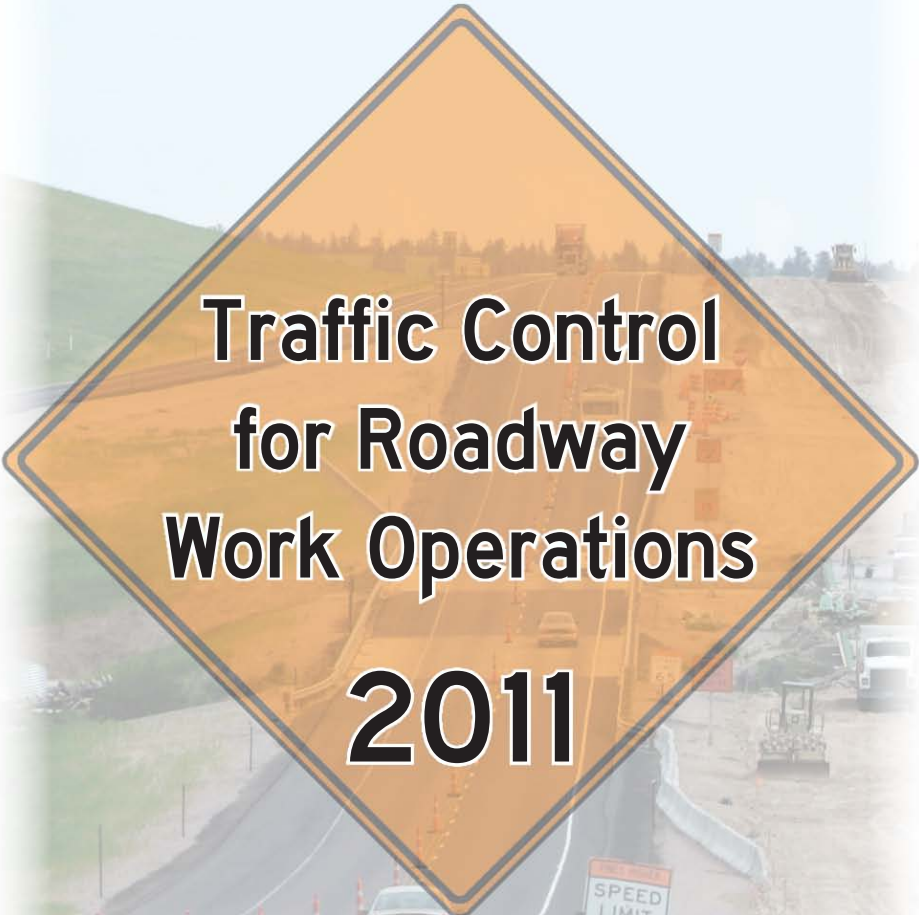


TRAFFIC CONTROL FOR ROADWAY WORK OPERATIONS

NOVEMBER 2011





**Traffic Control
for Roadway
Work Operations
2011**

WYDOT Traffic Program

Traffic Control for Roadway Work Operations

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Introduction

WYDOT, other agencies, and companies (utilities, fencing, guardrail, etc.) working within the right-of-way of any state owned roadway shall use this manual or the latest version of the MUTCD. The safety of WYDOT employees and the public during roadway work operations depends on the correct use of traffic control. This manual serves to provide minimum guidelines for use during a variety of situations, from short-term mobile operations to long term work zones. Certain cases may require more TTC than what is provided here. It does not serve to supersede current standards in place for work zone operations on WYDOT projects. If questions arise, don't hesitate to contact the District Traffic Engineer or the Headquarters Traffic Program.

Abbreviations

AADT - Annual Average Daily Traffic

ANSI - American National Standards Institute

DMS - Dynamic Message Sign

ISEA - International Safety Equipment Association

MASH - Manual for Assessing Safety Hardware

mph - Miles per hour

MUTCD - Manual on Uniform Traffic Control Devices

NCHRP - National Cooperative Highway Research Program

PCMS - Portable Changeable Message Sign(s)

SEMM - Supervisor's Employee Management Manual

TMA - Truck Mounted Attenuator or Trailer Mounted Attenuator

TMC - Transportation Management Center

TTC - Temporary Traffic Control

VSL - Variable Speed Limit

WYDOT - Wyoming Department of Transportation

Traffic Control Guidelines

The type of temporary traffic control that will be required depends on the duration and location of work.

Duration of Work

Mobile Operation

Work that moves intermittently or continuously and does not occupy the immediate area for more than 15 minutes. If work does not move more than one-half mile within an hour, the operation is not considered mobile. Examples include: mowing, striping, mechanical sweeping, traffic control setup, and removal.

Short Duration

Work that occupies a location from 15 minutes to 1 hour. Examples include: delineator repair and replacement, hand patching, and spray injection patching.

Short-term Stationary

Work that occupies a location for more than 1 hour but less than 12 hours within a single daylight period. Examples include: crack sealing, chip sealing, and patching.

Intermediate-term Stationary

Work that occupies a location for more than one 12 hour daylight period up to 3 days, or nighttime work lasting more than 1 hour. Examples include: slab repair, culvert replacement, and sub-grade repair.

Long-Term Stationary

Work that occupies a location longer than 3 days. Examples include: bridge damage and reconstruction.

Nighttime Activities

Work that occurs from 30 minutes before sunset to 30 minutes after sunrise.

Location of Work

General Considerations

The type and amount of traffic control is dependent upon the location of the work zone in relation to the travel way. The closer to the road, the more traffic control is justified. Encroachment into the travel way involves the highest level of traffic control. Both the location and duration of work must be considered when planning the type and amount of traffic control. Figures for each are located in the back of this manual.

Work Outside the Shoulder Edge

Traffic control devices will not normally be needed if the work activity is 15 or more feet from the edge of the travel way. If workers or machinery occasionally move closer to the roadway but do not encroach onto the travel way, a ROAD WORK AHEAD or SHOULDER WORK AHEAD sign should be erected. Use of amber lights on vehicles and proper high-visibility safety apparel (according to the latest SEMM 17-2) are still required while within the right-of-way, regardless of other traffic control used.

Work Near the Shoulder

Work on or near the shoulder or within 15 feet of the travel way should be signed as if the work were on the road itself since it is in the clear zone and is part of the drivers' recovery area. Advance warning is needed and channelizing devices are used to close the shoulder, guide traffic, and protect the work space.

Work in the Median

The traffic control needed in a median depends on the width of the median. Generally the traffic control needed will follow the guidelines for work outside the shoulder or near the shoulder. Consider traffic control in both directions for wide operations or narrow medians.

Work in the Travel Way

Work on the travel way takes place within the lanes for moving traffic, and it demands the highest level of traffic control. It must give information and warning to the motorist and provide protection for the worker.

Traffic Control Devices

The following are types of traffic control devices commonly used in work zone traffic control:

- ***Signs***
- ***Channelizing Devices***
- ***Lighting Devices***
- ***Markings***
- ***Truck Mounted Attenuators***

Signs

Signs used in work zone traffic control are classified as regulatory, warning, or guide. Due to wind loading, 36-inch warning signs may be used. Whenever possible, standard sign messages should be used because they increase driver familiarity, solicit appropriate responses, and reduce driver confusion.

As a general rule, signs should be installed on the right-hand side of the roadway. Where special emphasis is needed, such as on multilane divided highways, signs shall be placed on both sides of the road.

Sign Installation

Signs installed for up to two weeks - may be mounted on portable sign support stands or clamped to delineator posts. Portable sign supports shall meet NCHRP 350 or MASH compliance. A mounting height of 1-foot from the ground should be used.

Signs installed for longer than two weeks - shall be on posts with acceptable breakaway characteristics.

Permanent Signs in the work area that are not applicable because of the work operation should be completely removed or covered. Portable signs that are not applicable shall be completely removed or covered, such as if work is shut down for the night and the roadway is fully opened to traffic. Contact the TMC for VSLs and DMSs within the work area.

Regulatory Signs

Regulatory signs are used to advise motorists of applicable laws and regulations. Regulatory signs are enforceable by law and in some instances, such as speed limit signs, require permission to install. Regulatory signs shall be placed at the point where the regulation becomes effective.

Regulatory signs in work zones shall follow the same color and shape format as permanent signs.

Warning Signs

Warning signs give the motorist notice of hazards or unexpected conditions. Warning signs should be placed far enough in advance to give the driver adequate time to both understand the message and make the required response.

Spacing for these signs depends on the speed, traffic volume, and complexity of the situation.

- *Urban Low Speed (speeds 30 mph and below)* - the signs should be at least 100 feet apart, as permitted by field conditions
- *Urban High Speed (speeds 35 to 45 mph)* - the signs should be at least 350 feet apart, as permitted by field conditions

- *On Rural Two Lane Roadways* - the spacing should be increased to 500 to 600 feet apart
- *Interstate* - the sign spacing should be 750 to 1000 feet

Warning signs are generally diamond shaped with black letters on orange background. Rectangular supplemental distance and advisory speed limit plaques may be used in conjunction with warning signs. When used, they shall be placed immediately below the diamond signs in a way not to obscure the warning sign shape. Plaques are supplemental and are not to be used unaccompanied.

Guide Signs

Guide signs in work zones typically include DETOUR and PILOT CAR FOLLOW ME. Guide signs are rectangular in shape and are black letters on an orange background.

Channelizing Devices

Channelizing devices warn and alert drivers of conditions or hazards associated with the work, provide guidance to users, and separate users from the work area. Channelizing devices are part of a total traffic control plan and must be preceded by warning signs.

Typical channelizing devices:

- **Cones**
- **Tubular markers**
- **Drums**
- **Vertical panels**
- **Barricades**

Channelizing devices may be used to form an island around the work zone and the tapers surrounding the work zone. This separates the work area from the roadway that carries traffic. All equipment and workers shall stay within the work zone.

Channelizing devices may also be used to delineate a single point hazard; the device shall be placed in front of the hazard to draw atten-

tion to it. If the hazard is linear, such as a shoulder drop-off, a continuous line of channelizers should be spaced alongside the hazard. Equipment and other moveable objects shall be moved out of the clear zone and shall not be marked as single point hazards.

In high wind areas, 36-inch cones may be used for channelization, rather than taller devices, for daytime use only. Operations staying in place overnight shall use cones with a minimum height of 42 inches or drums with a minimum height of 36 inches.

Temporary Pavement Markings

When a centerline or lane line is obliterated, temporary pavement markers are used. Temporary raised pavement markers, motorist guidance markers, temporary striping tape, or paint may be used for temporary markers. Paint on final surface will be done by WYDOT striping crews only.

Temporary pavement markings shall be replaced with permanent markings within 14 days of work operation.

Signing shall be used for obliteration of permanent markings. Advance signing shall indicate "NO CENTER STRIPE." Areas of no passing shall use a "DO NOT PASS" on the right-hand side and a "NO PASSING ZONE" pennant on the left side. When passing is once again allowed, the sign "PASS WITH CARE" shall be used. Tabs shall be placed along with signing. The tabs shall be placed one tab every forty (40) feet continuously through the area with no markings. See Figure 15a and Figure 15b for clarification

Components of a Work Zone

A standard work zone consists of four parts:

Advance Warning Area - tells traffic what to expect ahead

Transition Area - moves traffic out of its normal path

Activity Area - where the work takes place, including buffer space

Termination Area - lets traffic resume normal operations

Each area has a set distance assigned to it based on lane width and traffic speeds. Taper is referred to as “L” in the formulas and diagrams in this manual. Many lanes in Wyoming are 12 feet wide and a table has been provided for quick look up.

Taper Length Requirements

Table 1 - Taper Length Requirements

Type of Taper	Taper Length
Merging Taper	L Minimum
Shifting Taper	½ L Minimum
Shoulder Taper	1/3 L Minimum
Two-Way Traffic Taper (with flagger)	50-100-feet
Downstream Taper	100-feet per lane Minimum

(See Figure 1 for examples.)

Taper Formula

Speed Limit	Formula
40 mph or less	$L = (W \times S^2)/60$
45 mph or greater	$L = W \times S$

(Where W = lane width in feet and S = speed in miles per hour.)

Taper Calculations for 12-ft Lanes

Table 2 - Taper and Buffer Calculations for 12-ft Lanes

Speed (mph)	Merging Taper L	Shifting Taper 1/2 L	Shoulder Taper 1/3 L	Buffer
25	125	65	45	155
30	180	90	60	200
35	245	123	82	250
40	320	160	107	305
45	540	270	180	360
50	600	300	200	425
55	660	330	220	495
60	720	360	240	570
65	780	390	260	645
70	840	420	280	730
75	900	450	300	820

Figure 1 - Component Parts of a Temporary Traffic Control Zone

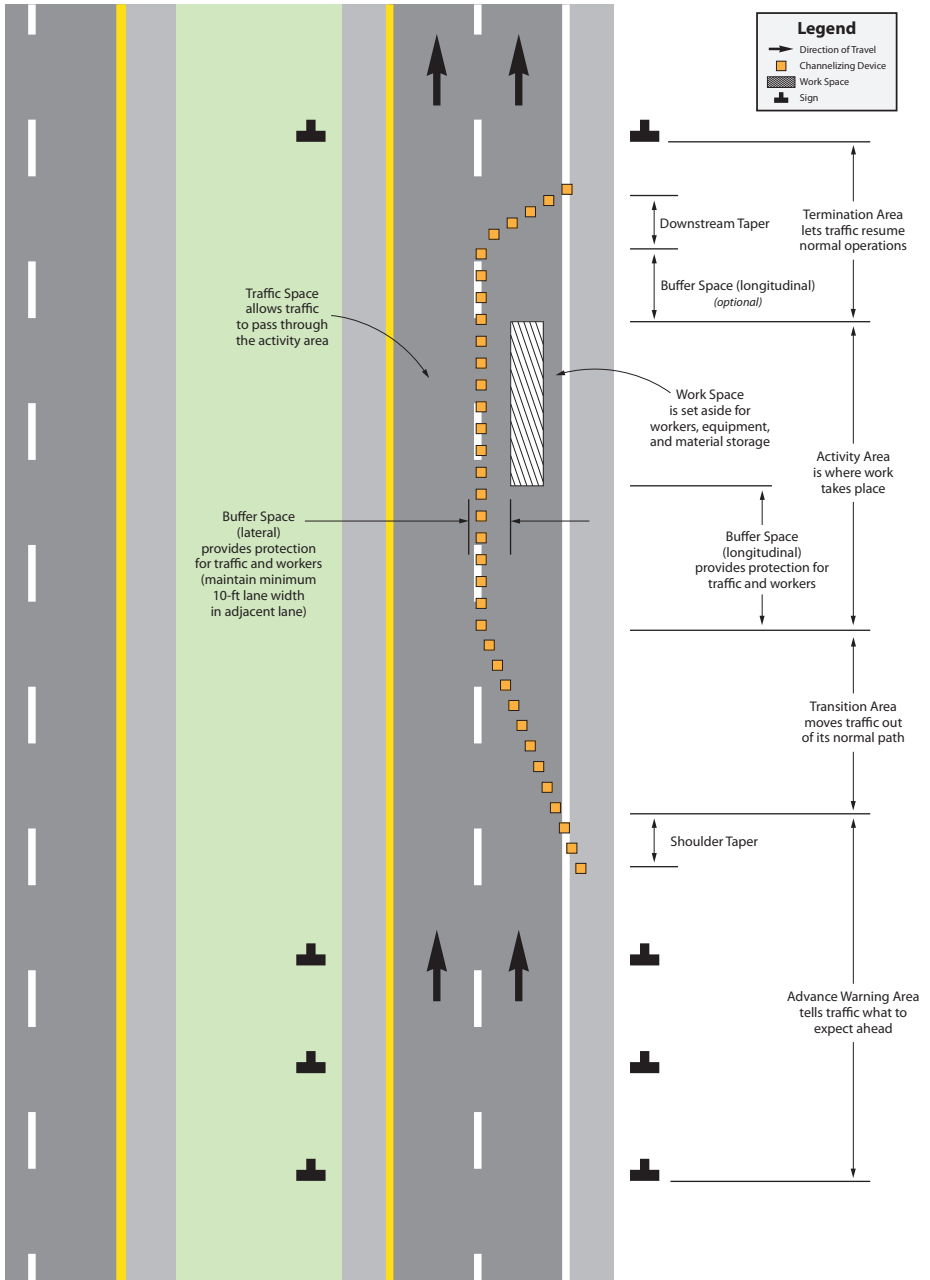
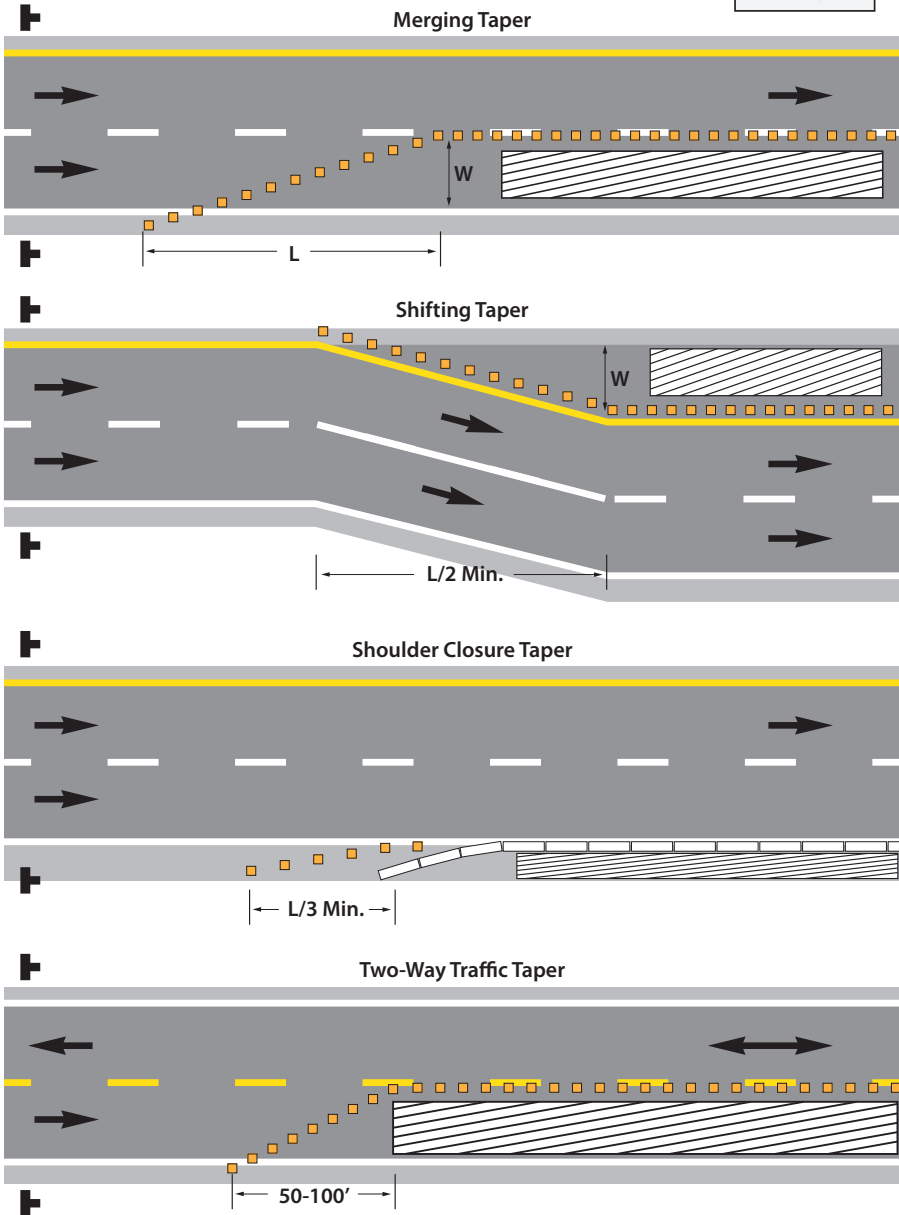


Figure 2 - Taper Examples

Legend	
	Direction of Travel
	Channelizing Device
	Work Space
	Sign
	Temporary Barrier



Longitudinal Buffer Space Recommendations

The longitudinal buffer space provides an extra measure of safety to workers inside the area by establishing an extra distance from the taper to the work area. At 50 mph and above, buffer space is required. See Table 2 for 12-ft lane width buffer space.

An exiting buffer is shown in many of the figures. While this buffer may provide extra room for equipment and materials, it is not required.

Lateral Buffer Space

The lateral buffer space provides space between the travel way and the active work space. The size of a lateral buffer is left up to judgment in the field, with 2 feet being a frequently recommended space. The lane width of the adjacent lane shall be maintained to at least 10 feet without encroachment by the lateral buffer.

Channelizing Device Spacing

The maximum taper device spacing is equal to the speed limit used to determine the taper length:

- 60 mph work zone = 60-ft taper device spacing

The maximum tangent (parallel) device spacing is equal to two times the speed limit used to determine the taper length

- 60 mph work zone = 2 x 60 ft = 120-ft tangent device spacing

Minimum number of devices

$$\text{Minimum number of devices} = \frac{\text{Length of taper}}{(\text{Spacing between devices})} + 1$$

So, for a 100-foot taper at 20 mph (20-foot spacing) the minimum number of devices would be:

$$\text{Minimum number of devices} = \frac{100}{20} + 1 = 6$$

Taper Lengths, Device Spacing, and Number of Devices for 12-ft Lane

Table 3 - Taper Lengths, Device Spacing, and Number of Devices for 12-ft Lane

Speed (mph)	Taper Length	Spacing of Devices on Taper (ft)	Spacing of Devices on Tangent (ft)	Number of Devices on Taper
25	125	25	50	6
30	180	30	60	7
35	245	35	70	8
40	320	40	80	9
45	540	45	90	13
50	600	50	100	13
55	660	55	110	13
60	720	60	120	13
65	780	65	130	13
70	840	70	140	13
75	900	75	150	13

Speed Reductions

Reducing the regulatory speed limit on a state highway more than 15 mph below the posted speed limit requires an approved T-1 form, as outlined in Operating Policy 25-6. Speed reductions of 15 mph or less for maintenance work zones do not require a T-1. The reduced speed limit signs should be placed at the location where the speed reduction is needed. Any existing speed limit signs that are in conflict with the reduced speed zone shall be covered. When reduced speed limits are used, an additional speed limit sign at the end of work shall be installed to inform motorists they are through the work zone and may resume the normal speed limit.

When not using a regulatory speed limit sign, speed may be reduced through other means:

- Narrowing the driving lanes with channelizing devices tends to slow down motorists since they are uncomfortable with the reduced width.
- A trained flagger with a SLOW paddle may also be used to slow traffic. If a flagger is used, a reduced speed limit sign should not be used. Rather, the signing indicating a flagger is ahead should be used.
- Advisory speed limit plaques may be used with warning signs;

however, the advisory speed is not enforceable. An advisory speed does not require a T-1 form.

Speed reductions are most effective when the motorist is compliant with the reduction. Using reasonable speed limit reductions and using reductions in appropriate circumstances increase compliance.

At the end of the work zone, signs returning the speed to normal shall be installed.

Figures 17 and 18 show signing for a regulatory speed limit reduction.

Flaggers

The use of a flagger to control traffic should be considered only if other forms of traffic control will not work.

Flaggers shall be properly trained and certified prior to flagging. All entities that use flagging on the state highway system shall ensure their employees have completed an approved flagger training program. The flagger shall be able to provide documentation of the successful completion of an approved training program. The State Construction Office maintains a list of approved flagger training programs. WYDOT personnel may contact the Training Program. A one-day grace period may be granted for flagger certification for emergency situations.

Due to wind loading, flagger paddles are a minimum of 5 feet tall and the signs are a minimum of 18 inches wide.

Shadow Vehicle

In the case of mobile and constantly moving short duration operations, such as pothole patching and striping operations, a shadow vehicle equipped with appropriate lights and warning signs shall be used to protect workers.

These shadow vehicles are normally equipped with:

- sequential chevrons
- changeable message signs
- and/or high-intensity rotating, flashing, oscillating, or strobe lights located properly in advance of the workers and/or equipment that they are protecting
- black on orange signs

The shadow truck should be positioned a sufficient distance in advance

of the workers or equipment being protected, but not so much so that errant vehicles will travel around the shadow truck and strike the protected workers and/or equipment.

- If shadow vehicles are not used, a lane closure must be used
- Don't stop just over crest of hill
- Keep buffer space

The shadow vehicle is the first vehicle that a motorist sees, so it should stay as far to the right or left as possible.

Truck-mounted attenuators and trailer-mounted attenuators can provide an extra measure of safety to workers and errant motorists by absorbing the energy of a crash. If used, the TMA should be used in accordance with the manufacturer's specifications. For mobile or short duration operations, a TMA is required if the AADT is 10,000 vehicles or more (5,000 vehicles per direction of travel) on the Interstate. For two-lane roads, an AADT of 5,000 requires a TMA. If a TMA is not available, a lane closure shall be used. For roads that do not meet the AADT requirement, a TMA is strongly encouraged but not required.

Urban Traffic Control

Urban work zones present special challenges for temporary traffic control. While the general principles that govern rural traffic control are still applicable, the urban environment sometimes renders them unworkable. Generally distances are restricted; it is difficult to find locations to place signs, and the visual clutter of the urban environment competes for the driver's attention. There is generally a wide range of traffic volumes and patterns to deal with, and bicycles and pedestrians have to be accommodated. Because of varying conditions, it is difficult to develop standards that cover the multitude of situations which arise in urban work areas.

The following is a list of items that should be considered when setting up urban traffic control. These questions are indicative of the more common problems that come up in urban areas, and they should not be considered all-inclusive.

1. Is there a time of day that is better for the work operation?
2. Will channelizing devices be needed? What type is best suited for the area? Will there be sufficient room for standard tapers?
3. Will a flagger be needed? Will he or she be easily visible?

4. Will sign placement be a problem?
5. Are there any existing sight restrictions or will the work cause any restrictions?
6. Are there any side streets that will require traffic control?
7. Will there be an area to store equipment and materials?
8. Is there a viable detour?

Emergency Road Closures

Emergency traffic control should be used only until standard temporary traffic control that is consistent with the situation can be installed.

Portable Changeable Message Signs and Truck-Mounted Changeable Message Signs

The primary purpose of portable changeable message signs in TTC zones is to advise the road user of unexpected situations. PCMS are particularly useful as they are capable of:

- Conveying complex messages
- Displaying real-time information about conditions ahead
- Providing information to assist road users in making decisions prior to the point where actions must be taken

Messages on a PCMS should consist of no more than two phases, and a phase should consist of no more than three lines of text. Each phase should be capable of being understood by itself, regardless of the order in which it is read. Messages should be centered within each line of legend. If more than one portable changeable message sign is simultaneously legible to road users, then only one of the signs should display a sequential message at any given time. Techniques of message display such as animation, rapid flashing, dissolving, exploding, scrolling, travelling horizontally or vertically across the face of the sign, or other dynamic elements shall not be used.

For speeds of 45 mph or greater, ensure the letters are a minimum of 18 inches in height. For speeds under 45 mph, ensure the letters are a minimum of

10 inches in height. Exceptions are made for truck-mounted changeable message signs or trailer-mounted changeable message signs that are attached to a vehicle and are mobile, then a minimum letter height of 10 inches may be used.

When a message is divided into two phases, the display time for each phase should be at least 2 seconds, and the sum of the display times for both of the phases should be a maximum of 8 seconds. The message should be as brief as possible and should contain three thoughts (with each thought preferably shown on its own line) that convey:

- The problem or situation that the road user will encounter ahead,
- The location of or distance to the problem or situation, and
- The recommended driver action

PCMS should be used as a supplement to and not as a substitute for conventional signs and pavement markings. PCMS should be sited and aligned to provide maximum legibility and to allow time for road users to respond appropriately to the sign message. PCMS should be placed off the shoulder of the roadway and behind a traffic barrier, if practical. When PCMSs are not being used to display TTC messages, they should be relocated so that they are outside of the clear zone or shielded behind a traffic barrier and turned away from traffic. If relocation or shielding is not practical, they should be delineated with retroreflective TTC devices.

The following table provides acceptable abbreviations for use on PCMS. Other abbreviations must be cleared by the District office.

Table 4 - Abbreviations for Portable Changeable Message Signs

Word Message	Standard Abbreviation	Prompt Word that Should Precede the Abbreviation	Prompt Word that Should Follow the Abbreviation
Access	ACCS		Road
Ahead	AHD	Fog	
Blocked	BLKD	Lane	
Bridge	BR	[Name]	
Cannot	CANT		
Center	CNTR		Lane
Chemical	CHEM		Spill
Condition	COND	Traffic	
Construction	CONST		Ahead
Crossing	XING		
Do Not	DONT		
Downtown	DWNTN		Traffic
Eastbound	E-BND		
Emergency	EMER		
Entrance, Enter	ENT		
Exit	EX	Next	
Frontage	FRNTG		Road
Hazardous	HAZ		Driving
Highway-Rail Grade Crossing	RR XING		
Interstate	I-		[NUMBER]
It Is	ITS		
Lane	LN	[Roadway name], Right, Left, Center	
Left	LT (LFT)		
Local	LOC		Traffic
Maintenance	MAINT		
Major	MAJ		Accident
Minor	MNR		Accident
Normal	NORM		
Northbound	N-BND		
Oversized	OVRSZ		Load
Parking	PKING		

Table 4 - Abbreviations for Portable Changeable Message Signs (cont.)

Pavement	PVMT	Wet	
Prepare	PREP		To Stop
Right	RT (RGT)	Keep, Next	
Right	RT (RGT)		Lane
Roadwork	RDWK		Ahead, [Distance]
Service	SERV		
Shoulder	SHLDR		
Slippery	SLIP		
Southbound	S-BND		
Speed	SPD		
Tires With Lugs	LUGS		
Traffic	TRAF		
Travelers	TRVLRS		
Two-Wheeled Vehicles	CYCLES		
Vehicle(s)	VEH, VEHS		
Warning	WARN		
Westbound	W-BND		
Will Not	WONT		

The following message sets are recommended for maintenance work using PCMS.

Table 5 - Recommended Message Sets for Maintenance Work

Operation	Road Type	Primary Concern	Phase 1	Phase 2
Sweeping	2-lane, 2-way or Multilane	Debris/dust obstructing vision	SWEEPING AHEAD	REDUCED VISION
	Multilane	Lane encroachment	SWEEPING AHEAD	STAY IN LEFT [or RIGHT] LANE
Workers Out of Vehicle	2-lane, 2-way or Multilane	Protection of workers	# WORK TRUCKS	WATCH FOR WORKERS

Nighttime Work

Nighttime work provides an advantage when traditional daytime traffic control strategies will not work. Although working at night might offer advantages, it also includes safety issues. Reduced visibility in night work impacts the performance of both drivers and workers. Because traffic volumes are lower and congestion is minimized, speeds are often higher at night. Finally, the incidence of impaired (alcohol or drugs), fatigued, or drowsy drivers might be higher at night. A decision to perform construction or maintenance activities at night normally involves some consideration of the advantages to be gained compared to the safety and other issues that might be impacted.

Where reduced traffic volumes at night make it feasible, the entire roadway may be closed by detouring traffic to alternate facilities, thus removing the traffic risk from the activity area. Consideration should be given to stationing uniformed law enforcement officers and lighted patrol cars at night work locations where there is a concern that high speeds or impaired drivers might result in undue risks for workers or other drivers.

Except in emergencies, temporary lighting shall be provided at all flagger stations. Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 5 foot candles can be adequate.

Surveying

The majority of surveying operations will occur off the travel way. For these instances, a SURVEY CREW AHEAD, SURVEYING AHEAD, or ROAD WORK AHEAD sign should be placed at the following spacing from the location of the crew:

- 1300'-1500' for full access controlled highways
- 500'- 800' on other roadways where the posted speed limit is greater than 45 mph
- 350'-500' where the posted speed limit is 45 mph or less

Each vehicle involved in the surveying operation shall be equipped with at least one rotating amber light or high intensity amber light. Although vehicle hazard warning signals can be used to supplement the rotating light or strobe light, they shall not be used instead of rotating lights or strobe lights. Maximum length of the work zone shall be two miles.

Surveying operations taking place on the travel way shall use standard traffic control for two-lane or four-lane roadways, involving lane closures and flagging as needed.

Clothing

WYDOT policy and federal regulations require the use of high-visibility safety apparel for all people within the right-of-way. Failure to wear appropriate high-visibility safety apparel may result in employee disciplinary actions. All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear" (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. WYDOT's Employee Safety Program shall make the selection of the appropriate class of garment for WYDOT employees. Reference SEMM Policy 17-2 for information about safety apparel.

Emergency and incident responders and law enforcement personnel within the TTC zone may wear high-visibility safety apparel that meets the performance requirements of the ANSI/ISEA 207-2006 publication entitled “American National Standard for High-Visibility Public Safety Vests” or equivalent revisions, and labeled as ANSI 207-2006, in lieu of ANSI/ISEA 107-2004 apparel.

Installation of Temporary Traffic Control

Traffic control devices are set up in the direction that traffic moves. Advance warning signs are placed first. Channelizing devices are then installed, with each device placed in sequence. The devices should be moved out from the shoulder with the worker looking toward traffic.

Removal of Temporary Traffic Control

When traffic control devices are removed from a work operation, items should be picked up in the reverse order in which they were installed. Only remove devices after all work is complete. This keeps the warning signing up to alert motorists that workers are ahead. Do not stop in the travel way when picking up signs--use the shoulder and uncover permanent signing.

Typical Applications

The following diagrams show typical applications as provided in the MUTCD. They provide an easy visual of how many typical work zones should be set up. The selection here is not all inclusive and if a unique situation arises, questions may be directed to District staff for solutions.

Figure 3 - Symbols used in typical application drawings

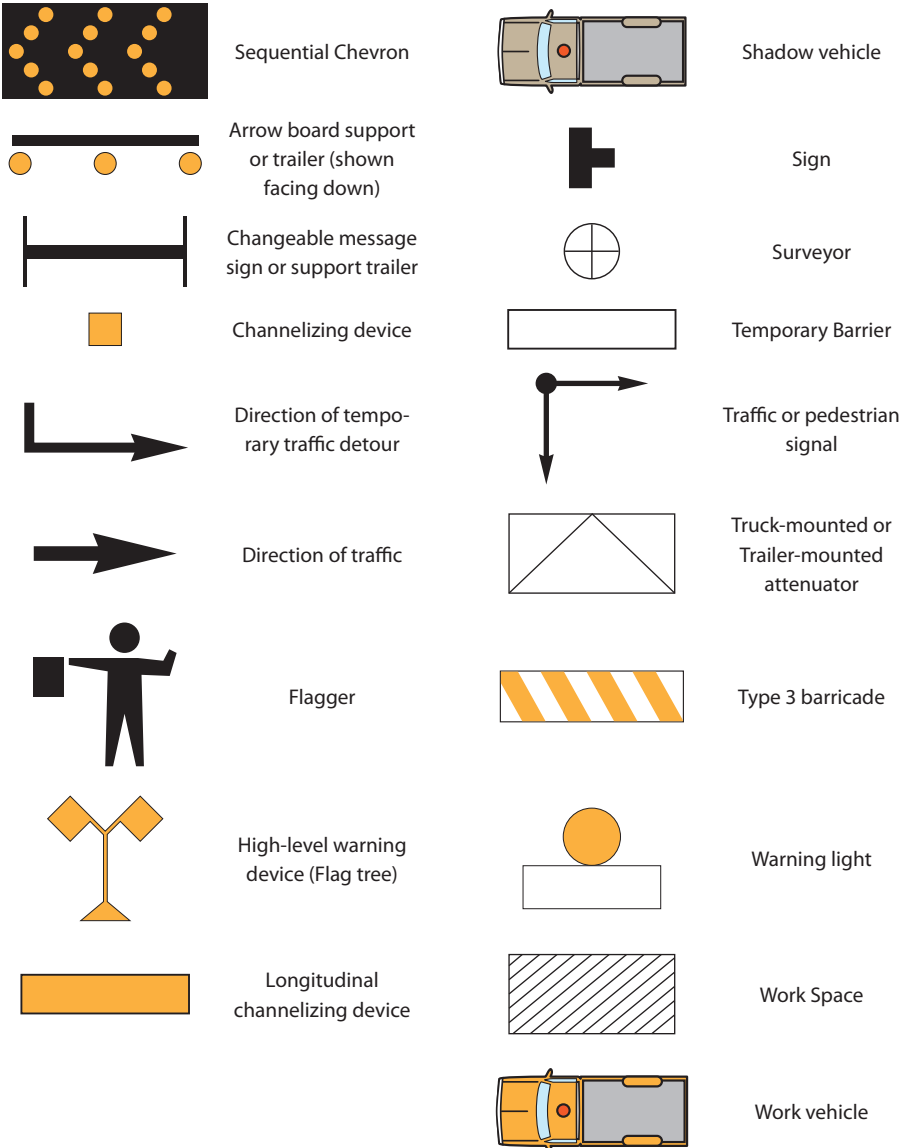


Table 6 - Distance between signs

Road Type	Distance Between Signs*		
	A	B	C
Urban (low speed) – 30 mph or less	100-feet	100-feet	100-feet
Urban (high speed) – 35 to 45 mph	350-feet	350-feet	350-feet
Rural – greater than or equal to 50 mph	500-feet	500-feet	500-feet
Interstate	750-feet	1,000-feet	1,000-feet

*The column headings A, B, and C are the dimensions shown in Figure 4 through Figure 18. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The “first sign” is the sign in a three-sign series that is closest to the TTC zone. The “third sign” is the sign that is furthest upstream from the TTC zone.)

Figure 4 - Work Outside the Shoulder Edge for Two-Lane (shown) or Interstate

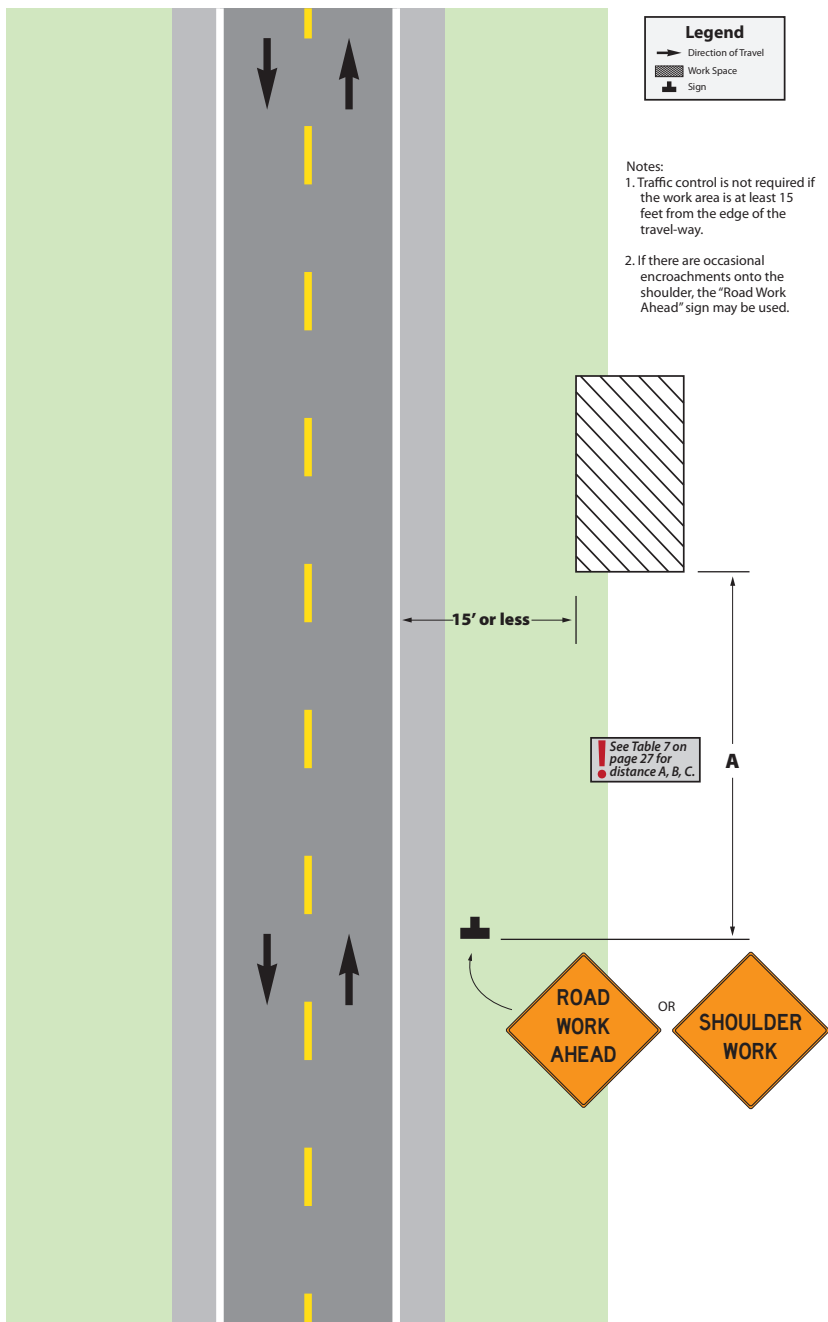


Figure 5 - Short Duration or Mobile Operation on a Shoulder for Two-Lane or Multilane

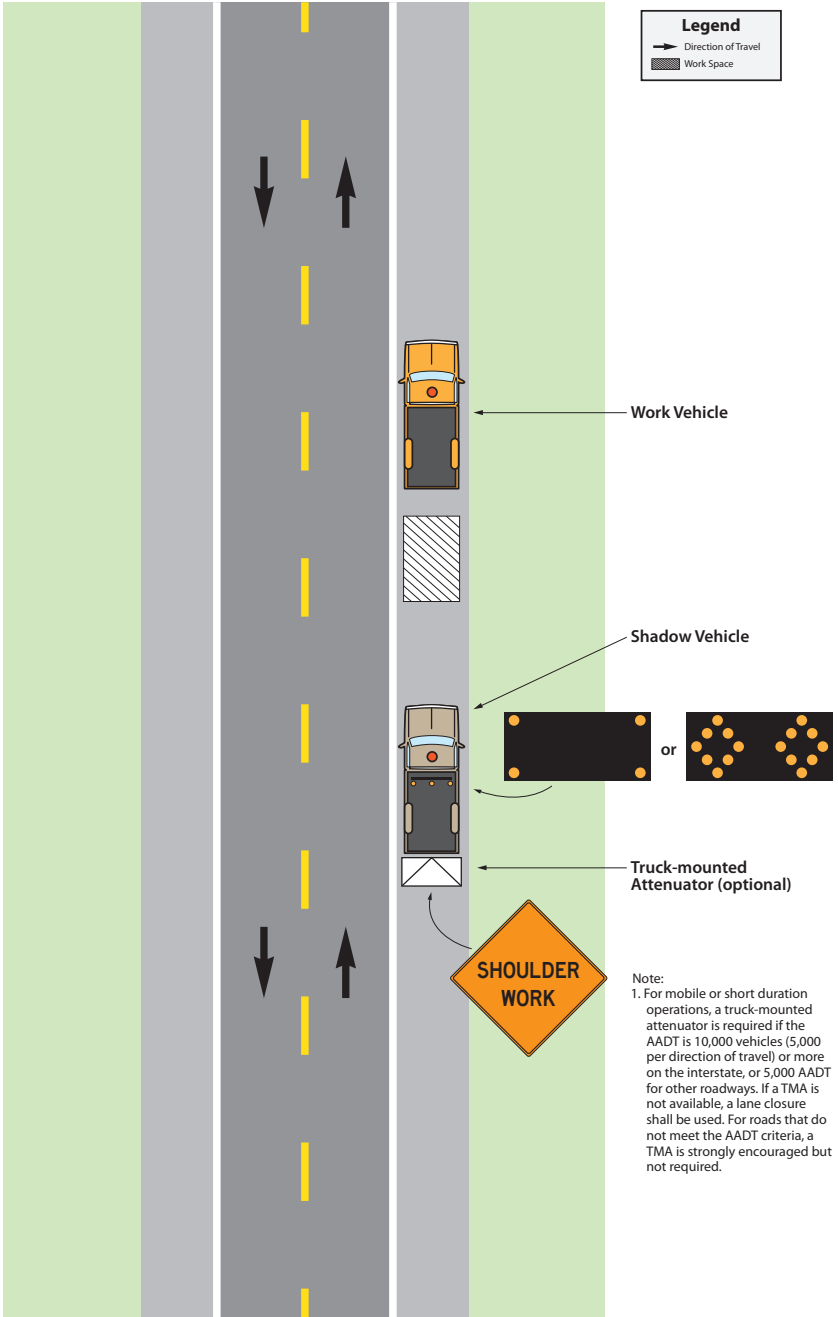


Figure 6a - Shoulder Closure on Interstate, Divided Highway, or Two-Lane

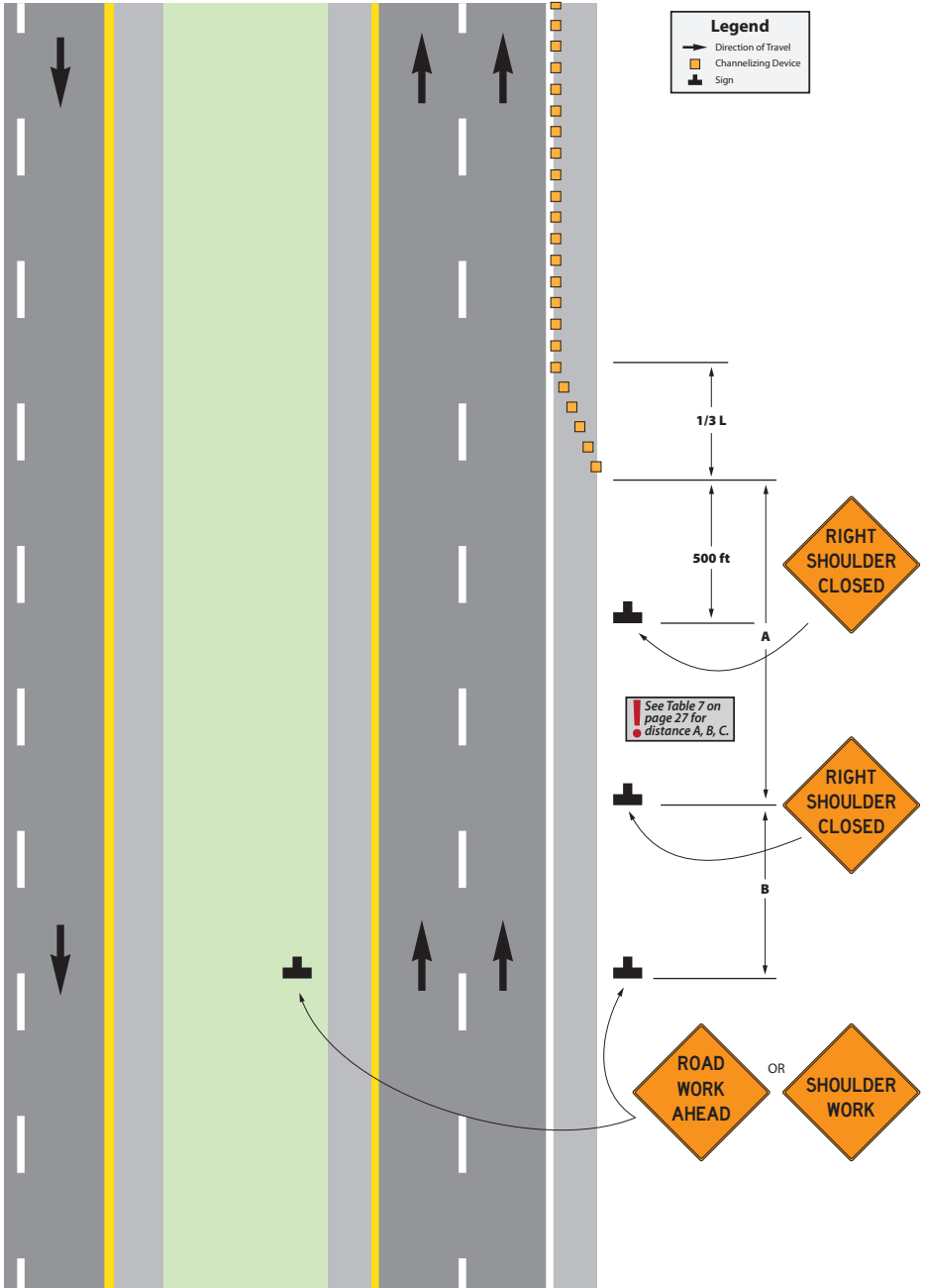


Figure 6b - Temporary Barrier on Interstate or Divided Highway

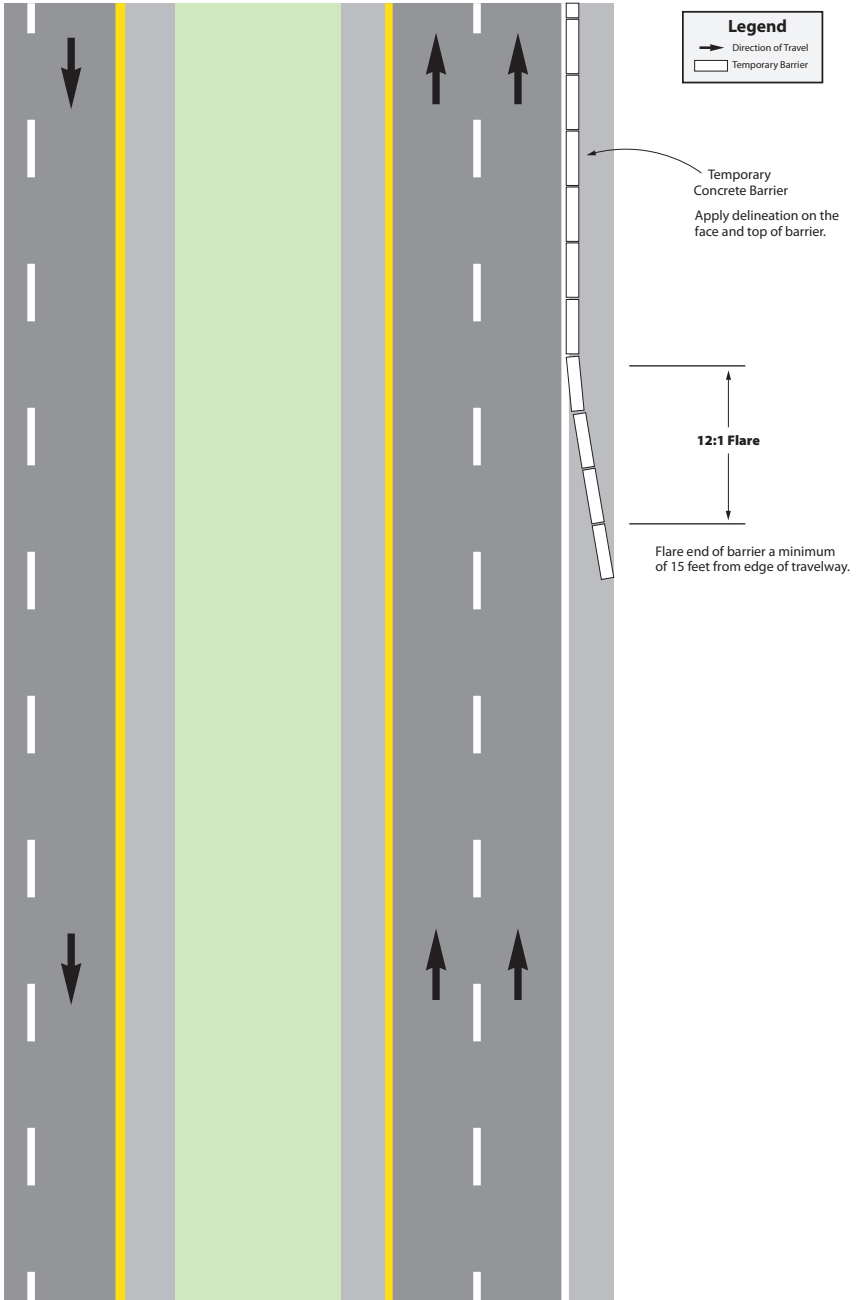


Figure 7 - Shoulder Work with Minor Encroachment for Two-Lane or Interstate

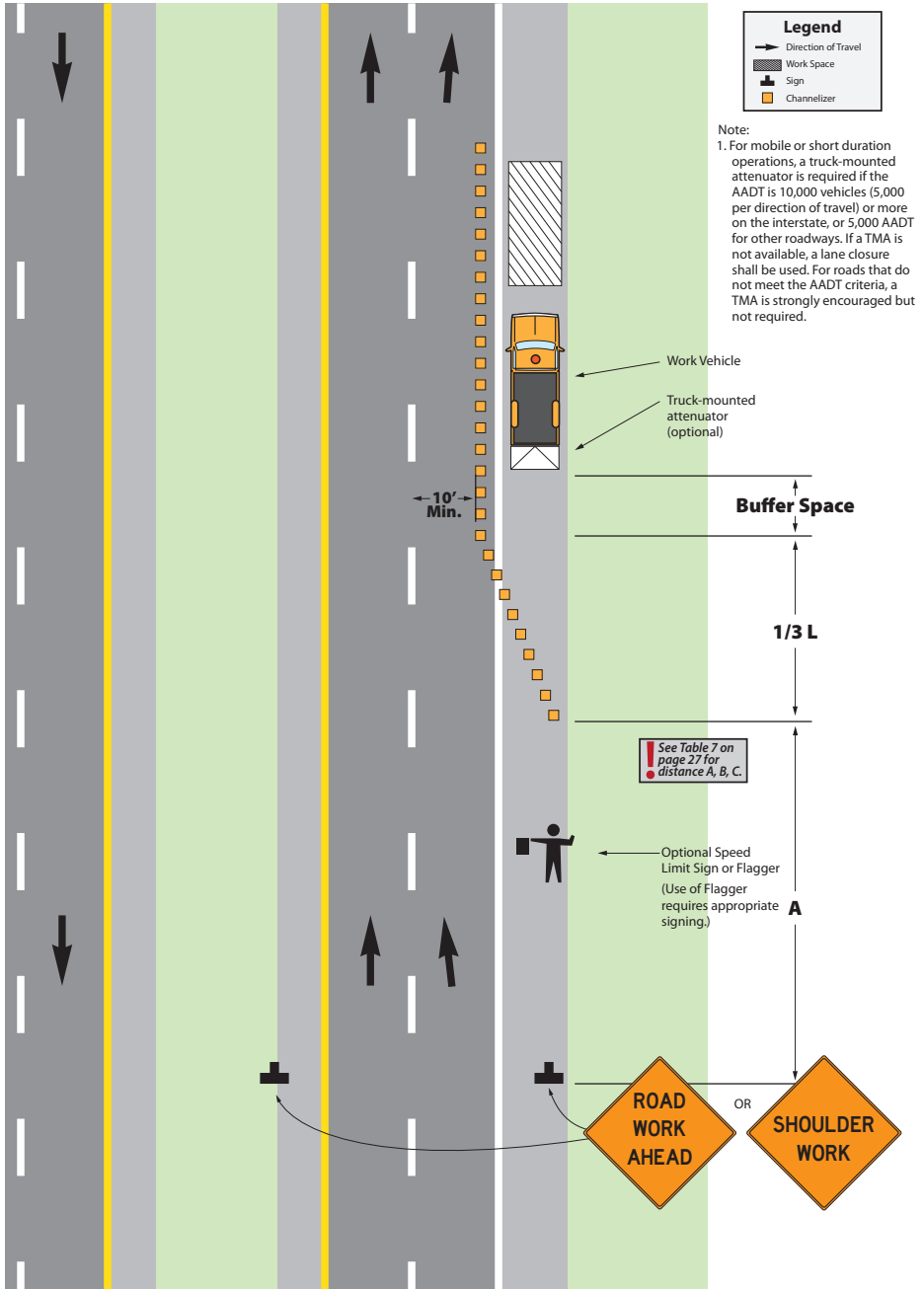


Figure 8 - Lane Closure on Two-Lane Road Using Flaggers

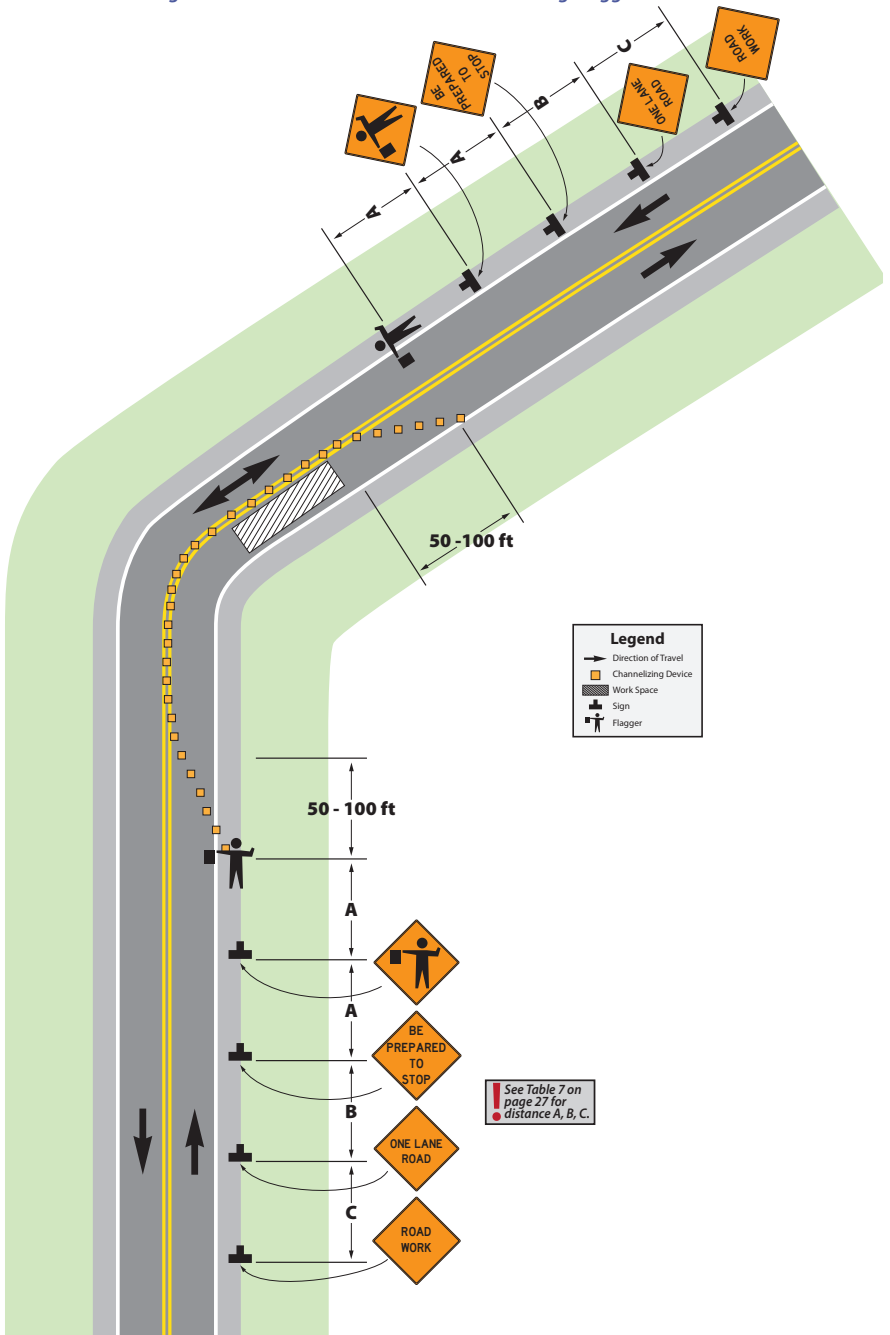


Figure 9 - Lane Closure on Two-Lane Road with Low Traffic Volumes
(400 vehicles/day or lower with clear views)

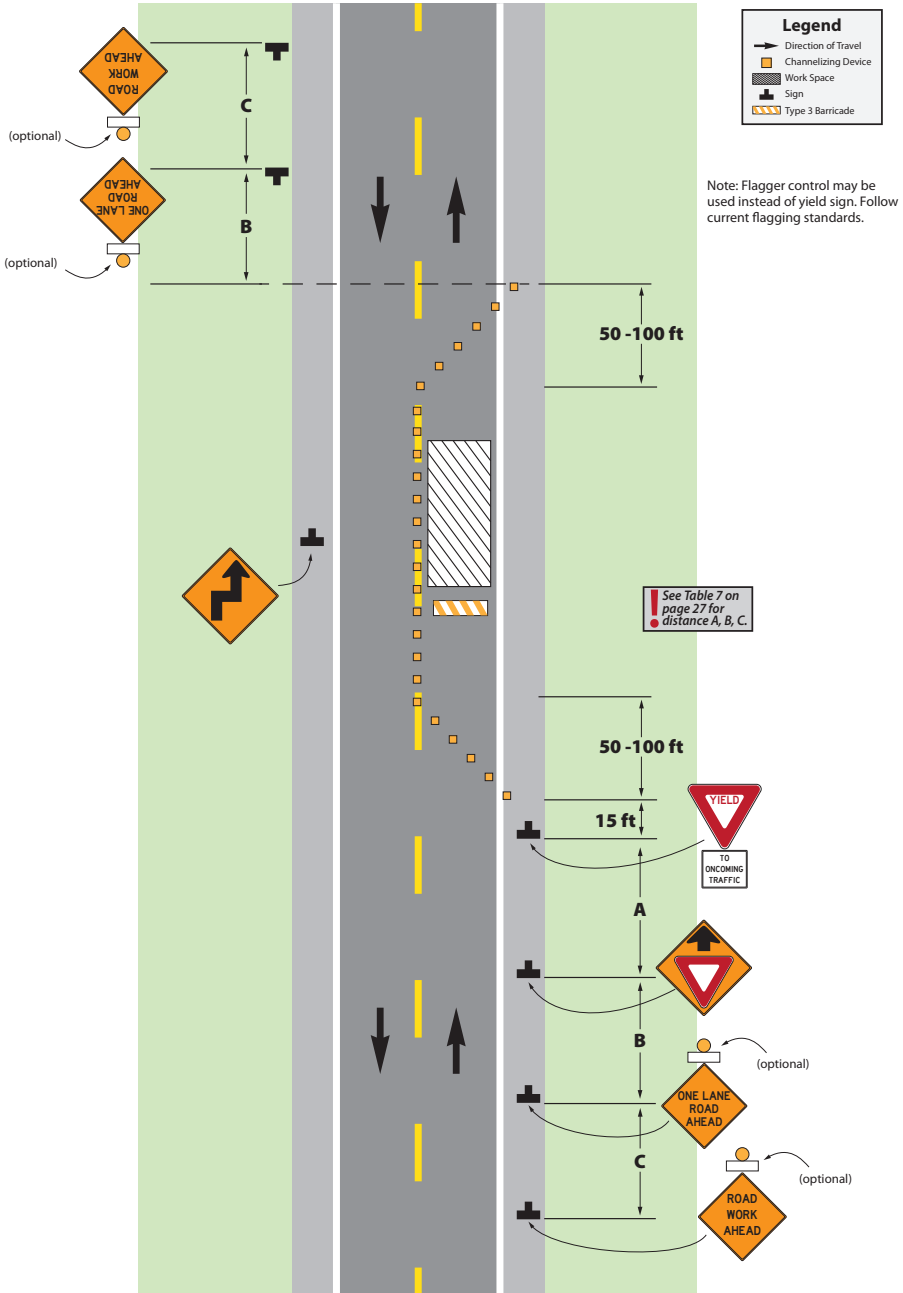


Figure 10 - Mobile Operations or Short Duration Work on Two-Lane Road

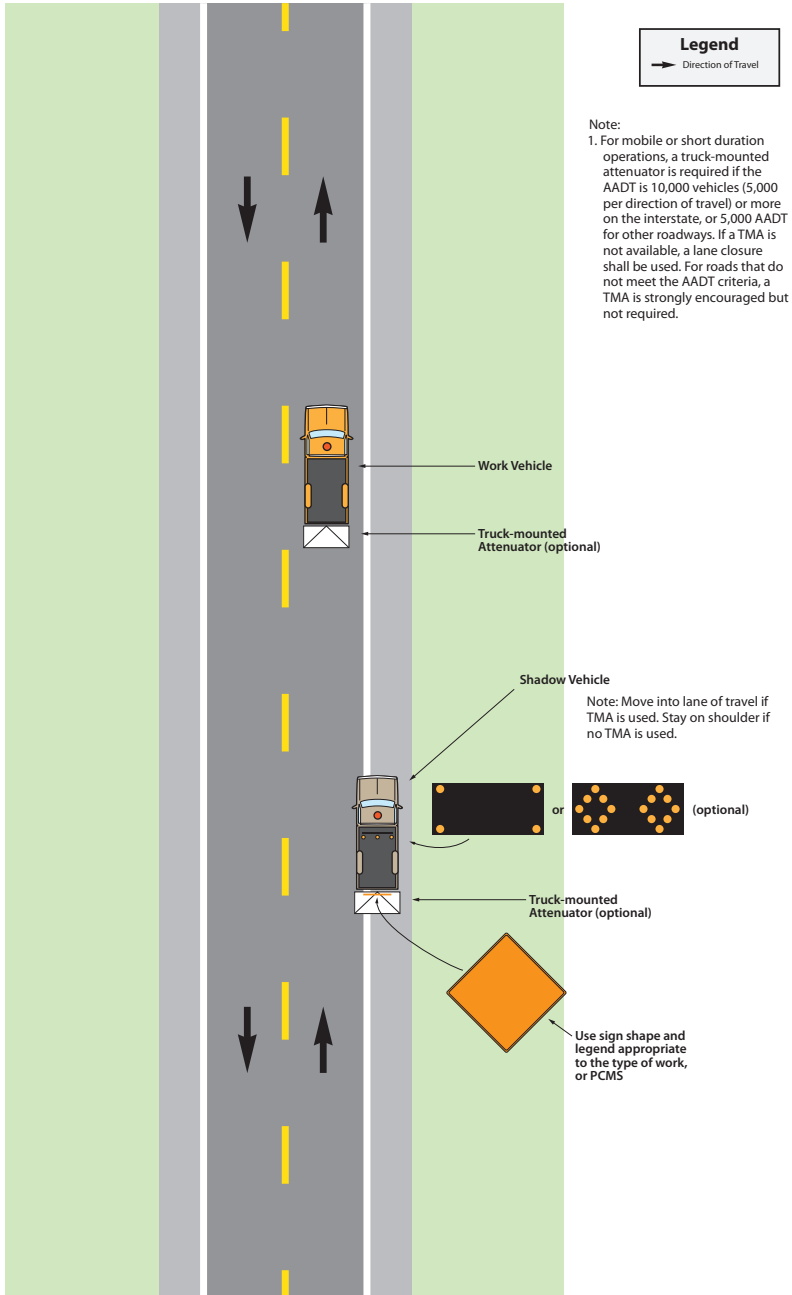


Figure 11 - Interior Lane Closure on a Multilane Road

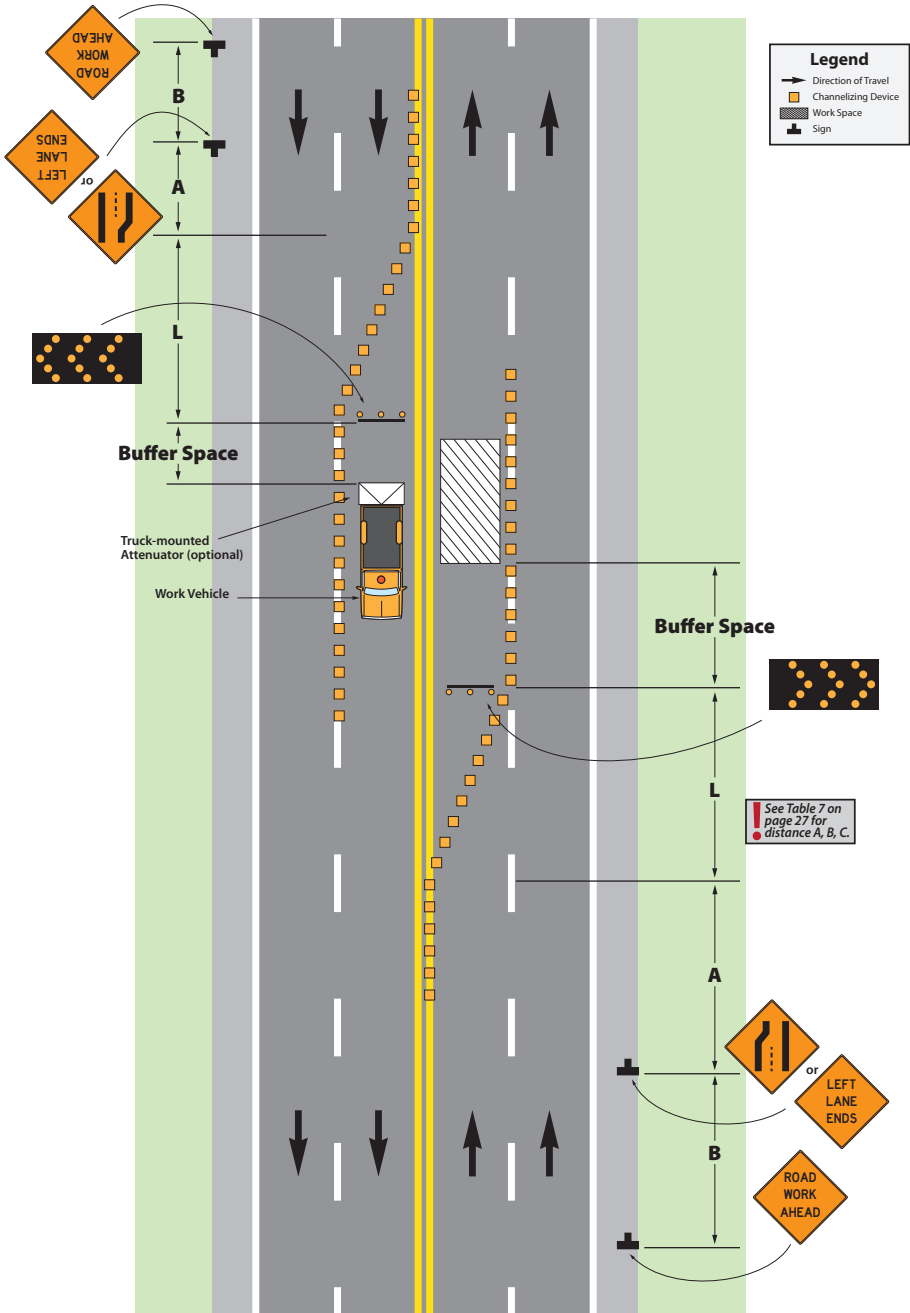


Figure 12 - Stationary Lane Closure on Interstate or Divided Highway
Intermediate and Short-Term

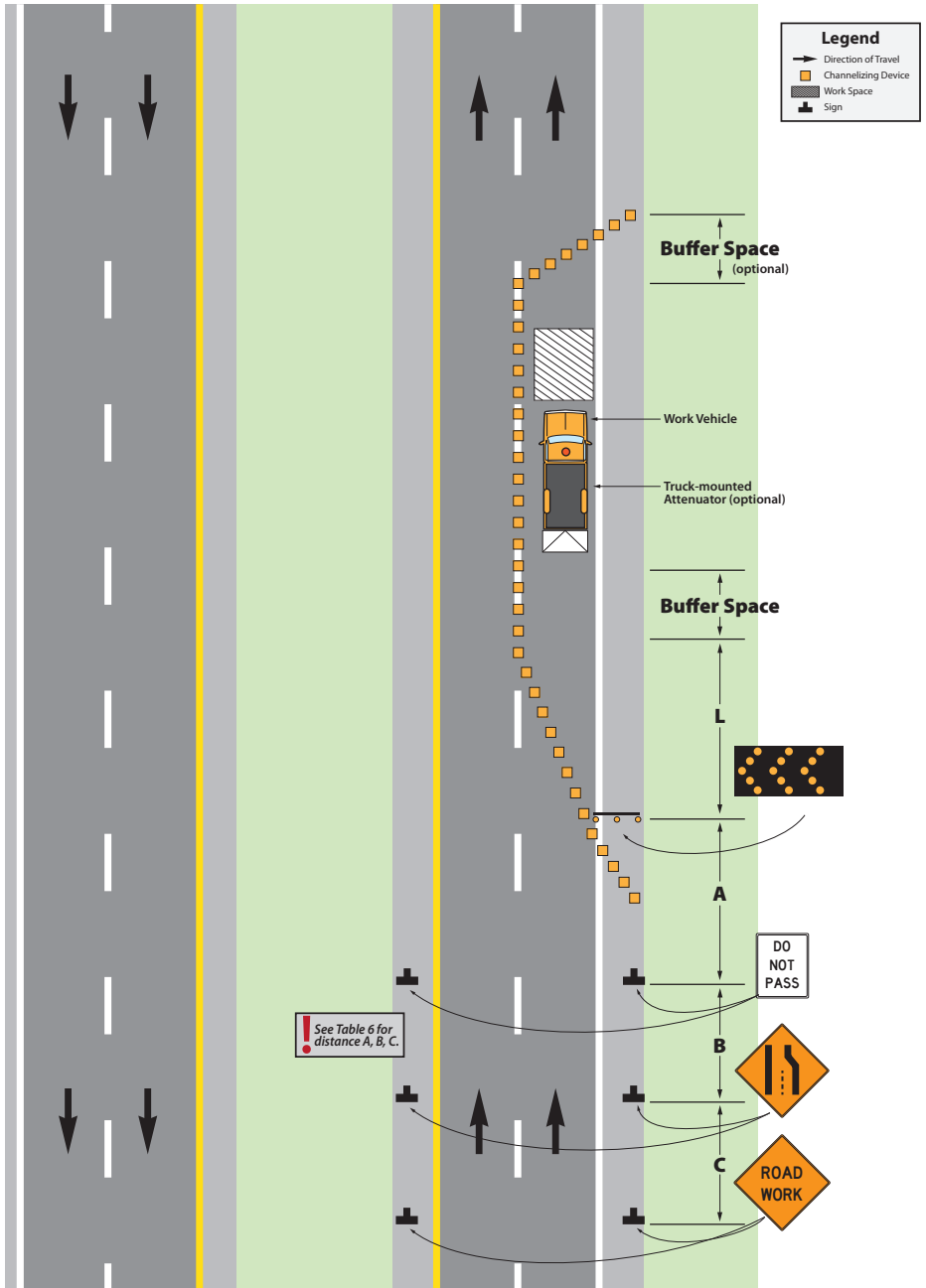


Figure 13a - Mobile or Short Duration Operation on a Multilane Road



Note:

1. For mobile or short duration operations, a truck-mounted attenuator is required if the AADT is 10,000 vehicles (5,000 per direction of travel) or more on the interstate, or 5,000 AADT for other roadways. If a TMA is not available, a lane closure shall be used. For roads that do not meet the AADT criteria, a TMA is strongly encouraged but not required.

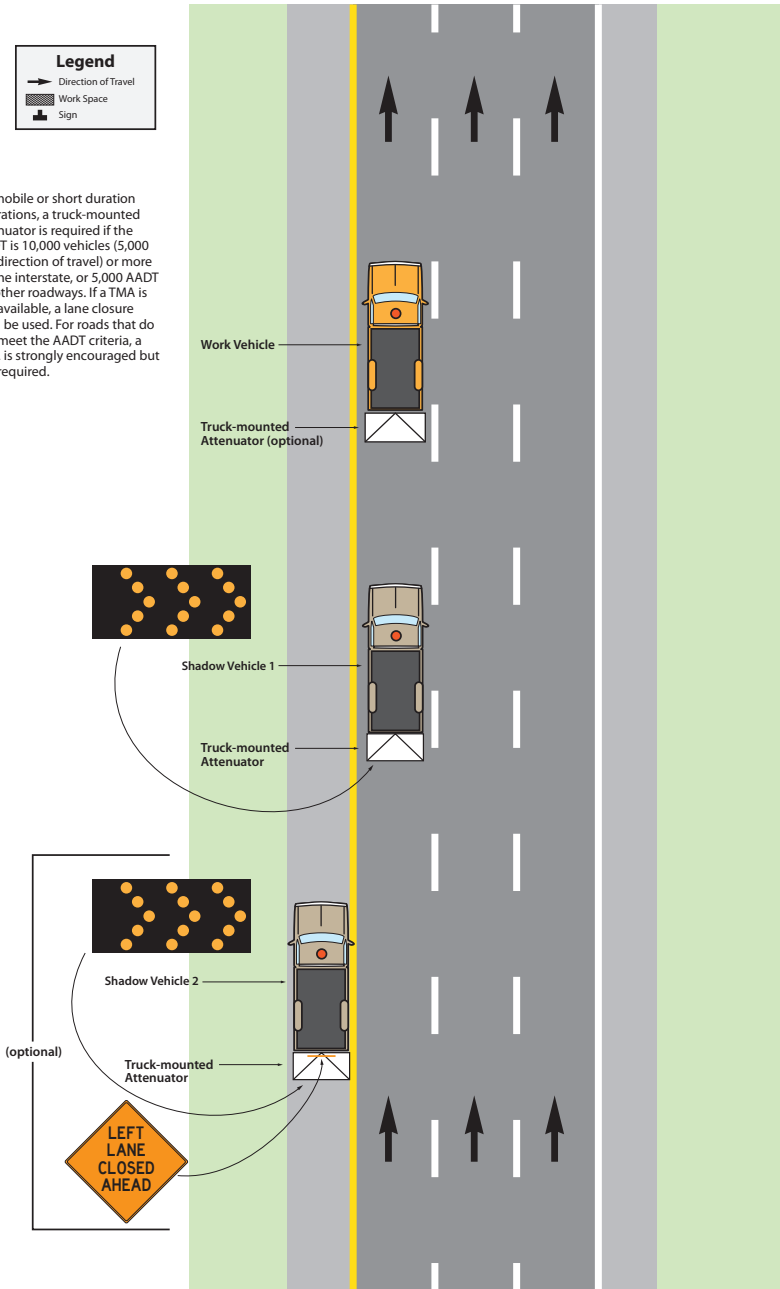


Figure 13b - Mobile or Short Duration Operation on a Multilane Road

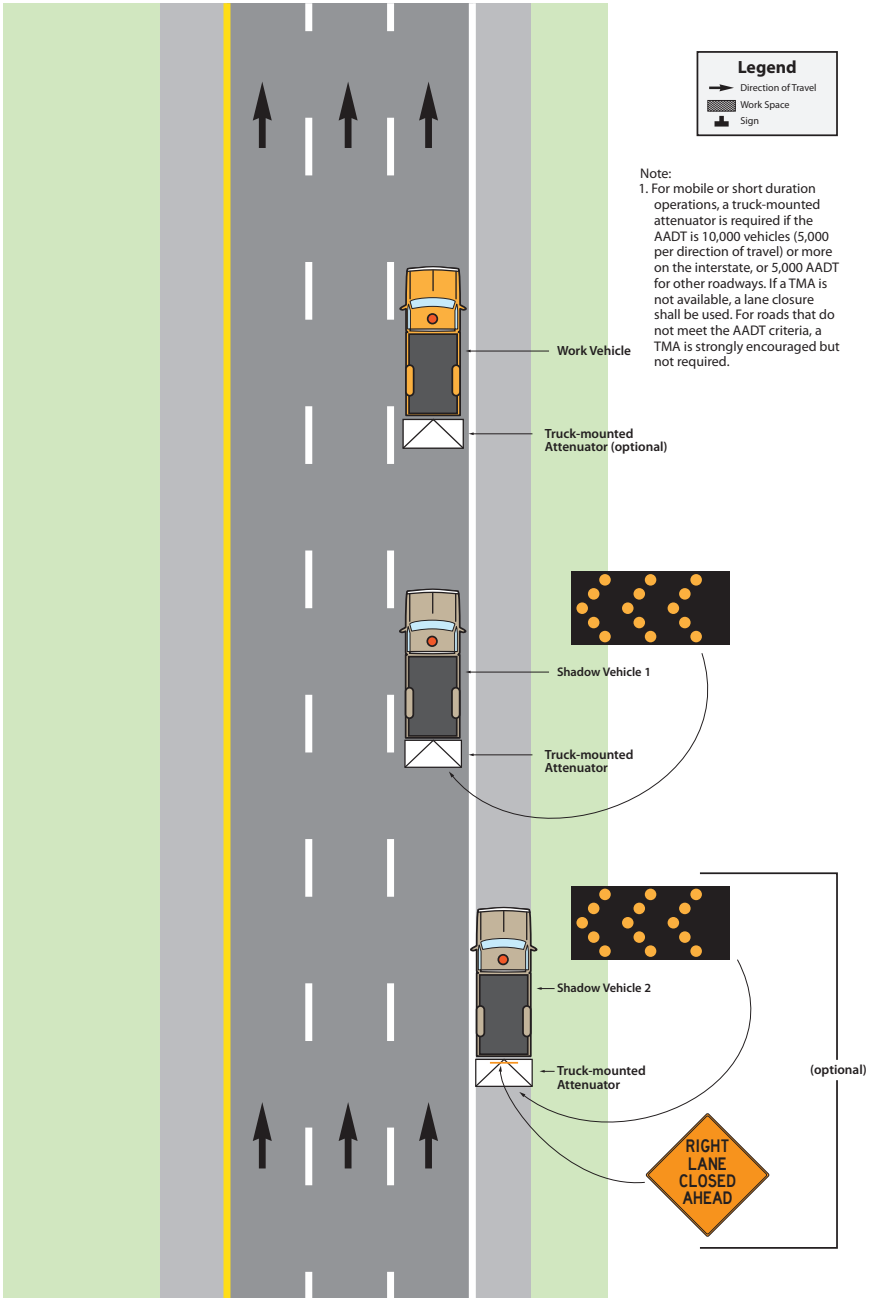


Figure 13c - Mobile or Short Duration Operation on a Multilane Road



Note:

1. For mobile or short duration operations, a truck-mounted attenuator is required if the AADT is 10,000 vehicles (5,000 per direction of travel) or more on the interstate, or 5,000 AADT for other roadways. If a TMA is not available, a lane closure shall be used. For roads that do not meet the AADT criteria, a TMA is strongly encouraged but not required.

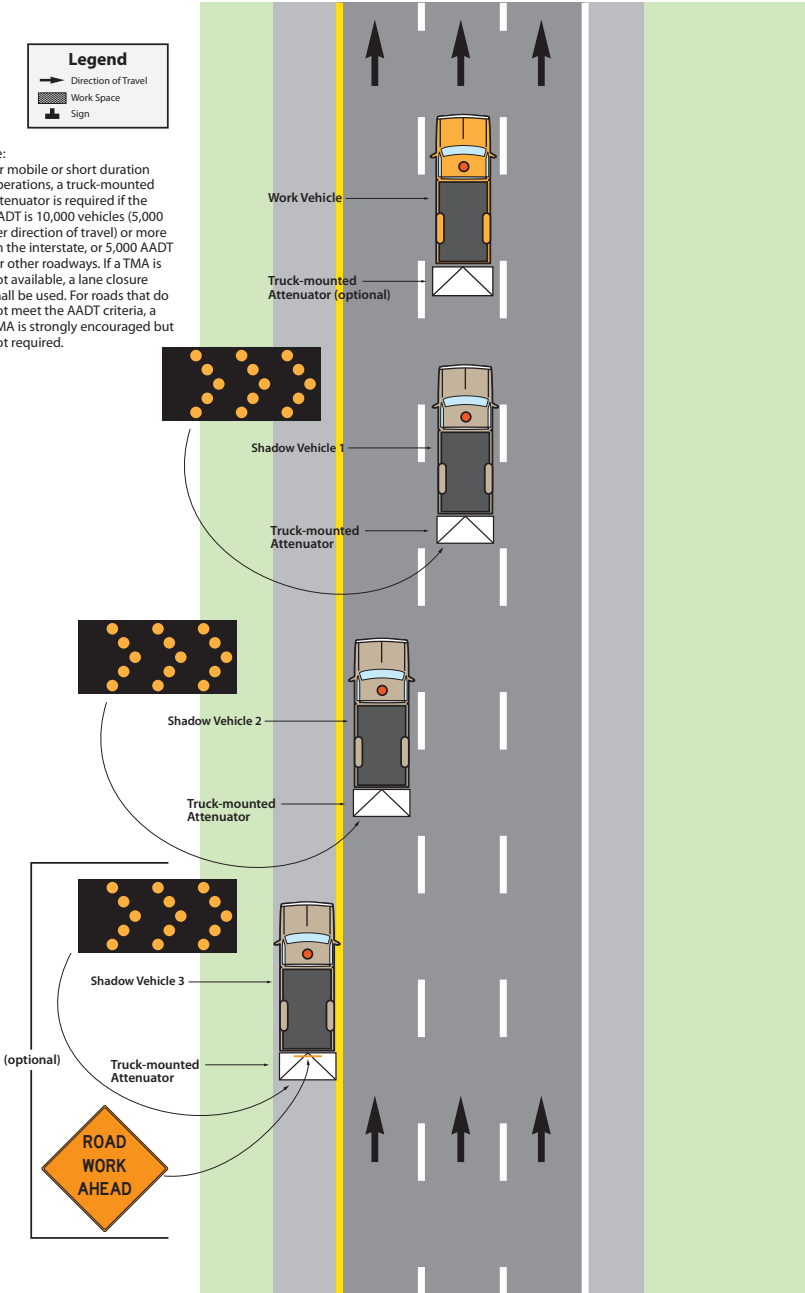


Figure 14 - One-Lane Closure on Two-Lane Road Using Pilot Car

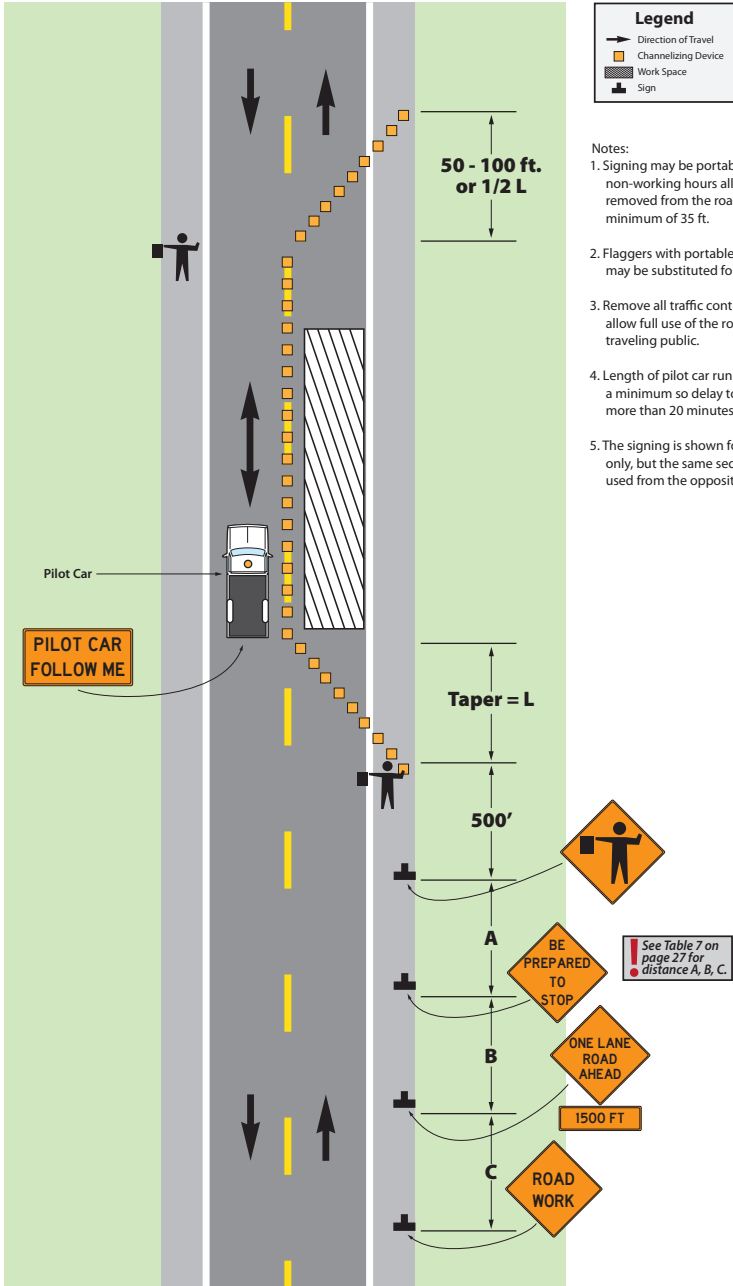


Figure 15a - Chip Sealing and Patching Operations Advance Signing

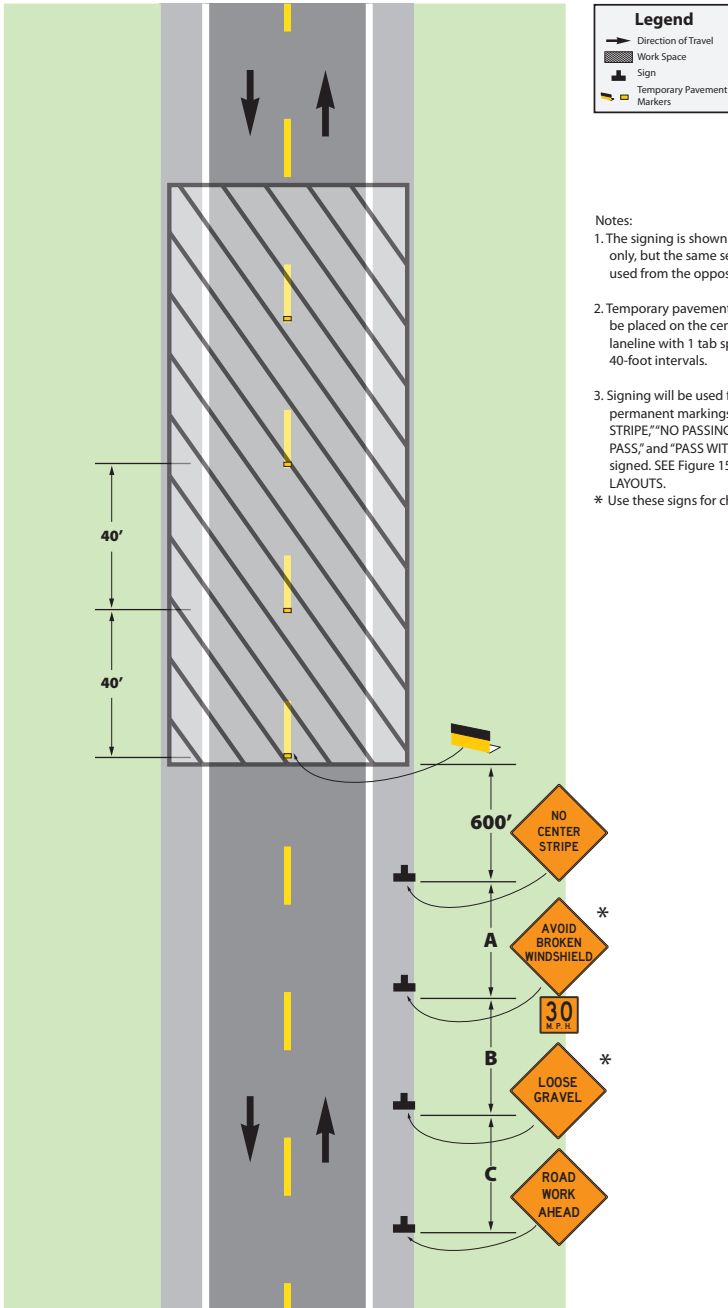


Figure 15b - Chip Sealing and Patching Operations No Passing Zone Signing

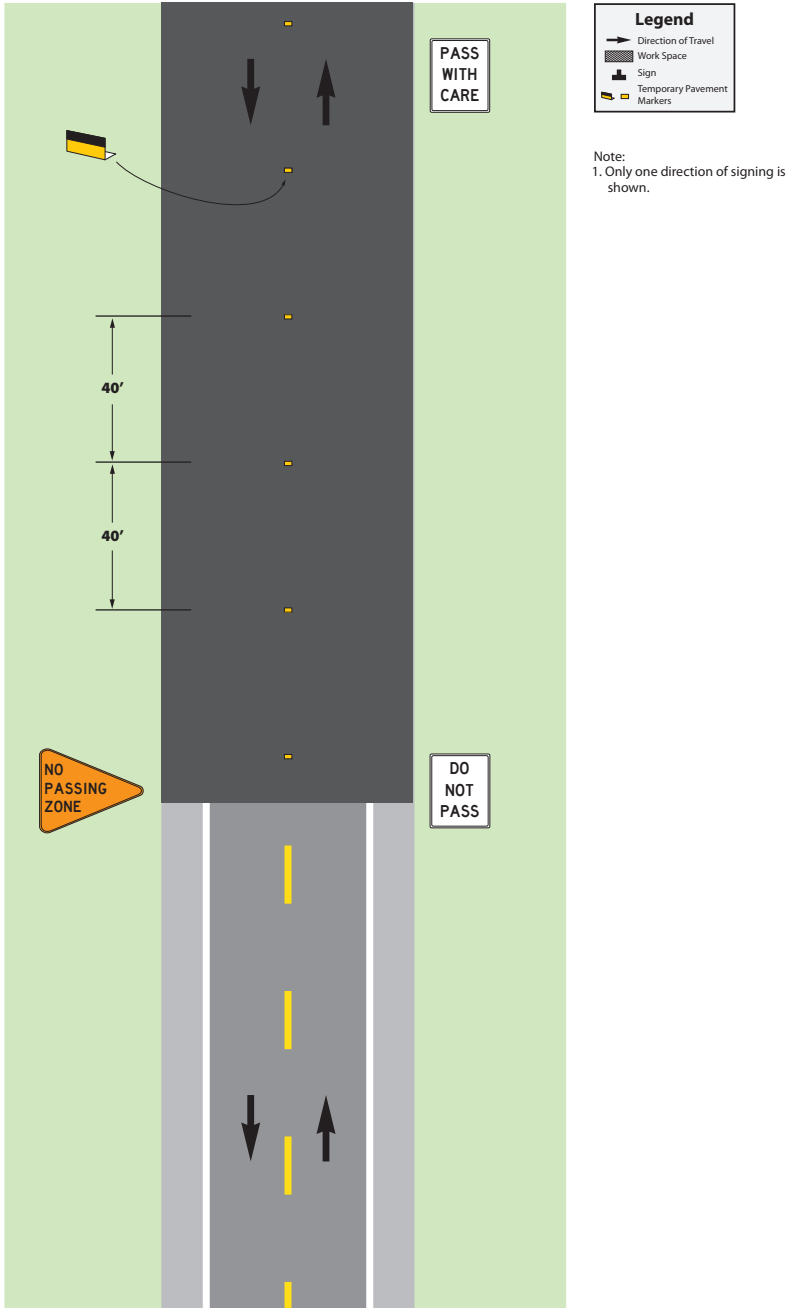


Figure 16a - Short-Term Road Damage, One Area

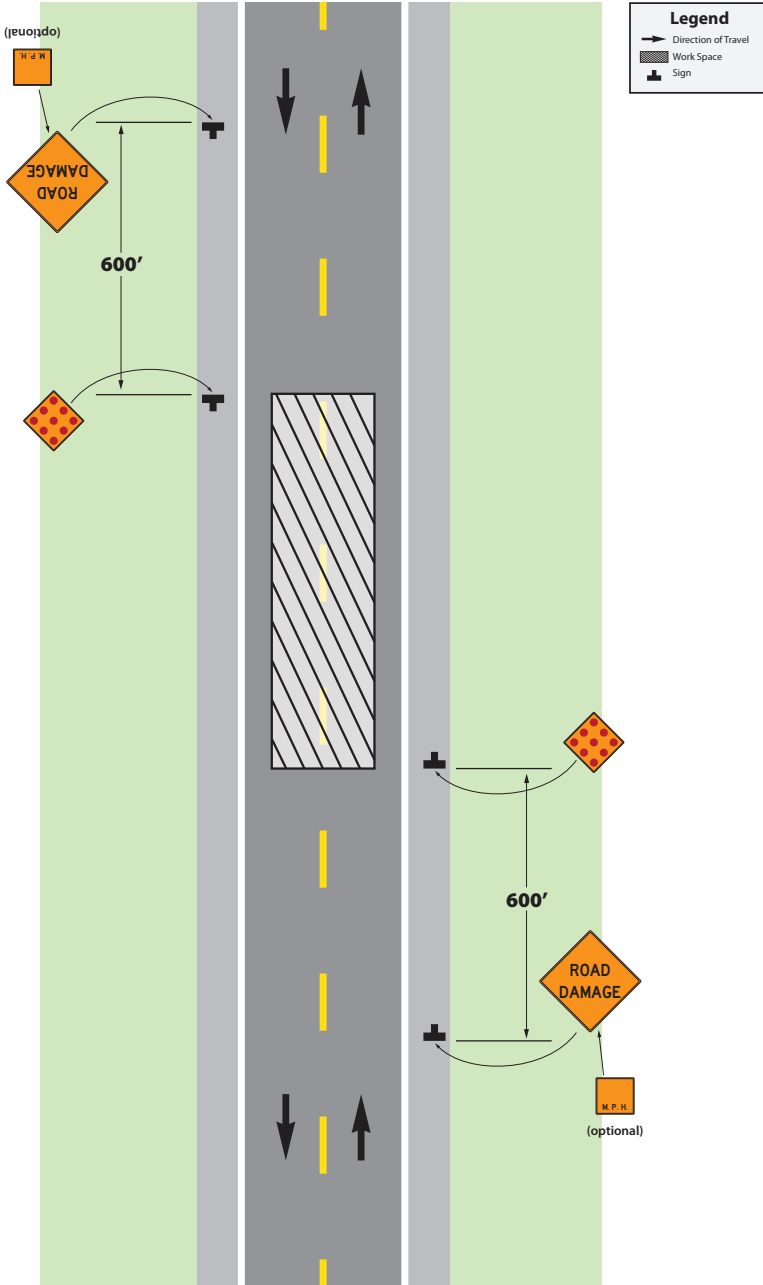


Figure 16b - Short-Term Road Damage, Multiple Areas

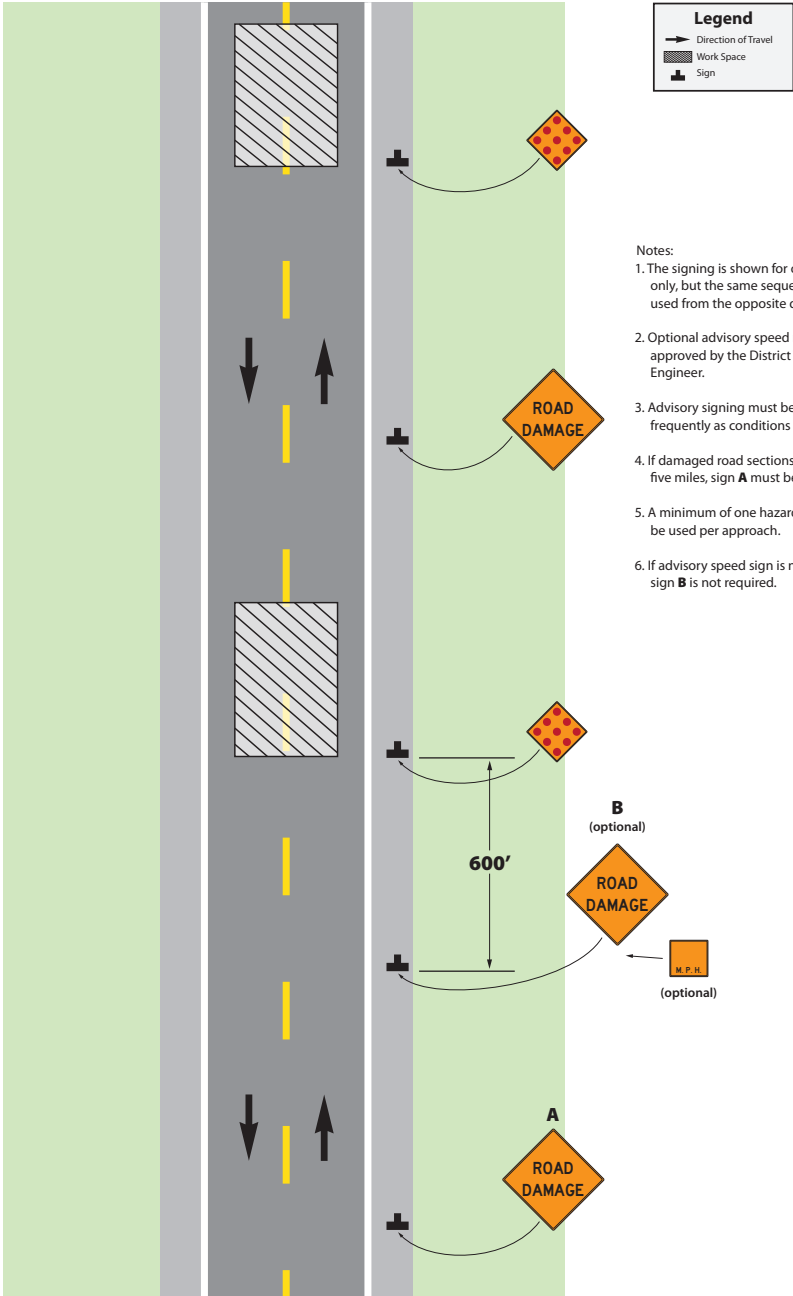


Figure 17 - Typical Speed Reduction on Two-Lane Road

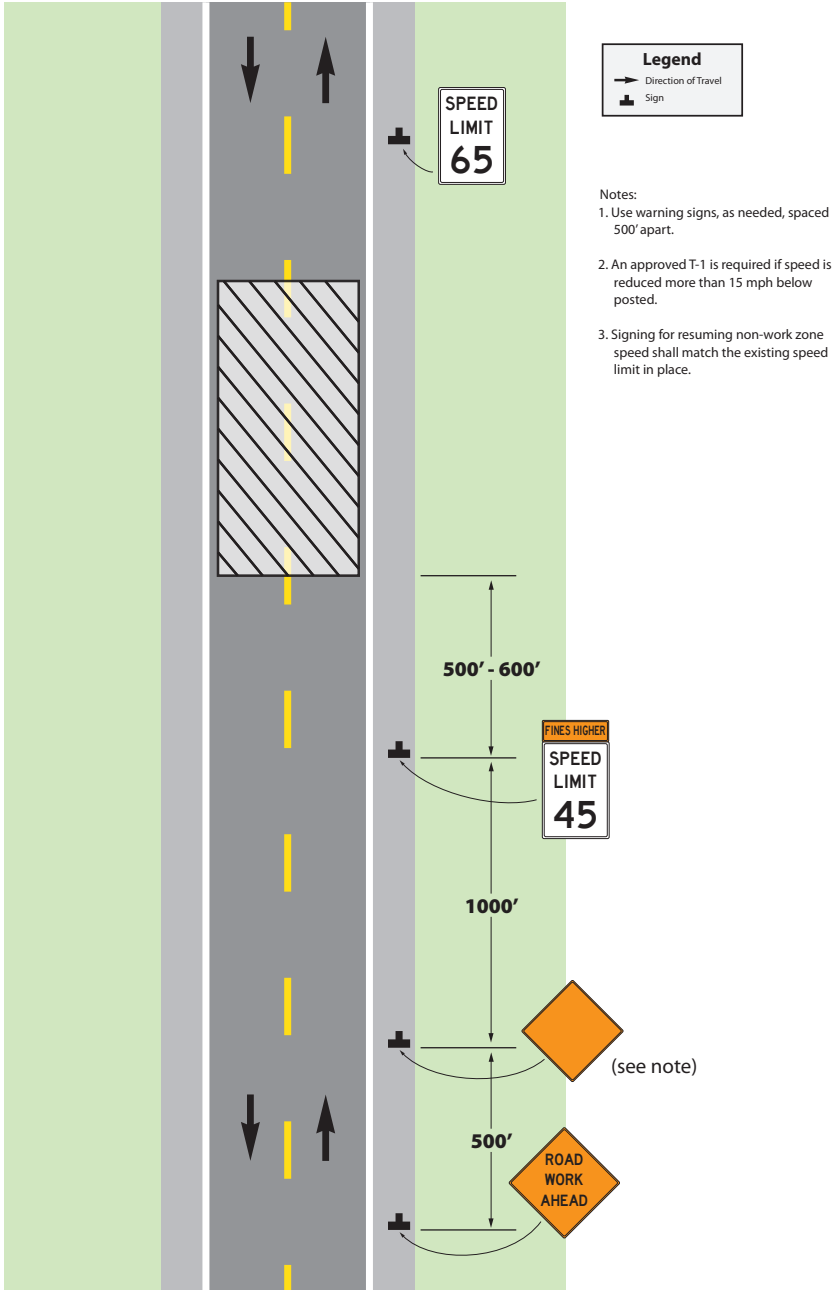


Figure 18 - Typical Speed Reduction on Interstate or Divided Multilane

