. Visible enforcement of the speed limit may also be necessary in order for drivers to realize that speed limit signs are credible and are to be obeyed.

PRIMARY BENEFIT(S):

When a VSL system is deployed far enough ahead of the work zone, it can reduce the number of crashes that could occur as drivers approach the back of the queue. Another benefit of VSL systems is to reduce congestion and ease traffic through a work zone depending on current conditions.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

VSL systems should be considered for deployment in situations where frequent lane closures are expected, where frequent work activities are occurring and lower, temporary speed limits would be beneficial, and where traffic speeds vary widely throughout the length of the project. In general, these systems are most suitable for longer length, long-term work zones.

STATE(S) WHERE USED:

Michigan, New Hampshire, Ohio, Utah, Virginia, Washington

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ITS and Innovative Technology → Traffic Monitoring and Management	J1-6

BEST PRACTICE:

Queue Warning Systems

DESCRIPTION:

Queue Warning Systems are used to warn motorists approaching congested work zones, predictable bottlenecks, or areas with sight distance limitations of an impending stop or slow down of traffic. Queue Warning Systems typically consist of roadside sensors downstream of Portable Changeable Message Signs (PCMS). When stopped or slowing vehicles are detected by the sensors, warning messages are displayed on the upstream PCMS alerting motorists of the impending traffic conditions.

REASON(S) FOR ADOPTING:

The purpose of implementing Queue Warning Systems is to reduce the number and severity of rear end crashes at these locations.

PRIMARY BENEFIT(S):

Queue Warning Systems can help reduce primary and secondary incidents by alerting drivers to congested conditions. Furthermore, the incident severity is reduced because drivers are prepared for impending congestion. Queue Warning Systems can also help delay the onset of congested conditions. With more uniform speeds, traffic flows more efficiently. This allows higher traffic volumes to pass by the work zone and improves trip travel time reliability. Finally, data collected from the sensors can be used in traffic analyses or after action reviews.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

Queue Warning Systems are suitable upstream of work zones along frequently congested freeways, facilities with frequent queues in predictable locations, and facilities with sight distance restricted by vertical grades, horizontal curves or poor nighttime illumination.

STATE(S) WHERE USED:

California, Illinois, Michigan, Oregon, Pennsylvania, Texas, Virginia, Washington, Wisconsin

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Evaluation and Feedback → Data Collection/Analysis	K1-4

BEST PRACTICE:

Work Zone Intrusion Reporting

DESCRIPTION:

The Minnesota Department of Transportation (MnDOT) initiated an independent study to learn more about best practices for reporting and documenting vehicle intrusions into the work space of a work zone including "near misses" that do not result in crashes. To support this effort, a survey of State departments of transportation (DOT) was conducted to learn about peer practices for work zone intrusion data collection. This survey was supplemented by follow-up interviews with survey respondents and a literature review that gathered information on work zone data collection practices.

REASON(S) FOR ADOPTING:

The purpose of the study was to determine what data other States collect about vehicle intrusions and what technologies are used in gathering and reporting the data.

PRIMARY BENEFIT(S):

From the three States that responded, MnDOT found that work zone intrusion data was typically collected via electronic PDF forms (Minnesota Department of Transportation, Transportation Research Synthesis, "Work Zone Intrusion Reporting: A Survey of State Practices," published June 2015, http://www.dot.state.mn.us/research/TS/2015/TRS1506.pdf). The information collected included incident location, diagrams, accident history, and resulting actions. The survey information offers helpful insights for other States that are considering collecting, reporting, and documenting data on vehicle intrusions into work zones.

MOST APPLICABLE LOCATION(S)/PROJECT(S):

All work zone related projects.

STATE(S) WHERE USED:

Iowa, Minnesota, North Dakota, Pennsylvania

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FHWA-HOP-13-012 December 2017