Guidelines

on Ensuring Positive Guidance in Work Zones

This document describes challenges and countermeasures in the provision of positive guidance for motorists in a work zone. The document presents recommended practices and effective strategies and techniques that can be used during the planning and construction phases to ensure positive guidance.

This document is organized into the following sections:

- Background
- Challenges and Techniques to Improve Positive Guidance
  - Signing
  - Arrow Boards
  - Pavement Markings
  - Channelizing Devices
- Examples of Good Agency Processes for Ensuring the Provision of Positive Guidance
  - Maryland State Highway Administration
  - Virginia Department of Transportation

Refer to http://www.workzonesafety.org for a copy of this document.

Guidelines on Ensuring Positive Guidance in Work Zones

Background

Motorists, bicyclists, and pedestrians should be directed in a clear and positive manner while approaching and traveling through work zones. The process by which this is accomplished is termed positive guidance. Positive guidance ensures that a driver is able to detect a hazard in a roadway environment that may be visually cluttered, recognize its threat potential, select an appropriate speed and path, and complete the required maneuver safely. Positive guidance principles ensure that information needed by travelers to negotiate safely through a work zone is provided:

- at locations where it is needed;
- in a format that is easily understood and is unambiguous; and
- at a rate that motorists can safely process and use.

The national *Manual on Uniform Traffic Control Devices* (MUTCD) contains standards and guidance on the design and application of signs, channelizing device, and other traffic control devices that effectively guide travelers in and through a number of "typical" work zones. The devices and their proper applications in the MUTCD's typical applications are based on positive guidance. The typical applications found in the MUTCD are an important first step in making sure that traveler positive guidance needs are met at a work zone. However, some work zones present unique safety challenges and require additional information or adjustments to the type and location of information required in the MUTCD in order to enhance the guidance provided to travelers. Federal regulations (23 CFR 630 Subpart K) encourage state agencies to consider the use of enhanced traffic control measures where added emphasis is desirable in order to reduce work zone crashes. Subpart K identifies a number of traffic control measures that agencies should examine when striving to create a work zone that is as safe as possible for both travelers and workers. Several of these measures pertain specifically to devices used to ensure that travelers have good positive guidance through the work zone. The following measures all contribute, when applied properly, to good positive guidance through the work zone:

- effective, credible signing;
- proper use of arrow panels;
- use of warning flags and lights on signs;
- high quality work zone pavement markings and removal of misleading markings;
- reduction of channelizing device spacing; and
- use of longitudinal channelizing barricades.

Failure to meet positive guidance principles leads to traveler confusion and can increase crashes within the work zone.

To apply positive guidance principles to maximize work zone safety, traffic control designers, technicians, and supervisors should consider these four questions once the work zone traffic control has been designed according to the MUTCD or implemented in the field:

1. Have all driver and pedestrian information needs been met to allow them to navigate safely through the work zone?
2. Is the information provided to drivers and pedestrians standardized (or consistent) throughout the work zone so that it meets their expectations?
3. Has critical information been spread out through the approach and work area so that drivers and pedestrians are not overloaded at any given time?
4. Are all hazards in the work zone identified so that they are visible, and therefore avoidable, for drivers and pedestrians?

In the sections that follow, a number of challenges to providing positive guidance in work zones are identified along with techniques available to mitigate those challenges.

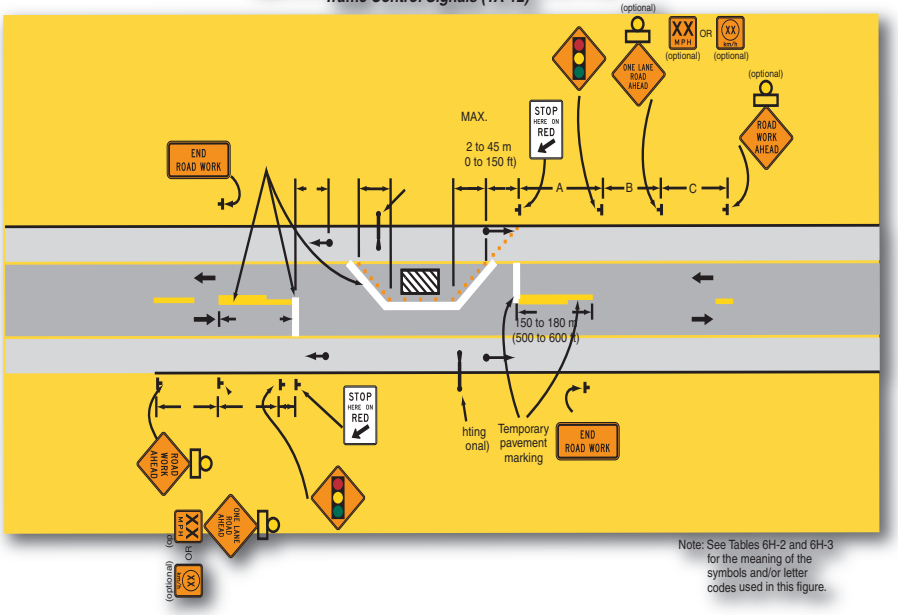
Challenges and Techniques to Improve Positive Guidance

SIGNING

Correct design and use of warning and other signs (including portable changeable message signs) are important in maintaining safe and efficient traffic movement through a work zone. The basic requirements for work zone signing are found in the national MUTCD for a variety of typical applications. (See example TA at right.) However, many work zones require additional signing and/or the blending of signing from two or more typical applications in order to meet fully the positive guidance needs of travelers approaching and passing through the work zone.

There are a number of challenges in the proper selection and positioning of work zone signing so as to maintain positive guidance. Examples of some of the major challenges are described below.

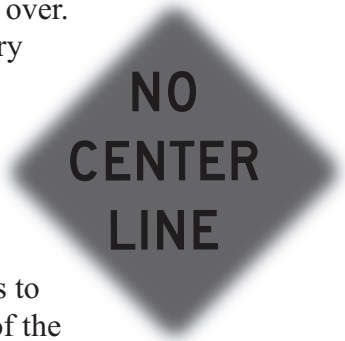
Figure 6H-12. Lane Closure on Two-Lane Road Using Traffic Control Signals (TA-12)



Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

Leaving Signs in Place When Work Zone Conditions No Longer Warrant

One of the more common situations where positive guidance principles are violated is in leaving signs up or uncovered when they are no longer needed. An example of this is when a work crew stops for the day but the traffic control signing for that operation (e.g., Flagger Ahead, Left or Right Lane Closed Ahead, etc.) is left in place. In some states, temporary reduced work zone speed limits are established when workers are present, and may be incorrectly left up when the work shift is over. This situation also often occurs when signing for a temporary hazard (e.g., Bumps, Grooved Pavement, or No Center Line) remains installed after that condition no longer applies. Each of these situations reduces driver confidence that the signs are presenting accurate information, and thus reduces the overall credibility of the temporary traffic control system.



A drive-through site inspection at the end of each work shift is one of the easiest ways to reduce the frequency of this type of positive guidance violation. A quick assessment of the appropriateness of each sign should be made. For certain signs initially installed throughout the work zone on long-term supports, (e.g., No Center Line or Grooved Pavement signs), it may be possible to cover some when work has already been completed and the specified hazard no longer exists.

Installing Work Zone Signs Too Close to Other Signs

As previously noted, the signs and their layout shown on the various typical applications in the national MUTCD are based on application of positive guidance principles to warn and guide motorists safely past a particular work zone situation. It is important to recognize that these applications were developed without consideration of any other signing or information sources existing at a work zone location. For many work zones, the existing signing on the roadway is limited and so its interaction with the temporary traffic control is negligible. In other work zones, however, the interaction between temporary traffic control signing and the signs (temporary/permanent) already present can create confusion and/or overload drivers.

The most common situation where such interactions occur is when work zone signs are placed adjacent to or immediately upstream or downstream from static signs (either overhead or side-mounted). If static signs are mounted on the roadside, temporary work zone signing placed too close in front of or behind the existing sign will obscure one or more other signs. As a result, operational and safety problems can then occur. Depending on the amount of existing sign information already present at a location, the addition of a temporary traffic control sign can exceed driver information processing capabilities at that point, and can result in drivers missing key information from one of the signs. Drivers may slow down dramatically to allow additional time to read the signs (which creates speed differentials among vehicles) or fail to take appropriate driving actions because they missed key information or were confused as to the correct action to take.

Another situation where sign interactions may occur is at work zones where multiple typical applications from the national MUTCD are applied. An example would be a work zone with a long-term lane closure that requires an additional temporary short-term lane closure nearby during work activities. If the appropriate typical application for each closure is implemented in isolation, two work zone signs may be installed adjacent or very close to each other. Again, signs placed so close together can create confusion and/or driver overload.

Both types of signing challenges can be avoided by striving to maintain sufficient distances between all signs (both existing and temporary traffic control) that are located in the work zone to allow adequate information processing time for drivers. When considering the spacing between signs, the sequence of messages that end up being deployed in the field should be reviewed to ensure that an incorrect message is not implied to drivers. As shown in the photo, a Left Lane Closed sign for a downstream temporary lane closure that is positioned just upstream of an End Road Work sign for an upstream work zone could be incorrectly interpreted as a very short work zone.

Using Work Zone Signs That Are No Longer Legible (Especially at Night)

A third challenge to signing as positive guidance is the use of signs beyond their useful service lives. Unlike permanently-installed highway signs, work zone signs are often subjected to fairly harsh conditions, especially if they are used repeatedly. Storage and retrieval techniques such as throwing signs on the top of one another can put significant wear and tear on a sign, particularly the sheeting material. Cuts, tears, and stains on the sheeting can make the symbol or text illegible from required reading distances.

Further, damage to the sheeting material can destroy its retroreflective properties, which are essential for legibility under nighttime viewing conditions.

Federal regulations (23 CFR 630.1110) require agencies to develop and implement quality guidelines to help maintain the quality and adequacy of the temporary traffic control devices for the duration of the project. The national MUTCD also requires agencies to maintain signs, including work zone signs that will be in place during nighttime hours, at minimum levels of retroreflectivity. Finally, work zone conditions often stir up dirt and road grime that quickly accumulate on a sign face, reducing retroreflectivity and legibility below acceptable levels.

Challenges in maintaining work zone sign legibility can best be met by employing one or more of the sign management methods outlined in Section 2A.08 of the MUTCD. Regular visual nighttime inspections of work zones is a common way many agencies ensure that signs are adequately legible and retoreflective, although inspectors may need to be trained as to the proper levels of retroreflectivity that are required. Sign retroreflectivity can actually be measured in the field, but specialized equipment and personnel trained in its use

are required. Agencies can also establish blanket sign replacement policies based on experience or other data. Other criteria, such as the use of the *Quality Guidelines for Work Zone Traffic Control Devices* prepared by the American Traffic Safety Services Association (ATSSA) can also be used to assess sign and channelizing device acceptability in the field.

Regardless of the method used, it may be necessary to clean signs on a regular basis to remove dirt and grime. Agencies can identify the need for sign cleaning based on visual inspections or can establish a set cleaning interval based on experience.

Critical Work Zone Signs Not Attracting Sufficient Driver Attention

The extensive amount of utility, maintenance, and construction activity on roads in most regions means that travelers see many work zone signs. Over time, travelers can become desensitized to work zone signing and miss key information. Warning flags or lights are used on signs to increase the conspicuity of the sign and thereby raise driver awareness of important information. Warning lights are also sometimes used on channelizing devices and barricades to call additional attention to them during nighttime hours. Increasing the conspicuity of work zone signs by flags or flashing lights reduces the likelihood that the signs will be overlooked by drivers. This can be especially important in both high and low driver workload environments. Flags and warning lights both draw attention through the sense of movement that is detected visually and attracts the driver's attention.

One concern with the use of flags or flashing lights is that they can be overused within a work area (i.e., used for non-critical information). Also, the implementation of these devices increase the maintenance requirements in that periodically the lights must be checked and flags replaced when tattered and/or faded. Care should be taken to use warning flags and signs only when necessary to increase driver awareness of highly critical warning information that, if missed, could significantly reduce safety at that location. To manage usage, some agencies will allow or require warning lights or flags on the first sign encountered when entering a work zone, and not use them on the remaining signs in the work zone. The intent of this practice is to maximize the probability that motorists observe the first sign, recognize that they are entering a work zone, and pay additional attention to the work zone signs that follow to warn of hazards and guide them through the work zone.

In summary, positive guidance can be compromised in several ways with work zone signing. Table 1 on page 6 provides a quick guide to the challenges and possible countermeasures available to ensure that traveler positive guidance needs continue to be met over the duration of a work zone.

Table 1. Ensuring Work Zone Signing Is Providing Positive Guidance

Challenges	Countermeasures
Leaving signs in place when work zone conditions no longer warrant them	• Drive through inspections to verify sign need • Cover unneeded signs until they can be removed
Installing work zone signs too close to other signs	• Verify that each work zone sign is sufficiently spaced away from other signs • Adjust sign location to avoid unintended sequences for adjoining work zones
Using work zone signs that are no longer legible (especially at night)	• Periodically inspect sign legibility under daytime and nighttime conditions • Establish other sign performance management methods as needed • Clean signs to maintain retroreflectivity and legibility when needed
Critical work zone signs not attracting sufficient driver attention	• Use flags and warning lights attached to critical signs

ARROW BOARDS

When properly used and adequately maintained, arrow boards provide clear positive guidance information that a lane is closed in a work zone. The national MUTCD requires arrow boards for lane closures on high-speed multilane roadways and allows optional use at several other types of lane closures. Arrow boards are also required for mobile operations in travel lanes on multi-lane roads. For lane closures on a two-lane highway or when the work zone is located on a shoulder, the arrow display is not to be used when lanes are shifted but not closed. However, a four-corner caution or dancing diamond display can be used for those situations.

Although the arrow board can significantly enhance positive guidance at a work zone, there are challenging situations and conditions where an arrow board can actually confuse drivers and thus detract from positive guidance goals. Several of these situations, and methods to counter them, are provided below.

Arrow Display Not Legible

The national MUTCD allows an arrow board to display a flashing arrow, sequential arrow, or sequential chevron to indicate that a lane is closed to traffic (a flashing double arrow can be used on mobile operations or at lane splits to tell drivers to merge left or right). Many arrow boards use a set number of pixels to create these arrows/chevrons. Although an arrow board is readily legible and recognizable from a significant distance when all pixels are performing properly, the loss of a few critical pixels can seriously reduce legibility.

Repair of malfunctioning pixels is the obvious countermeasure to address this type of positive guidance challenge. Arrow boards should be visually inspected from a significant distance upstream because pixels can sometimes shake out of alignment and appear to be lit up close but not be visible at a distance. Regular visual inspections during different times of the day can also identify whether orientation of the arrow board relative to the sun causes a "washout" condition at certain times and obscures the arrow display. If this occurs, the board should be moved to a different location or replaced with one that has a higher luminance output (the layout of the lane closure taper would obviously have to be moved as well if the arrow board must be moved).

Positioning Arrow Boards Too Far into the Lane Closure

The arrow board is to be placed on the shoulder at the beginning of the merging taper. If a shoulder is not available, however, the board can be placed in the closed lane behind the channelizing devices. Care must be taken not to allow the arrow board to be placed too far downstream in the closed lane, however, as this can violate a driver's expectancy for the merging taper to be located at or just beyond the location of the board.

Arrow Board Placement Where Sight Distance Is Limited

In addition to issues with the board itself or with sunlight glare, arrow board visibility and legibility can be compromised if the board is located just beyond the crest of a hill. The objective of lane closure taper and arrow board placement is to ensure enough visibility to provide decision sight distance. At normal highway speeds (i.e., 55 to 70 mph), the arrow boards should be positioned so that they are visible from at least 900 and 1,500 feet upstream. Further, arrow boards are to be designed so that they are legible from ½ mile, or 2,640 feet, away.

Cross-street overpasses, pedestrian bridges, and overhead sign structures can also obstruct visibility of the arrow board. In most cases, this issue can be solved by simply extending the lane closure upstream to the top of the hill or before the features that are causing the sight obstruction. On urban freeway sections that are depressed below grade through downtown areas, this may mean extending the lane closure upstream several hundred feet until adequate sight distance to the arrow board can be obtained.

Sight distance to arrow boards can also be restricted by horizontal curves and should be relocated when such sight distance restrictions are present. However, even when adequate sight distance is available, placing arrow boards on horizontal curves creates additional positive guidance challenges to motorists because the curvature of the roadway makes it difficult for motorists to interpret easily if it is their lane that is being closed (since it does not align with their current vehicle direction). As with other arrow board challenges, moving the lane closure taper and the arrow board to a tangent section will provide more positive guidance for the driver.

Positioning Arrow Boards at Exit or Entrance Ramps

Locating arrow boards at entrance or exit ramps presents another positive guidance challenge. When the board is positioned at an exit ramp, motorists can become confused into thinking that they should take the exit as part of the traffic control plan (for a left lane closure adjacent to a right-handed exit ramp), or that the ramp itself is closed when it is not (for a right lane closure just beyond a right-handed exit ramp). When placed adjacent to entrance ramps, the arrow board competes for driver attention at the same spot where vehicles are attempting to enter the roadway. Depending on the volume of entering ramp traffic, such a situation can create an information overload condition for drivers. Moving the lane closure taper and arrow board upstream before the entrance ramp allows drivers to concentrate on one activity at a time (first to move out of the closed lane, then to accommodate traffic entering the roadway).

Failing to Switch Between Lane Closure and Caution Mode Displays on Arrow Boards During Mobile Operations

The final type of positive guidance challenge occurs during mobile work operations rather than stationary lane closures. When a work convoy is moving along the shoulder of a roadway performing maintenance or other activity, the arrow board on the upstream shadow vehicle is to display a caution message rather than an arrow, as drivers are not being told to exit a lane. However, many roadway shoulders are discontinuous such as across long bridge spans. When a work convoy reaches these locations, it must move into an active travel lane, and then move back to the shoulder once across. Vehicle operators will sometimes forget to switch from the caution display to an arrow display when moving into the travel lane, and/or back to the caution mode once moving back to the shoulder.

Remembering to switch between display modes is one of the many issues that shadow vehicle operators traveling in a convoy must attend to while working. Making sure the issue is brought up during initial training is key to reducing its occurrence in the field. Periodic reminders of the importance of proper arrow board displays will encourage correct procedures.

Table 2 on page 9 provides a quick guide to the challenges and possible countermeasures available to ensure that arrow board usage meets traveler positive guidance needs over the duration of a work zone.

Table 2. Ensuring Arrow Boards Are Providing Positive Guidance

Challenges	Countermeasures
Arrow display not legible	• Regular inspection of arrow board operation • Replace or realign pixels that are not visible • Relocate or replace arrow boards that are washed out in bright sunlight conditions
Positioning boards where sight distance is limited	• Move board and lane closure taper to top of vertical curve (extending the work zone) • Move board and lane closure taper upstream beyond sight obstructions
Positioning arrow boards on or near horizontal curves	• Move board and lane closure taper to a tangent section
Positioning arrow boards at exit or near entrance ramps	• Move board and lane closure taper to a location upstream of the ramp
Failing to switch between lane closure and caution mode displays on arrow boards during mobile operations	• Train new shadow vehicle operators on correct usage procedures of the arrow board • Periodically conduct refresher talks with operators to remind them of correct usage procedures

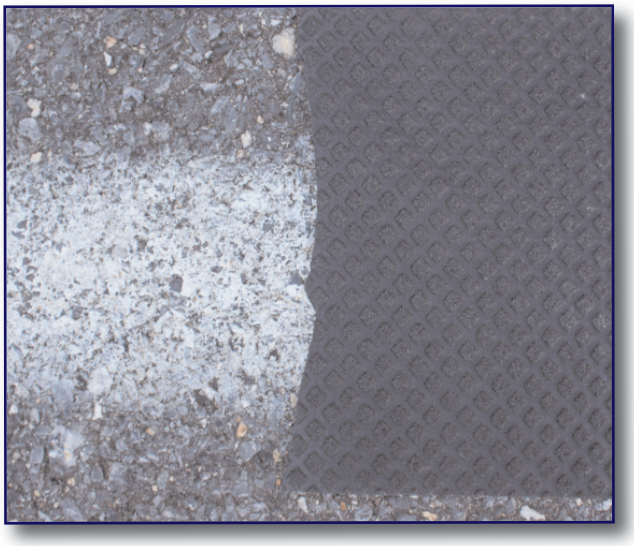
PAVEMENT MARKINGS

Pavement markings provide continuous lane guidance information to motorists as well as supplement information provided by other traffic control devices in a work zone. As such, they are critical to ensuring good positive guidance. However, pavement markings are one of the most challenging components of the positive guidance system to maintain through work zones where pavement is being rehabilitated or reconstructed. Certainly, failure to put down markings as required by the agency during construction is one way in which positive guidance is not maintained. However, even when such markings are installed, it can be challenging to ensure that positive guidance is continuously provided. As work progresses, lane closures and lane shifts require that existing pavement markings be removed and new ones installed. The following positive guidance concerns exist regarding pavement marking applications in work zones.

Scarring or Incomplete Removal of Old Pavement Markings

Perhaps the greatest challenge that agencies face when trying to ensure positive guidance through a work zone is the obliteration of existing pavement markings and installation and maintenance of temporary markings. When markings are removed, they are commonly ground or burned off, which leaves a scar in the shape of the existing marking. If the pavement is particularly porous, the marking material seeps into the pavement and can be very difficult to remove completely without removing a significant portion of the roadway surface. Both scarring and incompletely removed markings can be confused with newly installed markings, especially under wet nighttime viewing conditions.

Various methods have been developed through the years to reduce the scarring and incomplete removal problems associated with work zone pavement marking. Both water and sand (or other material) blasting techniques have been developed, but are expensive compared with other removal techniques. Paints that can be more easily removed with water or special solvents are under development for potential application in work zones, but as yet are not generally durable enough to withstand the environmental and traffic conditions present in most work zones. Likewise, foil-backed temporary pavement marking tapes have been developed that can be more easily removed when markings must be changed. However, these tapes can be more expensive than traditional marking materials and must be applied in warm, dry conditions in order to remain adhered.



Some agencies have found blackout tape to be an effective alternative to pavement marking removal. However, if used, blackout tape should provide — and be able to maintain — sufficient friction so as to not be a hazard to motorcyclists and bicyclists. Also, some blackout tapes can create glare in certain sun positions and appear to be a marking itself, which agencies should be aware of and on guard against. In some cases, an agency may require the contractor to cover the entire pavement surface with a thin overlay or seal coat to obliterate pavement markings each time a phase change requires a shift in travel lanes.

Need for Enhanced Temporary Pavement Markings

Even if scarring and incomplete pavement marking removal are not significant issues, the complexity of certain work zones can make it challenging for motorists to comprehend and safely negotiate the travel path through the work zone. In those cases, techniques are available to help increase the attention-getting and information dissemination properties of pavement markings. One technique is to use wider temporary pavement markings, especially for the edge line. Studies indicate that wider edge lines improve safety in permanent applications, and so should also improve conditions in temporary applications. Another technique is to use contrast markings around or adjacent to the actual pavement markings to increase their conspicuity and the ability of drivers to be guided by them.

A third technique, most commonly considered in urban freeway work zone applications, is the use of in-lane markings to supplement overhead or side-mounted temporary guide signing. Freeway reconstruction activities in and around major interchanges often involve lane shifts and even lane reconfiguration from exclusive to optional exit lanes (and vice versa) as the project proceeds through its various phases. Additional guidance is needed to aid commuters in determining the appropriate lanes they should use in each phase. Both text and route shield markings can be used (although the text markings may be more common because of cost savings). These markings can have less friction than the surrounding pavement in wet-weather conditions. Consequently, they should be located on tangent sections, if possible, to reduce the chance that motorcycles leaning into a curve lose control if passing over one of these markings.

Table 3 provides a quick guide to the challenges and possible countermeasures available to ensure that pavement markings meet positive guidance needs over the duration of a work zone.

Table 3. Ensuring Pavement Markings Are Providing Positive Guidance

Challenges	Countermeasures
Scarring or incomplete removal of old pavement markings	• Regular inspections to identify locations that need additional attention • Use of innovative marking removal techniques (water or sand blasting) • Use of temporary marking materials (soluble paints, foil-backed temporary tape) • Use of blackout tape to cover longitudinal markings • Use of overlays or seal-coats to cover existing markings after each project phase
Need for enhanced pavement markings within the work zone	• Use of wider markings, especially for edge lines • Use of contrast markings to increase lane line and edge line conspicuity • Use of in-lane pavement markings to supplement guide signing at complex freeway interchange work zones

CHANNELIZING DEVICES

Channelizing devices are designed to warn road users of conditions created by work activities in or near the roadway and to guide road users. The role of channelizing devices in work zone positive guidance is critical. Agencies have a range of channelizing device options to choose from, including cones, drums, vertical panels, tubular markers, and barricades. When properly applied and maintained, channelizing devices serve the intended functions very well.

As with the other traffic control devices discussed in this document, the use of channelizing devices does create some challenges to establishing and maintaining positive guidance for travelers through the work zone. The sections that follow identify several of the key challenges associated with channelizing device use along with methods of addressing those challenges.

Devices Not Providing Adequate Visibility

Like work zone signs and arrow boards, channelizing devices are subjected to harsh environmental, traffic, and work activity conditions that degrade the retroreflective sheeting and make them less visible to travelers. The devices are located close to the pavement surface and to both moving traffic and work vehicles which spray dirt and road grime on the devices during wet weather conditions. Also, the devices are often hit by passing vehicles (or knocked down by the vehicle draft) which can damage both the structure of the device and the sheeting attached to it. Certain work activities are extremely dirty (e.g., seal-coat or pavement overlay operations), which can coat the devices with tar or other contaminants and make them nearly invisible, especially at night.

Countermeasures to address these types of challenges are fairly straightforward. Regular inspections of work zone traffic control should occur during both daytime and nighttime viewing conditions and compared to established quality guidelines (the condition of retroreflective properties of sheeting on the devices may not be evident to inspectors during the day). The inspections may be part of the guidelines to maintain quality and adequacy of temporary traffic control devices required by the federal regulations (23 CFR 630.1110). Those devices that are damaged or covered with contaminants should be removed from service and replaced with new devices. If the contaminants are soluble, it may be possible to wash the devices and return them to a serviceable condition. However, a follow-up nighttime inspection should be performed soon after they are cleaned to verify that the devices are performing as expected.

Motorists Driving Between Devices

Another challenge in the use of channelizing devices is preventing motorists from choosing to drive between the devices to reach a driveway, ramp, or intersection that has been closed to traffic. Drivers may also enter the work zone in an attempt to bypass a traffic queue that has formed. This behavior is undesirable and increases safety risks to both workers on foot and drivers, so it is important that the devices can be easily seen, provide clear guidance, and are properly used.

Channelizing device spacing requirements are based on the speed of traffic on the roadway. When a higher operating speed is assumed, the spacing between devices is large enough to allow a vehicle that slows down significantly to turn between successive devices without hitting them. If one or more devices are missing in a continuous line, it becomes even easier for motorists to turn into the work zone. The formation of traffic congestion and delays that reduce the average speed of traffic not only increases driver frustration, but also makes it easier for motorists to drive between devices, which may increase the likelihood that drivers do not follow the positive guidance provided.

One technique to reduce the frequency of this behavior is to reduce the spacing between channelizing devices. A reduction in spacing is also believed to create more of a "wall" perception of the devices and contribute to better driver behavior. Consequently, reduced channelizing device spacing may be appropriate at work zones where destination points are closed to traffic, where traffic congestion is anticipated to develop during all or part of the day, and where workers on foot are close to moving traffic. In extreme cases, it may be worthwhile to install longitudinal channelizing devices to eliminate completely the spaces where vehicles can try to enter the work zone. It is important to remember that these devices do not provide positive protection for workers on foot, even though the devices look similar to water-filled barriers.

Another technique is to reduce the queues and delays through adjustments to work zone traffic management or project scheduling.

Incorrect Channelizing Device Use for Pedestrian Traffic Controls

The Americans with Disabilities Act requires agencies and contractors to provide an acceptable path through or around a work zone that can be safely negotiated by pedestrians with disabilities whenever a permanent pedestrian facility is affected by a work zone. Sequences of individual channelizing devices normally used for controlling and guiding vehicles through a work zone are not sufficient for pedestrian traffic control purposes. Furthermore, tape, rope, fencing, or plastic chains between channelizing devices are not detectable and should not be used as a control for pedestrian movements. Rather, pedestrians with visual disabilities require continuous channelization so that they do not become disoriented and accidentally enter into the work zone. The national MUTCD specifies that channelizing devices for pedestrians have continuous bottom and top surfaces that are detectable to users of long canes. The detectable bottom surface shall be no higher than two inches above the ground. The detectable top surface shall be no lower than 32 inches above the ground. In addition to these requirements, the channelization device base or supports should not extend beyond the continuous surface into the walkway because they can be a tripping or snagging hazard for pedestrians.

Agencies and contractors are allowed to use a variety of materials to construct pedestrian channelization, as long as the requirements listed in the national MUTCD are met. In addition, a number of vendors have developed pedestrian channelizing devices which meet these requirements. Many longitudinal channelizing devices mentioned previously can also be used for pedestrian channelization. If used for pedestrian traffic control, longitudinal channelizing devices must be interlocked, and not have gaps that allow pedestrians to stray from the channelizing path.

Table 4 provides a quick guide to the challenges and possible countermeasures available to ensure that channelizing devices meet positive guidance needs over the duration of a work zone.

Table 4. Ensuring Channelizing Devices Are Providing Positive Guidance

Challenges	Countermeasures
Devices not providing adequate visibility	• Inspect devices, replace those covered in tar or that have lost retroreflectivity • Clean devices that have become covered with dirt and grime
Motorists driving between devices	• Reduce channelizing device spacing • Use longitudinal channelizing devices • Improve queue/delay management
Incorrect devices being used for pedestrian traffic control	• Inspect usage to verify compliant devices are being used • Deploy national MUTCD-compliant devices • Use specially-designed pedestrian channelizing systems • Use interlocked longitudinal channelizing devices

EXAMPLES OF GOOD AGENCY PROCESSES FOR ENSURING THE PROVISION OF POSITIVE GUIDANCE

Maryland State Highway Administration

The Maryland State Highway Administration (MDSHA) has taken a very proactive approach to ensuring that positive guidance is provided in its work zones. The agency has adopted specific criteria for when to use channelizing devices at closer spacing than required in the national MUTCD, and when to require wider edge lines in work zones. Table 5 on page 15 summarizes the conditions and criteria recommended for reduced channelizing device spacing.

Table 5. MDSHA Channelizing Device Spacing for Selected Work Zone Conditions

Work Zone Location/Condition	Spacing in Feet	
	Low-speed (45 mph or less)	High-speed (greater than 45 mph)
Transitions and curves with a degree of curvature greater than 6 degrees	20	40
Work zone activity areas where work is taking place		
Intersections		
Conflict areas where there are no pavement markings or where there is a conflict between existing markings and channelizing devices		
Hazardous conditions; e.g., equipment very near the traffic stream, unusual conditions hidden from the motorists, trucks entering and leaving the traffic stream, etc.		
Nighttime operations		

To address edge lines in work zones, MDSHA developed a number of guidance statements. Specifically, 10-inch wide lines should be used when using wider edge lines in work zones. Also, the reflectivity of the wider lines should match all MDSHA standards for reflectivity. Wider lane lines should not be used next to temporary or permanent concrete barriers. MDSHA also specifies that all wider lane lines should be solid, and should be deployed prior to a lane shift to allow motorists to become accustomed with the wider lane lines.

Finally, MDSHA also specifically mentions positive guidance as a criterion in its rating system used during regular work zone inspections. This system uses ratings from "A" to "F" to identify the quality of the temporary traffic control (TTC) devices (e.g., signs and channelizing devices) and operations (e.g., accidents and work zone impacts).

Virginia Department of Transportation

The Virginia Department of Transportation (VDOT) looks at positive guidance in several ways during its inspections. In different parts of the inspection, the user is asked to evaluate the following positive guidance components:

- maintenance of arrow panels;
- if portable changeable message signs are being used appropriately;
- if signs are not conflicting; and
- if there are no unnecessary pavement markings.

Additionally, the drive-thru portion of the inspection form considers the concept of positive guidance when the work zone is viewed from a driver perspective. This portion of the form is displayed below.

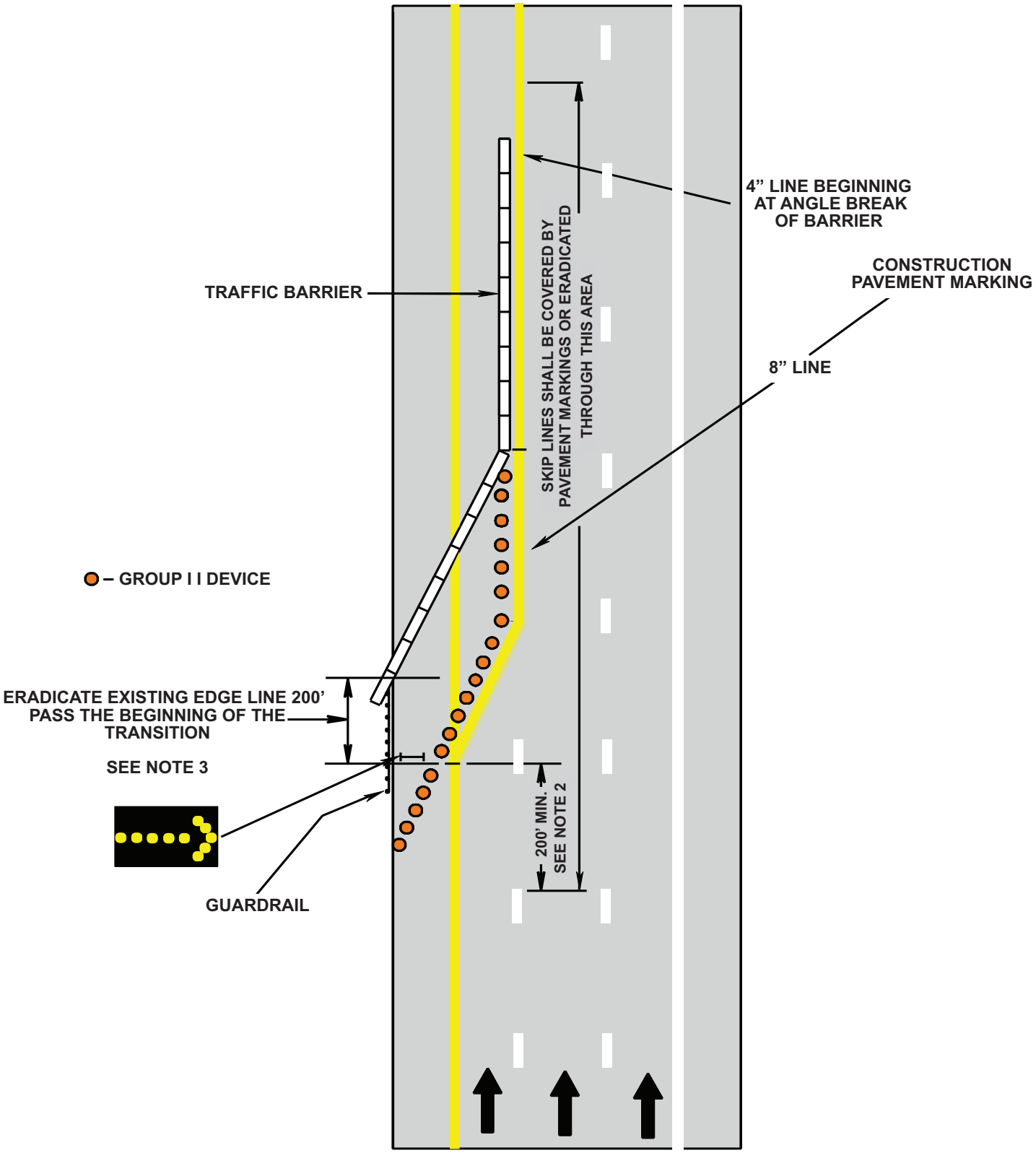
A. DRIVE THRU:

ARE MANEUVERS DIFFICULT OR UNEXPECTED?	☐ **YES**	☐ **NO**
ADEQUATE WARNING OF HAZARDS?	☐ **YES**	☐ **NO**
IS SIGNING CLEAR/UNCLUTTERED AND PROPERLY SPACED/	☐ **YES**	☐ **NO**
ARE TRAFFIC CONTROL DEVICES SUFFICIENTLY VISIBLE?	☐ **YES**	☐ **NO**

COMMENTS: _____

_____

VDOT has also created a typical temporary traffic control application for the "eradication of pavement markings in work zones." This typical application (shown on page 17) states that all skip lines shall be removed a minimum of 200 feet before a lane closure and that the existing edgeline shall be removed a minimum of 200 feet beyond the beginning point where the new edgeline is transitioned over.



Eradication Of Pavement Markings In Work Zones
(Figure TTC-38.0)

How Can I Locate More Information Regarding This Topic?

H. Lunenfeld and G.J. Alexander. A User's Guide to Positive Guidance (3rd Edition). Report No. FHWA-SA-90-017. FHWA, U.S. Department of Transportation, Washington, DC. September 1990.

G.L. Ullman and S.D. Schrock. Improving Traffic Control Effectiveness in Complex Work Zones. Report No. FHWA/TX-03/4021-2. Texas Transportation Institute, College Station, TX. January 2003. Accessible at http://tti.tamu.edu/documents/4021-2.pdf.

Reduced Channelizing Device Spacing. Office of Traffic and Safety, Maryland State Highway Administration. August 2005. Accessible at http://www.sha.maryland.gov/OOTS/09ReducedChannelizingDevic Spacing.pdf

Wider Edge Lines. Office of Traffic and Safety, Maryland State Highway Administration. August 2005. Accessible at http://www.sha.maryland.gov/OOTS/11WiderLaneLinesW-Summary.pdf

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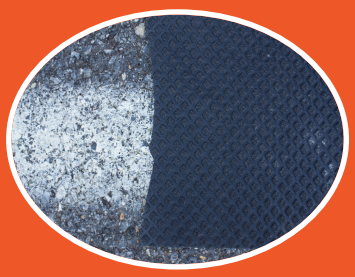
Virginia Work Area Protection Manual, Appendix B: Work Zone Safety Checklist Form Documentation. Virginia Department of Transportation. May 2011. Accessible at http://www.virginiadot.org/business/resources/wztc/Virginia_WAPM_201 1_web.pdf

Quality Guidelines for Work Zone Traffic Control Devices. American Traffic Safety Services Association. For more information: http://www.workzonesafety.org/node/1957



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Laborers' International Union of North America
Laborers' Health and Safety Fund of North America
LIUNA Training and Education Fund
American Road and Transportation Builders Association
National Asphalt Pavement Association
International Union of Operating Engineers
American Association of State Highway and Transportation Officials
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