Work Zone Field Manual

For Maintenance Operations

TN TDOT Department of Transportation

Updated 2021

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List of Typical Applications

INTRODUCTION

The purpose of this Field Manual is to provide basic guidance for work zone traffic control and supplement *Part 6* of the *Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition*. These guidelines apply to Temporary Traffic Control (TTC) operations of 3 days or less for maintenance, construction, utility work areas, and incident management. Always follow any TTC plans, specifications, and special provisions written for a specific project.

The primary function of Temporary Traffic Control is to provide for the reasonably safe and efficient movement of road users through or around work zones while protecting workers, responders to traffic incidents, and equipment.

This manual contains basic principles, descriptions of the standard traffic control devices used in work areas, guidelines for the application of the devices, and typical application diagrams. The typical layouts contained in this manual are not comprehensive of all possible scenarios. Because all situations differ, experiential and engineering judgment should be used to ensure proper traffic control.

Field staff can contact the following if uncertain about how to proceed: Tech Supervisor, District Supervisor, District Manager, District Engineer, or the Regional Traffic Office.

These are guidelines, and not absolute standards. The information provided in this manual is intended to provide consistent statewide guidance in how TDOT Staff may address common work operations and does not address all possible work zone operations. Modifications to the layouts to fit specific work operations and locations are encouraged when called for by engineering judgment. Characteristics of the location such as weather, time of day, traffic volumes, traffic speed, roadway geometry, roadside conditions, and your inventory of traffic control devices should all be considered when implementing the guidelines of this manual. If the requirements in this manual cannot be physically implemented, then the MUTCD standards shall apply as the minimum.

This Field Manual is intended for TDOT Staff use only.

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MAJOR TRAFFIC CONTROL CONSIDERATIONS

General Responsibilities

Qualified individuals who have taken TDOT's Work Zone Safety series of training or completed coursework by other approved providers and have a basic understanding of the MUTCD should supervise the selection, placement, and maintenance of traffic control devices in TTC zones.

Prior to starting work, permission shall be obtained from the governing road authority. In addition, contact *Tennessee 811*, 1-800-351-1111, or 615-366-1987 at least five (5) days prior to when excavation begins. Beginning work earlier can result in forfeiture of your rights and protections granted under the Tennessee code, 65-31-101. *Tennessee 811* will issue the earliest legal start date possible, usually three (3) business days after you contact *Tennessee 811*.

TDOT's Lane Closure approval process should be completed prior to work start.

The governing road authority may limit the hours of work. Peak traffic periods vary by hour and day of week and all work should be scheduled during non-peak hours. When working in or near an intersection with a traffic control signal system, the road authority with jurisdiction over the signal should be contacted to ensure proper operation of the signal while the work is in progress.

Typical Application Activity Matrix

This Field Manual has been organized such that field personnel are able to determine the proper TTC layout(s) for the work zone needed. The layouts are divided primarily by the type of roadway, but a matrix is also provided to assist in choosing a TTC by the activity being performed. The matrix on the following page shows the suggested TTC for various work activities.

- A listing of common work activities is provided along with the TTC layouts (Typical Applications) that may be considered.
- No situation will exactly match those provided in the Typical Applications. Experiential and engineering judgment should be used to determine which layout best matches your situation.
- Recommended method for using the matrix:
  - Determine the work activity and find it, or an activity similar to it, in the matrix.
  - Determine the location of the work activity (e.g., in a travel lane, on the shoulder, in the median). The location of the work affects the type of Typical Application used.
  - Determine the duration of the activity. Again, the duration of the work affects the type of Typical Application that can be used.
  - Review all suggested Typical Applications to see which best fits the operation.
- TTC supervisors should be fully aware of the variations in the layouts due to the various factors, as well as when and how the layouts may be modified. See the *Checklist for Establishing a Temporary Traffic Control Zone* on page 138.
- TTC supervisors should conduct the *TDOT 4Us Daily Checklist*, included on page 142.

GENERAL ACTIVITY

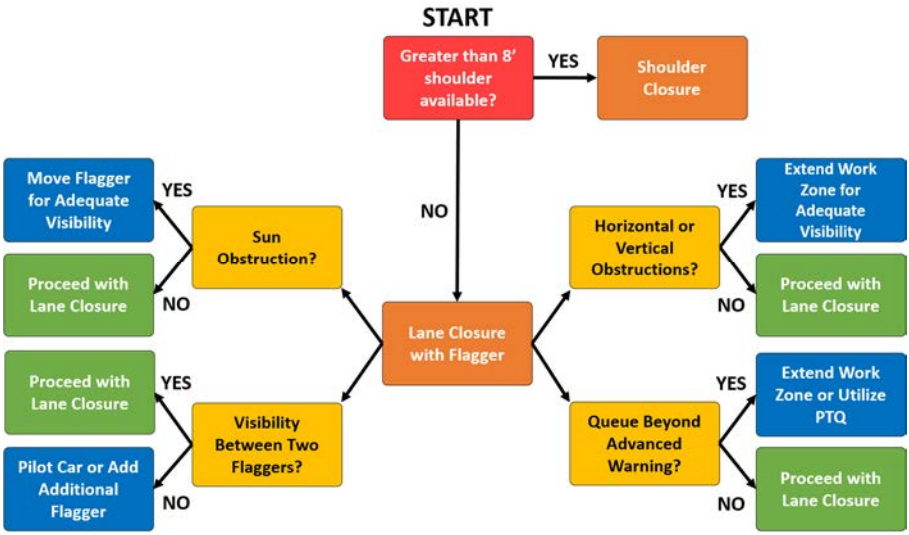
TYPICAL APPLICATION

	POTHOLE REPAIR	PAVING ACTIVITIES	SHOULDER MAINTENANCE	STORM SEWER MAINTENANCE	ROW/BOOM/SLOPE MOWING	LITTER/ANIMAL/LARGE DEBRIS CLEARING	OFF-SHOULDER MAINTENANCE	STREET CLEANING	BRIDGE REPAIR	PAVEMENT MARKING/STRIPING	GUARDRAIL/CRASH REPAIR	SINKHOLE/SLOPE REPAIR	EMERGENCY MANAGEMENT	CHEMICAL APPLICATION/SPRAYING
(4) Shoulder Closure			x	x	x	x			x		x	x	x	x
(5) Off Shoulder				x	x	x	x				x	x		x
(8) 2-Lane Mobile Lane Closure		x			x			x		x				x
(9) 2-Lane Stationary Lane Closure	x	x	x	x		x			x	x	x		x	
(20) Multi-Lane Undivided Left Lane Closure	x	x				x				x			x	
(21) Multi-Lane Undivided Outside Lane Closure	x	x	x	x		x			x	x	x		x	
(23) Multi-Lane Divided Mobile Shoulder > 8ft Closure	x		x		x	x								x
(24) Multi-Lane Divided Mobile Shoulder < 8ft Closure	x		x		x	x								x
(25) Multi-Lane Divided Mobile Lane Closure		x			x			x		x				x
(26) Freeway Mobile Double Lane Closure	x	x												
(28) Multi-Lane Divided Short Duration Lane Closure					x			x						x
(29) Multi-Lane Divided Outside Lane Closure Nighttime	x		x	x					x		x		x	
(31) Multi-Lane Divided Outside Lane Closure	x	x	x	x		x			x	x	x		x	
(32) Multi-Lane Stationary Inside Lane Closure	x	x		x		x			x	x				
(33) Multi-Lane Divided Left Two Lanes Closed	x	x				x			x	x			x	
(34) Multi-Lane Divided Right Two Lanes Closed	x	x				x			x	x			x	
(35) Freeway Double Lane Closure	x	x				x			x	x			x	
(57) Multi-Lane Divided Median Closure						x								

Special Considerations

Typical layouts contained in this manual may need to be modified to fit more complex roadway conditions or operations. Special considerations to be considered include, but are not limited to, the following: shoulder width, horizontal and vertical geometry, lighting conditions, presence of fog, weather conditions, and queuing activity. The figure below is provided to help determine if adjustments should be made for scenarios that would normally call for a shoulder closure typical application.

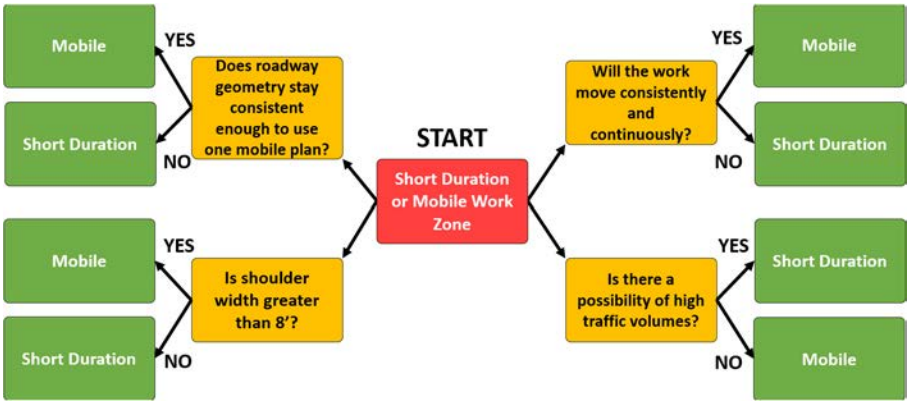
Shoulder Closure vs Lane Closure with Flaggers



Another situation that requires adjustments based on the special considerations is whether a mobile operation or a short duration work zone should be set up. A mobile operation is continuously moving or stopped in one location for periods of 15 minutes or less and traffic control devices are typically mounted on work vehicles. Short duration work zones stay in one location during daylight conditions from 15 minutes to one hour and minimal TTC devices are deployed.

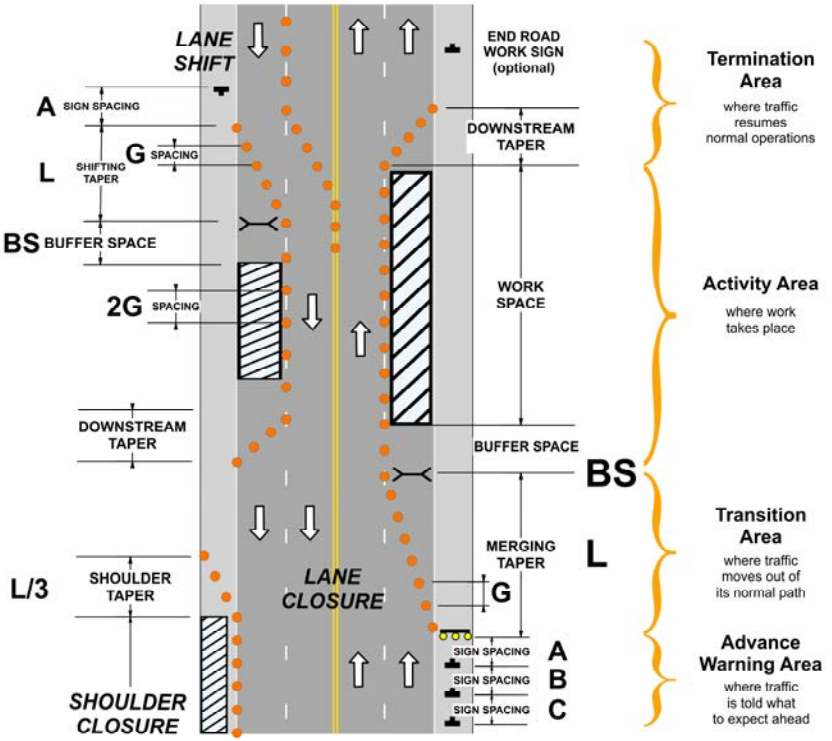
The figure below is provided to help determine whether to use a mobile operation or short duration work zone.

Mobile vs Short Duration

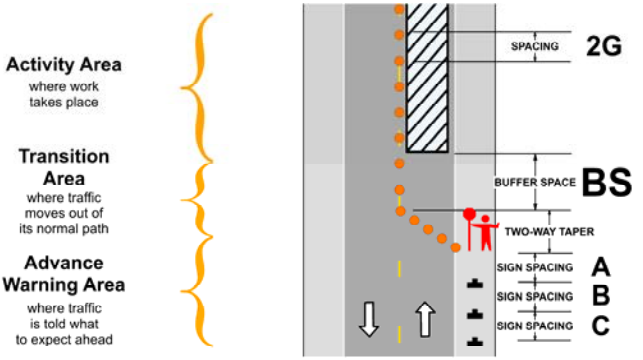


Components of a Temporary Traffic Control Zone

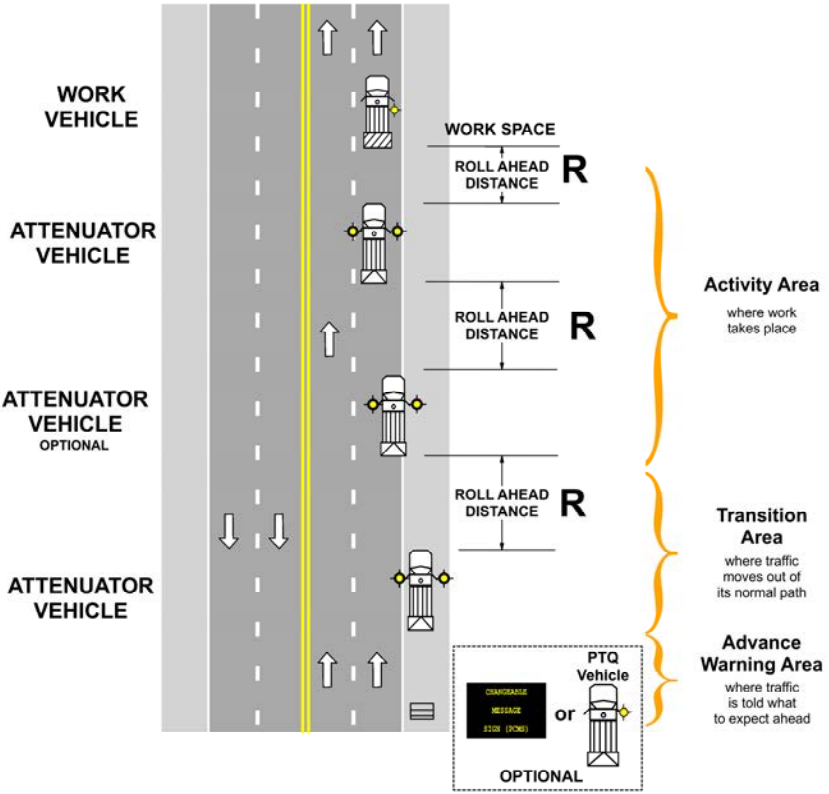
Multi-Lane Stationary Temporary Traffic Control Zone



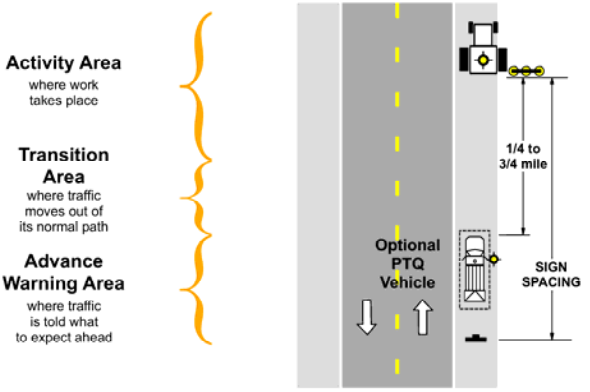
Two-Lane Stationary Temporary Traffic Control Zone



Multi-Lane Mobile Temporary Traffic Control Zone



Two-Lane Mobile Temporary Traffic Control Zone



Tapers

Merging Taper

The merging taper is used on a multi-lane road to close a lane and combine its traffic from that of the adjacent lane. Its length is dependent on the posted speed of the roadway. Higher speeds require a longer distance for traffic to merge lanes. Typical merging taper lengths (L) are included in the Taper Length Chart below. These lengths are rounded up to the nearest 20 feet.

Shifting Taper

The shifting taper is used to shift traffic in a lane to follow a new traffic pattern. This does not require traffic to merge into the adjacent lane. See the Taper Length Chart for the shifting taper lengths (L). While the MUTCD uses a value of (L/2) for a shifting taper, TDOT uses the full value of (L).

Shoulder Taper

The shoulder taper is used to close the shoulder off to traffic so that shoulder work can be done, or equipment can be placed on the shoulder. Since this taper is used to guide errant traffic back to its normal lane path, it does not require a full merge distance. The taper length is reduced to one-third of a merging taper length (**L/3**). See the Taper Length Chart for the shoulder taper lengths. These lengths are rounded up to the nearest 20 feet.

Table 1 - Taper Length Chart

Posted Speed Limit (mph)	Merging and Shifting Taper (L) (ft)	Shoulder Taper (L/3) (ft)
30	180	60
35	260	100
40	320	120
45	660	220
50	720	240
55	780	260
60	840	280
65	900	300
70	960	320
75	1020	340

Following are the formulas used to calculate taper length (L):

Under 45 mph: $L = WS^2/60$ 45 mph or over: $L = WS_{10}$

W = offset width (ft); S = posted speed; S_{10} = 10 mph over posted speed where W is assumed as 12 feet.

Downstream Taper

The downstream taper is optional and placed at the end of the activity area which guides traffic back into its original lane. When used, this taper has a minimum of five devices over a distance ranging from 50 feet to 100 feet with a 10-20 foot spacing between channelizing devices.

Two-Way Taper

The two-way taper is used on two-lane, two-way roads to change the road into a single lane of two-way traffic. It is primarily used for flagging operations and other traffic control situations. It is 50 to 100 feet in length and contains a minimum of five equally spaced channelizing devices.

Sight Distances

Approach Sight Distance

The approach sight distance is the distance in which a motorist can visually identify a workspace. The workspace may include the flagger station, a lane closure, a slow moving or stopped vehicle, or any other situation which requires adjustments by the motorist.

Decision Sight Distance

The decision sight distance is used to determine the minimum sight distance to flaggers and mobile operations. It is the total distance traveled during the length of time required for a driver to:

- Detect an unexpected or otherwise difficult-to-perceive information source or hazard in a roadway environment that may be visually cluttered,
- Recognize the hazard or its potential threat,
- Select an appropriate speed and path, and
- Initiate and complete the required maneuver safely and efficiently.

The required decision sight distances (**D**) based on speed are shown in Table 2.

Table 2 – Decision Sight Distance Chart

Posted Speed Limit (mph)	Distance (D) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

Device Spacing Criteria

Channelizing Devices

The function of channelizing devices is to delineate a desired vehicle path, mark specific hazards on or near the roadway, separate opposing traffic flows, and partially or totally close the roadway. The table to the right shows the maximum spacing of channelizing devices.

Table 3 - Device Spacing Chart

Posted Speed Limit (mph)	Channelizing Device Spacing (G) (ft)
< 45	20
≥ 45	40

Advance Warning Signs

The distance from the first sign to the start of the transition area should be long enough to give motorists adequate time to respond to the conditions. The table below summarizes the advance warning sign dimensions as referenced in the Stationary and Mobile Temporary Traffic Control Zone diagrams on pages 8 and 9, respectively. The A dimension is the distance from the transition to the first sign; B is the distance between the first and second signs; and C is the distance between the second and third signs.

Table 4 - Advance Warning Sign Spacing Chart

Road Type	Advance Warning Sign Spacing (ft)		
	A	B	C
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Buffer Space

Buffer space is the space which provides a margin of safety for both the driver and the workers. It is important that the buffer space be free of equipment, workers, material, and vehicles. The table to the right shows the required buffer space based on the speed limit, which is based on the stopping sight distance for all lane closures outside of flagger-controlled work zones (See page 19).

Table 5 - Buffer Spacing Chart

Posted Speed Limit (mph)	Buffer Space (BS) (ft)
30	200
35	260
40	320
45	360
50	440
55	500
60	580
65	660
70	740
75	820

Attenuator Vehicles

The **attenuator vehicle** is the vehicle that is placed in advance of the workspace and equipment to block errant motorists from entering the workspace. An attenuator vehicle may be used in a mobile operation to provide extra safety for the workers. The recommended minimum distance between an attenuator vehicle and the workspace is the Roll Ahead Distance (**R**). TDOT requires the roll ahead distances in the table below for short-term stationary, short duration, and mobile work zones. Truck or trailer mounted attenuator (TMA) vehicular operating weight is a primary component for proper TMA positioning; therefore, the distances listed are based on a tandem dump truck of ballasted single axle. The equivalent number of 10'-30' skip lines is provided to aid operators in easily determining their distance from the workspace.

Table 6 - Roll Ahead Distance Chart

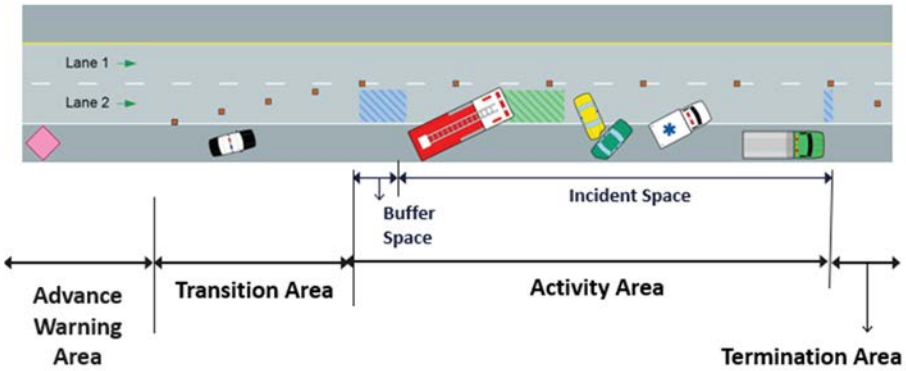
Facility Type	Roll Ahead Distance (R)	
	(ft)	# skip lines
Rural 2-Lane	75 – 100	3
Interstate/4-Lane Divided	150 – 175	5

Refer to the *Truck and Trailer Mounted Attenuators Manual* for additional guidance.

Incident Management

Introduction

A traffic incident management area is an area of a highway where temporary traffic controls are installed, as authorized by a public authority or the official having jurisdiction of the roadway, in response to a road user incident, natural disaster, hazardous material spill, or other unplanned incident. It is a type of TTC zone and extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where vehicles return to the original lane alignment and are clear of the incident.



Highway incident management includes the arrival, recovery, clearance, and termination of activities. Keys to the success of incident management include proper and safe traffic control at the incident scene and the areas affected by traffic movement and operation of vehicles approaching, passing, re-directed or otherwise affected by activities causing a disruption of safe travel through the incident scene per *MUTCD, Chapter 6I*.

Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes include:

- **Major Traffic Incidents** – Traffic incidents involving hazardous materials, fatal traffic crashes involving numerous vehicles, and other natural or man-made disasters. These traffic incidents typically involve closing all or part of a roadway facility for a period **exceeding 2 hours**.
- **Intermediate Traffic Incidents** – Traffic incidents that typically affect travel lanes for a period of **30 minutes to 2 hours**, and usually require traffic control on the scene to divert road users past the blockage.
- **Minor Traffic Incidents** – Traffic incidents typically involving disabled vehicles and minor crashes that result in lane closures of less than **30 minutes**.

Protect the Queue

Protect the Queue (PTQ) is a TDOT initiative that emphasizes the importance of providing advance warning to upstream traffic of a downstream incident in order to reduce the likelihood of a secondary accident.

TDOT will deploy resources and staff to establish a safe and mobile traffic control plan, including adequate traffic queue protection and motorist information plan using the following guidance:

- Queue protection activities are to be conducted on the shoulder or closed travel lane.
- Queue protection vehicles shall be placed to create an appropriate buffer zone between the end of the queue and oncoming traffic to maintain a warning area of approximately 0.25 to 0.75 miles upstream from the end when possible.
- PTQ Responders and Operations personnel shall consider roadway geometrics (hills and curves) as well as sight distance when staging a truck.
- Under no circumstances shall a PTQ truck be staged in an active travel lane.
- When repositioning a PTQ truck to accommodate queue movement, operators should only do so by backing up when there is both a clear sight distance and suitable shoulder width to avoid travel lane encroachment. Special considerations should be given to interchanges, bridges, shoulder width, and shoulder obstructions when backing up. In no case shall a PTQ truck be driven into an active travel lane to circumvent an obstacle while backing up.
- For major incidents, as many queue protection vehicles as necessary should be made available. During this case, if the queue extends to the first upstream vehicle, that vehicle should proceed to relocate as the second vehicle remains in place to warn oncoming vehicular traffic of the growing queue, thus trading places with the remaining vehicle to protect the back of the growing queue.

Additional information regarding personnel, equipment, training, and safety requirements can be found in the *TDOT Standard Operating Guidelines (SOG) 6303-01*.

Communication

TDOT Regional Operations and Incident Management Personnel shall perform protection activities as instructed by incident management personnel at the incident scene and in cooperation with other emergency response agency officials. TDOT personnel shall communicate with TMC Technicians for the purpose of scene status, queue protection issues, requesting additional resources and providing estimate times of durations and length of traffic queues. The first TDOT personnel on the scene will assess the need for appropriate resources and make contact through TDOT channels for establishment of proper traffic control. Queue protection activities shall be reported at these intervals:

- At arrival
- At 30-minute intervals
- At significant changes
- At conclusion of queue protection assignment

Traffic Management Center Contact Information is provided below:

REGION 1 (Knoxville) 865-594-3981	REGION 3 (Nashville) 615-350-3424
REGION 2 (Chattanooga) 423-510-1168	REGION 4 (Memphis) 901-537-2988

Interstate Incident Management Plan

In an effort to increase safety of responders while decreasing response time during interstate roadway closures, an Interstate Incident Management Plan (IIMP) has been created for each of the four TDOT Regions within the State. The intent of the plan is to provide all regional staff, especially Maintenance and Incident Management offices, with action plans and pre-established detours based on the location of an incident on the Region's interstate system. Each IIMP can be found by following the links provided:

Region 1 – Knoxville

Region 2 – Chattanooga

Region 3 – Nashville

Region 4 – Memphis

FLAGGING GUIDANCE

A flagger shall be a person who has successfully completed the TDOT Work Zone Flagger Certification and can competently provide active guidance to motorists. They shall be able to demonstrate the following abilities:

- Receive and communicate specific instructions.
- Move and maneuver quickly.
- Control signaling devices.
- Understand and apply safe traffic control practices.
- Recognize dangerous situations and warn coworkers.

Equipment

Clothing

For daytime and nighttime activity, flaggers shall wear high-visibility safety apparel that meets the Performance Class 3 requirements of the *ANSI 107-2015* standard. Refer to the "Table A: Personal Protective Equipment Requirements" in *TDOT Policy 305-01* for required clothing for maintenance activities.

Equipment

Per *SOG 477-1*, short-term, short-duration or mobile operations should utilize the following equipment or multiple pieces of equipment:

- Class I – Pickup trucks; full-size pickup with lighting installed according to the current edition of *TDOT's Warning Light Standardization Manual*
- Class II – Heavy duty, single axle dump truck or equivalent with message board and attenuator (trailer or truck mounted)
- Truck or Trailer Mounted Arrow board
- Traffic cones – 28" minimum height with retro-reflective banding (2 per device)
- Stop/Slow paddles a minimum 24" diameter and an illuminated face consisting of a flashing LED array cluster on each sign face. Item to be obtained from TDOT's Regional Stockroom Items List.
- Portable Temporary Traffic Control (TTC) signs and sign stands. Sign sizes shown in "Table 6F-1" of the *MUTCD*.
- PPE should be worn in accordance with *TDOT Policy 305-01*.
- Portable handheld radios shall be used by flaggers to establish and maintain communication for the duration of the work activity including deployment and removal of all Temporary Traffic Control Devices.

Note: At no time should a designated flagger utilize a truck mounted radio to conduct flagging operations.

Communication

When a single flagger is used to control traffic, the flagger should be stationed on the shoulder opposite the construction or workspace, or in a position where good visibility and traffic control can be maintained at all times. When multiple flaggers are used, the flaggers must be able to see each other or have two-way radios designated for communication.

Flagging Position

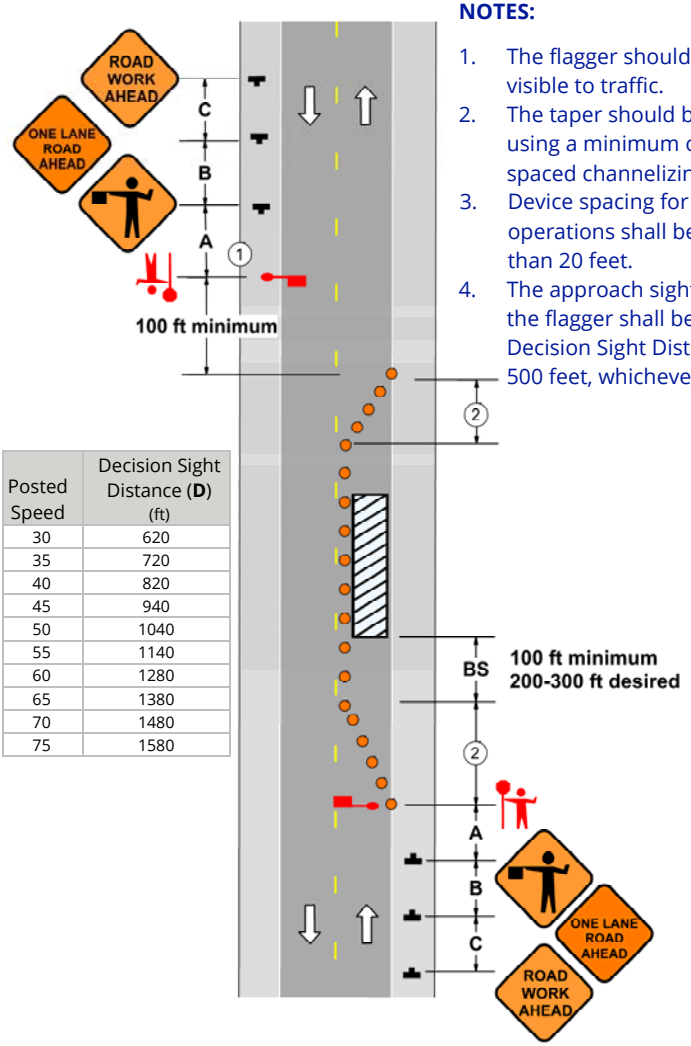
- Be alert and remain standing at all times.
- Face oncoming traffic – NEVER turn your back to oncoming traffic or stand in the path of moving traffic. See Figure 1 below for the preferred flagger position.
- A flagger's normal station is on the shoulder of the road.
- Park your vehicle off the road, away from your station.
- Stand alone. Do not mingle with the work crew or the public.
- Make sure that you are visible to oncoming traffic, not standing where the sun is impeding visibility or in a shadow.
- Stand in a location that allows approaching traffic adequate time to respond.

Figure 1 - Preferred Flagger Position

***Photo shown for illustrative purposes only**

Flagger Stations

	Advance Warning Sign Spacing (ft) (A, B, C)	Channelizing Device Spacing (ft)	Buffer Space (ft) (BS)
Urban (Low Speed)	100	20	200-300
Urban (High Speed)	350	20	200-300
Rural	500	20	200-300



Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

NOTES:

1. The flagger should be clearly visible to traffic.
2. The taper should be 50-100 feet using a minimum of 5 equally spaced channelizing devices.
3. Device spacing for flagging operations shall be no greater than 20 feet.
4. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.

Flagging Situations

Prior to the start of flagging operations, all signing shall be in place. A good visibility location is one where the sight distance is sufficient, and the flagger is clearly visible to approaching motorists.

When the TTC zone covers a long segment of highway, additional flagger signs may be needed. In high speed areas, the maximum distance from the last sign to the flagger shall not exceed two miles.

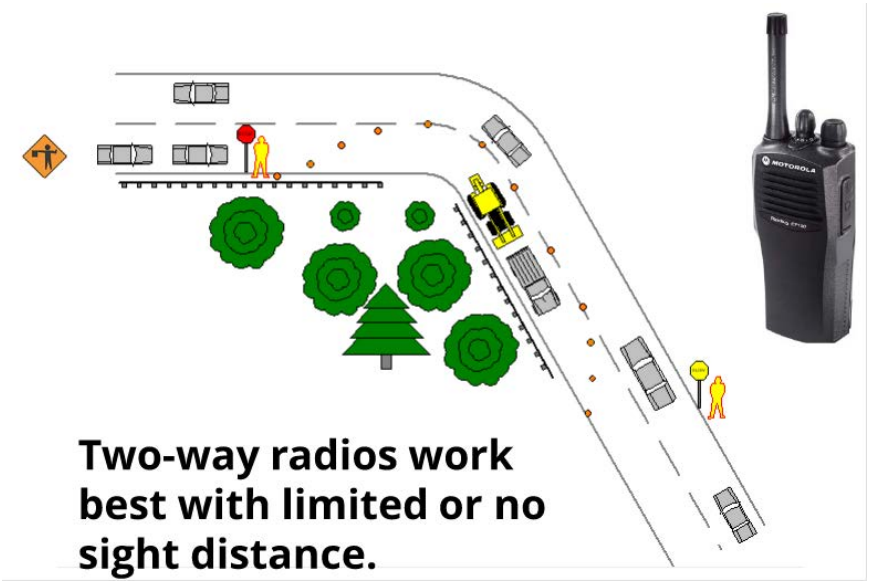
When more than one flagger is being used, all communication procedures should be clear before any flagging begins. If there is a roadway intersection within the closed area, an additional flagger may be needed to control traffic entering the TTC zone from the roadway intersection.

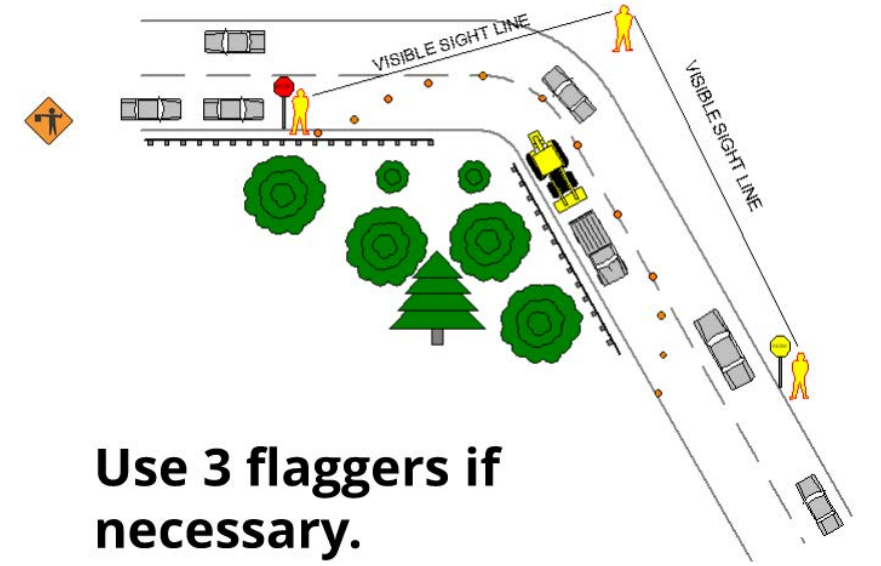
Traffic backing up over long distances due to flagging operations may cause potentially dangerous situations. These situations may include traffic backing up through an intersection, up an exit ramp onto the freeway, or stopping prior to the first warning signs. When the flagger observes this type of situation occurring, they should notify their immediate supervisor. To reduce traffic backups, the flagger may be given instructions on how to help maintain a shorter backup of vehicles.

Two Flaggers

When two flaggers are required, lines of communication must be established prior to the start of flagging operations. The flaggers must maintain communication through the use of two-way radios. One flagger should be the lead flagger and coordinate all activities. Work stops if communication cannot be maintained.

Figure 2 - Two Flagger Operation


MOTOROLA
Two-way radios work best with limited or no sight distance.


VISIBLE SIGHT LINE
VISIBLE SIGHT LINE
Use 3 flaggers if necessary.

One Flagger with AFAD

Automated Flagging Assistance Devices (AFAD) enable the operator to be positioned out of the lane of traffic and are used to direct road users through temporary, one-lane, two-way traffic control zones. These devices can stop traffic and allow traffic to proceed slowly while preventing the flagger from being in the immediate vicinity of the sign or on the roadway. The AFAD greatly enhances the safety of a work zone by removing/replacing the human flagger and thus, eliminating direct exposure to approaching vehicular traffic. The AFAD is remotely operated by a trained and certified flagger who will control the automated device at a predetermined and site-specific safe distance from the roadway.

Flagging with a Pilot Car

Two flaggers may also be used in conjunction with a pilot car. In this situation, the flagger stops the traffic until the pilot car arrives and has pulled into position to lead the traffic through or around the activity area. The flagger then releases traffic to follow the pilot. When a large gap in traffic or a pre-determined length of time occurs, as instructed by the supervisor, traffic is stopped. During pilot car operations, traffic should follow the pilot car and remain in a tight group to prevent traffic from separating along the route. To help keep the traffic group tight, flaggers should not allow additional cars to follow the group if the last car in the group has proceeded more than 300 feet from the flagging location. The flagger shall then stop and hold all traffic until the pilot car has returned for the next trip. See 2009 MUTCD Section 6F.58 PILOT CAR FOLLOW ME Sign (G20-4) and MUTCD Section 6C.13 Pilot Car Method of One-Lane, Two-Way Traffic Control.

Nighttime Flagging

Flagger stations shall be well illuminated except in emergency situations. The flagger shall wear high visibility, retroreflective vest, shirt, jacket, and leg gaiters. The flagger station should be illuminated with a supplemental light source. Reflective channelizing devices shall be used. See the TDOT Personal Protective Equipment (PPE) Policy for more detail.

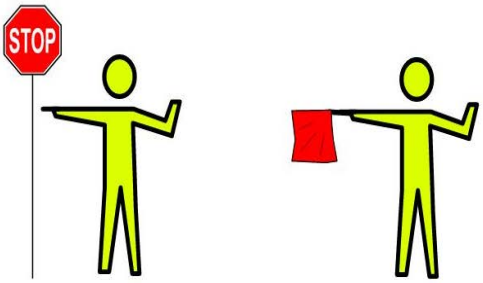
Emergency Situations

In emergency situations, a minimum size 24” x 24” retroreflective red flag may be used in lieu of a STOP/SLOW paddle. However, as soon as a STOP/SLOW paddle is available, it shall be used.

Flagging Procedures

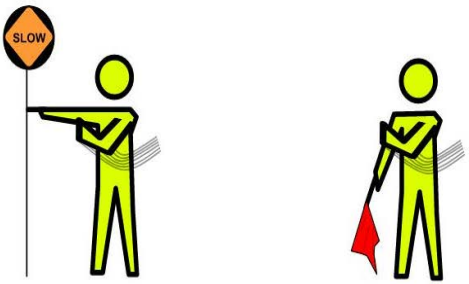
The following methods of signaling with paddles shall be used:

1. **To stop road users**, the flagger shall face road users and aim the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from the body. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.



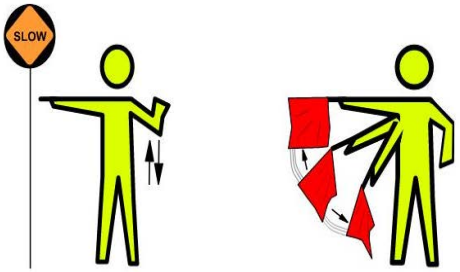
To Stop Traffic

2. **To direct stopped road users to proceed**, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger shall motion with the free hand for road users to proceed.



Traffic Proceed

3. **To alert or slow traffic**, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger may motion up and down with the free hand, palm down, indicating that the vehicle should slow down.



To Alert and Slow Traffic

Flagging at Intersections

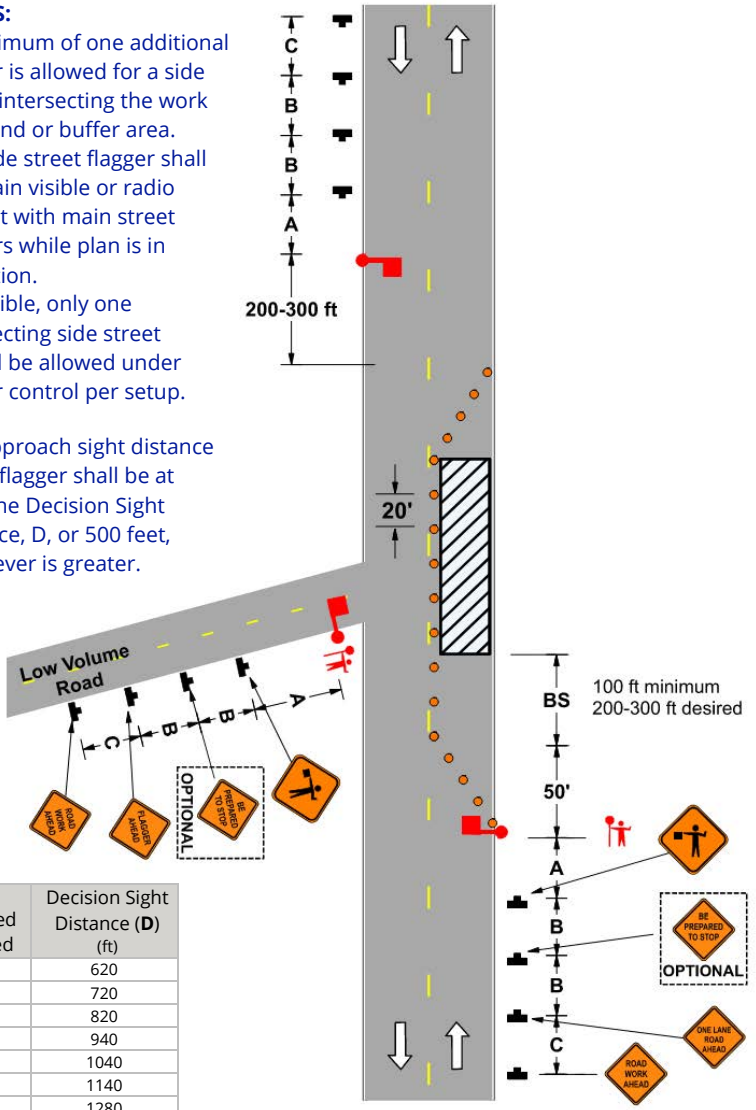
Only a licensed uniformed law enforcement officer may override a fully operating traffic control signal system. A flagging operation within a non-signalized intersection may override STOP and YIELD signs in the intersection. When traffic signals are set to flash red for all approaches, or turned off and temporary STOP signs are installed, the intersection may be treated as a non-signalized intersection. When flagging in an intersection, consider the following:

- The flagger should use a STOP/SLOW paddle.
- The flagger may direct vehicles to proceed through a STOP sign controlled condition while holding traffic on other approaches. Although the flagger may urge motorists to continue through the STOP, the flagger has no authority to prevent traffic from stopping and must allow for this stopping within the operation.
- The flagger should be aware of traffic conditions at adjacent intersections and should coordinate their operations to minimize traffic backups.
- High volume intersections, large intersection, roundabouts, or complicated situations may require additional flaggers. The flaggers shall coordinate their flagging operations to eliminate conflicts.

While it is not preferable, it is possible that a side street will intersect the TTC zone between the flagger positions. In this scenario, additional traffic control devices should be established in coordination with an additional flagger on the minor street. An example of this scenario is illustrated below.

NOTES:

1. A maximum of one additional flagger is allowed for a side street intersecting the work zone and or buffer area.
2. The side street flagger shall maintain visible or radio contact with main street flaggers while plan is in operation.
3. If possible, only one intersecting side street should be allowed under flagger control per setup.
4. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.



Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

Proper Conduct

- Do not abandon your post for any reason until the work is finished or a replacement flagger arrives.
- Do not engage in extended conversations with motorists or lean on vehicles. Be polite, but brief.
- Do not argue with a motorist. Be courteous.
- If a driver refuses to obey instructions, record a description of the car, driver, license plate, and the circumstances. Report this information to your supervisor as soon as possible.
- Remove or cover all signs indicating the presence of a flagger when a flagger is not actually flagging. This includes lunch and breaks.
- Be alert for emergency vehicles. They have “priority rights.” Allow them to pass as quickly as possible.
- Always make sure to have a clear escape path to get out of harm’s way if needed.
- No cellphones while flagging
- Flagger should have flagger certification card on them while performing flagging operations.

Notes to the Supervisor

- All flaggers should be properly instructed prior to the start of work. Training should be based on the requirements of individual road authorities.
- The importance of the job should be impressed upon the flagger. They are responsible for all workers’ safety.
- Flaggers should receive periodic breaks (minimum every 2 hours) to prevent fatigue and ensure maximum alertness while on station.
- Drive through the TTC zone after all signs, devices and the flagger are in place. Check the visibility of the signs, flagger, and the activity area.
- Ensure all signs indicating the presence of a flagger have been removed or covered when a flagger is not actually flagging.

Traffic Control Devices

A traffic control device is a sign, signal, marking, or other device used to regulate, warn, or guide traffic. The device is placed on, over, or adjacent to a street, highway, pedestrian facility, or shared-use path by authority of a public agency having jurisdiction. This section describes the most prominently used devices in TTC.

All TTC devices, including Type A and Type B channelizing devices, Type III barricades, ballast systems, and sign support structures used on any roadway open to public travel shall be crashworthy when installed facing traffic or turned away from traffic.

FHWA policy requires that all roadside appurtenances, including TTC devices, have been successfully crash tested in accordance with the *National Cooperative Highway Research Program (NCHRP) Report 350*, *"Recommended Procedures for the Safety Performance Evaluation of Highway Features"* or the American Association of State Highway and Transportation Officials (AASHTO) *Manual for Assessing Safety Hardware (MASH).*

Signs

Signs provide information to drivers and help them navigate the temporary traffic control zone. They consist of three types:

- **Regulatory signs** provide notice of traffic laws and indicate the applicability of legal requirements. MUTCD regulatory signs are typically preceded by an “R” in the name.
- **Warning signs** notify road users of conditions on or adjacent to the roadway that might not be readily apparent. They are typically diamond-shaped with black text and border on an orange background. MUTCD warning signs are typically preceded by a “W” in the name.
- **Guide signs** provide information to help guide road users through the temporary traffic control zone.

As a general rule, signs should be located on the right-hand side of a two-way roadway and on both the right and left sides of a multi-lane divided roadway and ramps. Signs are ordinarily mounted on posts for long-term operations, but may be mounted on or above barricades or on temporary supports. Signs mounted on temporary supports should not be placed in the open traveled lane where they pose a hazard to traffic nor where pedestrians are expected to travel. Generally, these signs are placed on the shoulder or in the parking lane of the street or highway. The signs should not be blocked from view by parked vehicles, trees, or other sight obstructions on or near the roadway.

Sign placement:

- Signs shall not be mounted on existing traffic signs, posts, or other utility structures without permission from the proper authority.
- All signs shall be mounted so that the sign face is perpendicular to the roadway and vertically plumb and may be placed on a side slope no more than 3 inches out-of-plumb for the entire height of the assembly.
- The bottom of signs mounted on barricades or temporary supports shall be no less than one foot above the travel way.
- All regulatory signs on portable supports shall be mounted with a minimum mounting height of 4 feet measured from the ground to the center of the sign face.

Advance Warning Signs

Do not display advance warning signs more than 48 hours before physical construction begins.

All advance warning signs shall be at least 48” x 48” in size when used on high speed roadways. Warning signs used on low speed roadways shall be at least 36” x 36” in size. Smaller signs may be used as approved by the governing road authority where larger signs become an additional hazard to motorists and pedestrians. On multi-lane divided roadways, where the median shoulder is narrow (less than 6 feet), the 48” x 48” advance warning signs may not fit on the left side of the roadway. Where this situation occurs, one of the following options may be used:

- Reduce the left side sign sizes, or
- Eliminate the left side signing, use an additional RIGHT LANE CLOSED (or LEFT as appropriate) sign on the right side, and require the use of an arrow board on the shoulder at the beginning of the lane closure taper.

Advance warning signs should be installed for drivers entering the TTC zone from cross streets. Sign W20-1 (ROAD WORK AHEAD) shall be installed on intersecting roadways if the motorist will not encounter another advance warning sign prior to reaching the activity area except for mobile operations.

Some activity areas move slowly down a roadway and away from the operation's advance signing. The distance from the last advance warning sign to the activity area should not allow the motorist to forget the existence of the TTC zone. For high-speed streets and rural highways, the total work zone length shall not exceed two miles. In urban areas, the number of intersections shall be considered, and this distance reduced accordingly.

Optional Signs

Several signs are shown on the TTC layouts as optional or have factors that may make them optional. Some advance warning signs may be omitted for low speed roads and/or if the duration will be less than an hour. Read the associated notes on each layout for options. Sign W3-4 (BE PREPARED TO STOP) is shown as optional on most TTC layouts. This sign is usually added to the complement of signs when restricted sight distances warrant additional warning to the motorist or the advance warning area becomes extremely long due to sight distances or a move of the operation.

The following pages provide a quick reference guide displaying typical signs used in temporary traffic control zones.

R1-1

R1-2

R3-1

R3-2

R4-1

R4-7

R4-7a

R4-8

R4-8a

R4-9

R10-6a

R11-2

R11-3a

R11-4

W1-2

W1-4

W1-4b

W1-6

W3-1

W3-2

W3-3

W3-4

W3-5

W3-5a

W4-2L

W4-2R

W5-3

W5-4

W6-3

W6-4

W7-3aP

W8-1

W8-2

W8-8

W8-9

W8-11

W8-15


W8-15P


W8-17

W8-17P

W8-23

W8-24

W8-25

W9-1

W9-2

W9-3


W12-1

W13-1P

W16-2P

W16-3P

W20-1

W20-4

W20-5

W20-5

W20-5a

W20-5a


W20-7

Flagger Paddle
W20-8


W21-1

W21-4

W21-5

W21-5a

W21-5a

W21-8

W24-1cp

G20-1

G20-2

G20-4

E5-1

E5-2

E5-2a

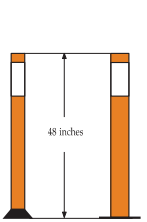
TN-78

Channelizing Devices

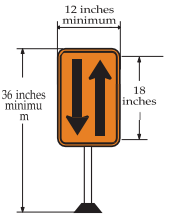
Channelizing devices are used to delineate the desired vehicle path, mark specific hazards on or near the roadway, separate opposing traffic flows, and partially or totally close the roadway. They include cones, drums, barricades, temporary raised islands, and various kinds of markers, and are divided into two classes based on the total amount of reflective area of the device:

- **Type A devices** have less than 270 in^2 of reflective area and are only used in attended TTC zones during daylight conditions.
- **Type B devices** have more than 270 in^2 of reflective area and are used when the devices will be left unattended or when the TTC zone will be installed for more than 12 hours.

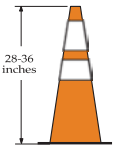
Examples of Type A Channelizing Devices:



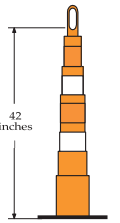
Surface or Ground Mounted Delineator



Opposing Traffic Lane Divider



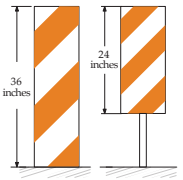
Cones



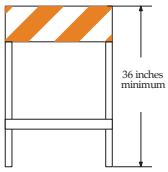
Weighted Channelizer

The 18-inch tubular markers and cones should only be used during low speed (≤40 mph) daytime conditions.

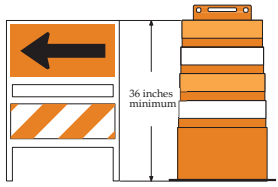
Examples of Type B Channelizing Devices:



Vertical Panel



Type I Barricade



Direction Indicator Barricade

Drum

Where a Type B channelizing device causes a sight restriction or is too wide for a space, the weighted channelizer may be substituted, and can be used in unattended overnight conditions as approved by the road authority. When used, the spacing of the devices should be reduced by up to 50%.

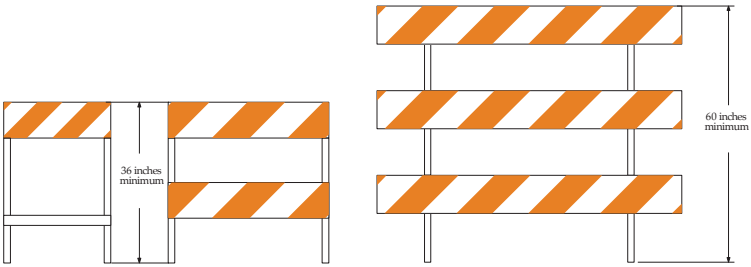
Refer to the MUTCD Part 6F for more details on application restrictions.

Barricades

Barricades are a type of channelizing device that are intended to communicate the end of a roadway or path in the TTC. They inform a road user that they cannot continue in the direction of the barricade.

Stripes on barricade rails slope downward at an angle of 45 degrees in the direction road users are to pass. When passing is allowed on the right and left, the barricade stripes should slope downward in both directions from the center of the barricade or barricades. Where movement is not allowed beyond the barricade, the stripes should be positioned to slope downward toward the center of the barricade or barricades.

Examples of Barricades:



Type I Barricade Type II Barricade Type III Barricade

Pedestrian Control

See *2009 MUTCD* "Typical Applications 28 – Sidewalk Detour or Diversion" and "Typical Application 29 – Crosswalk Closures and Pedestrian Detours" for guidance on pedestrian control.

Warning Lights

Warning lights are attached to traffic control signs and devices to warn road users of hazards and delineate the appropriate travel path. Warning lights are divided into three types:

- **Type A Low-Intensity** flashing warning lights are used to warn road users during nighttime hours that they are approaching or proceeding in a potentially hazardous area.
- **Type B High-Intensity** flashing warning lights are used to warn road users during both daylight and nighttime hours that they are approaching a potentially hazardous area. Type B warning lights are designed to operate 24 hours per day.
- **Type C Steady-Burn and Type D 360-degree Steady-Burn** warning lights may be used during nighttime hours to delineate the edge of the traveled way. When used to delineate a curve, Type C warning lights should only be used on devices on the outside of the curve, and not on the inside of the curve.

Installation:

Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens.

Advance Warning Arrow Board

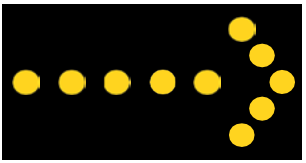
Arrow boards provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone. Arrow boards are placed on the shoulder and require DOT reflective tape or reflectors. They may also be placed on approved vehicles for mobile operations. Arrow boards are divided into four types based on their size and appropriate work zone.

Table 7 - Types and Dimensions of Arrow Boards

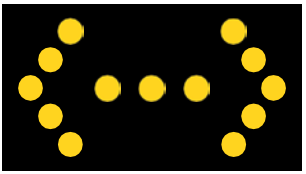
Type	Typical Application	Minimum Size	Minimum Legibility Distance
A	Low-speed urban streets	48” x 24”	1/2 mile
B	Intermediate-speed facilities, or maintenance or mobile operations on high-speed roadways	60” x 30”	3/4 mile
C	High-speed, high-volume motor vehicle traffic control projects	96” x 48”	1 mile
D	Truck or trailer mounted	None*	1/2 mile
*Length of arrow equals 48 inches; width of arrowhead equals 24 inches			

TDOT allows three modes of display:

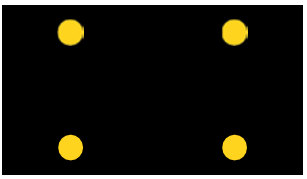
- Flashing Arrow



- Flashing Double Arrow



- Flashing Four Corners



Installation:

Arrow boards should be mounted a minimum of 7 feet above the pavement from the bottom of the board. When mounted on a truck or trailer, unacceptable installation includes:

- The arrow board is not within 3 inches of plumb for the height of the board
- The trailer mounted arrow board is not raised to at least 7 feet above the roadway surface (measured to the bottom of the board)
- The truck-mounted arrow board is mounted less than 3 feet above the roadway surface (measured to the bottom of the board) unless the road authority determines the height is as high as practical.

See MUTCD Section 6F.61 and TDOT standard drawing T-WZ-FAB1 for further guidance regarding Arrow Boards.

Portable Changeable Message Signs

The primary purpose of Portable Changeable Message Signs (PCMS) is to advise drivers of unexpected traffic and routing situations. Important items to consider when using a PCMS are:

- A PCMS should be used to supplement conventional signs, pavement markings, and lighting.
- If a PCMS is used as an arrow board, it shall meet all of the requirements of an arrow board and shall be used solely as an arrow board.
- Performance specifications can be found in the current version of the MUTCD Part 6, Section 6F.60.
- A PCMS installed on the shoulder of a road shall be accompanied with Type B channelizing devices.

See Appendix A for a list of abbreviations used in PCMS.

Temporary Portable Rumble Strips

Temporary Portable Rumble Strips (TPRS) provide an additional layer of protection for everyone within the work zone. The noise and vibration caused by driving over these devices alerts both workers and drivers to changing conditions ahead. TPRS are typically used when the following conditions are met concurrently:

- Work operations with flaggers on a two-lane roadway during daylight
- Work duration between 3 and 72 consecutive hours
- Existing posted or regulatory speed limit ≥35 mph
- Roadway has marked centerline

Source: Roads & Bridges 2015

Automated Flagger Assistance Devices

Automated Flagging Assistance Devices (AFADs) are capable of stopping traffic and allowing traffic to proceed slowly without the need for a flagger in the immediate vicinity of the sign or on the roadway. They are used in temporary, one-lane, two-way traffic control zones. Deployment of the AFADs and subsequent traffic control measures will function similarly to a traditional flagging operation with little to no change in overall operation and with minimal increase in signage requirements. However, the AFAD greatly enhances the safety of a work zone by removing/replacing the human flagger and thus, eliminating direct exposure to approaching vehicular traffic. AFADs increase work zone compliance, communication, visibility and safety of motorists. Use of pretimed or automated AFADs is prohibited.

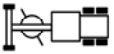
Temporary Striping

Temporary striping is used to mark guidelines on the roadway within the TTC zone that will only be used for the duration the zone is in effect. Temporary striping typically consists of reflective temporary pavement marking tape or reflectorized paint with raised reflective pavement markers, which can be removed or covered once the work has been performed.

Mounted Attenuators

A PTQ vehicle requires a truck or trailer mounted attenuator (TMA) in all lane and/or partial ramp closures on four or more lane roadways when the posted speed limit is 45 mph or greater, and for mobile operations which fully or partially block a lane on roadways posted 45 mph or greater. All TMA units shall conform to the requirements of *NCHRP 350 - Test Level 3* or *MASH* regardless of where the unit will be used. Each TMA vehicle shall have at least one amber high intensity rotating, oscillating, or flashing light functioning while in operation.

SYMBOLS USED IN TYPICAL APPLICATIONS

Symbol	Meaning
	Flagger or Operator of Automated Flagging Assistance Devie
	Automated Flagging Device (AFAD)
	Flashing Arrow Board (FAB)
	Portable Changeable Message Sign (PCMS)
	Portable Equipment - includes testing devices detection, surveying, etc.
	Traffic Signal Heads
	360-degree yellow flashing light(s)
	Work Vehicle
	Work Vehicle with Crash Attenuator (Truck of Trailer Mounted)
	Motor Grader
	Mower
	Type III Barricade
	Traffic Control Sign
	Type A Flashing Warning Light
	Type D 360-Degree Steady-Burn Light
	Channelizing Device
	Combination of Type A and B channelizing devices
	Direction of Traffic
	See Note, i.e. See Note 6
	Work Space

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TYPICAL APPLICATIONS

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Flagging

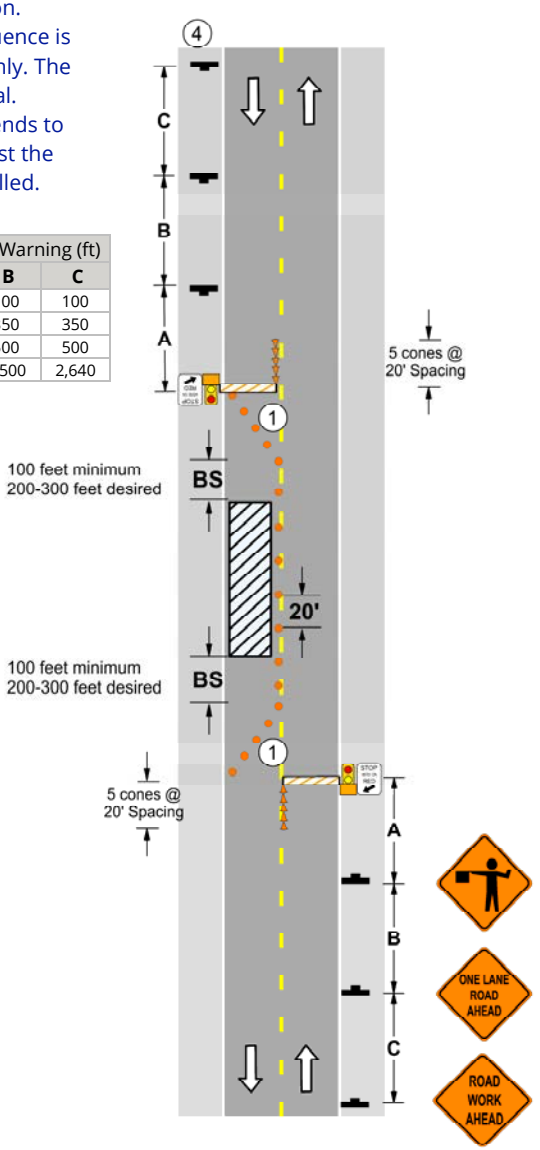
NOTES

(1) Lane Closure – Automated Flaggers

NOTES:

1. The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.
2. Maximum distances between AFAD units:
   - Two Operators: 1500’
   - Single Operator: 800'
3. A **Stop Here on Red** sign shall be installed as an additional sign to the typical 3-sign work zone for flagging operation.
4. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
5. Ensure that the gate arm descends to a down position to reach at least the center of the lane being controlled.

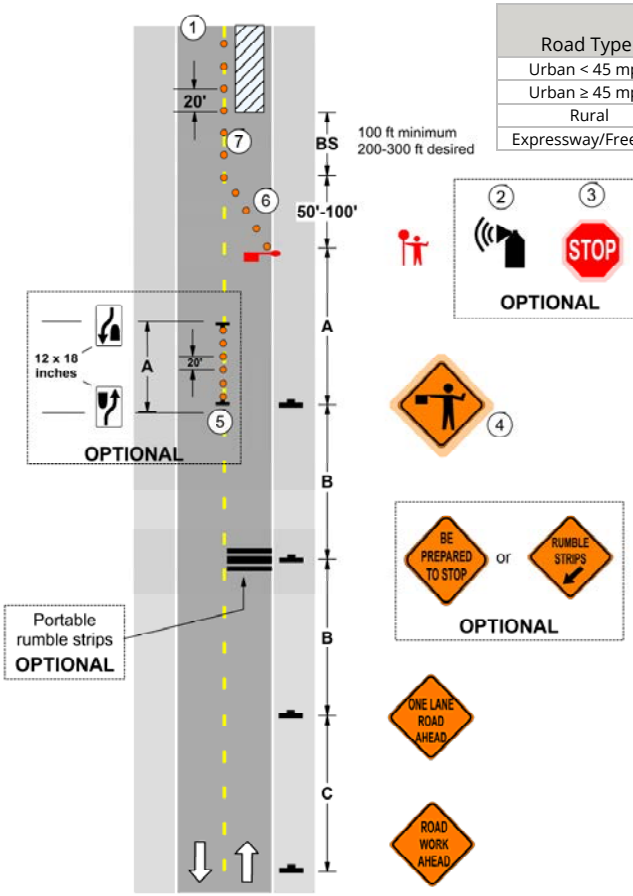
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640



(2) Flagging Station Options

NOTES:

1. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
2. The flagger may be equipped with an airhorn.
3. The STOP/SLOW paddle shall have flashing conspicuity lights on the signs.
4. The Flagger Ahead sign may have flashing conspicuity lights on it.
5. Use Type A channelizing devices such as weighted channelizers, cones, tubular markers, or centerline delineators.
6. The two-way taper should be 50-100 feet using a minimum of 5 equally spaced channelizing devices.
7. The centerline channelizers are optional with pilot car operations.
8. The portable rumble strips shall be spaced according to the manufacturer's recommendations or typical 15 foot on center.
9. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater. See *TDOT SOG 477-1* for additional guidance on flagging operations.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

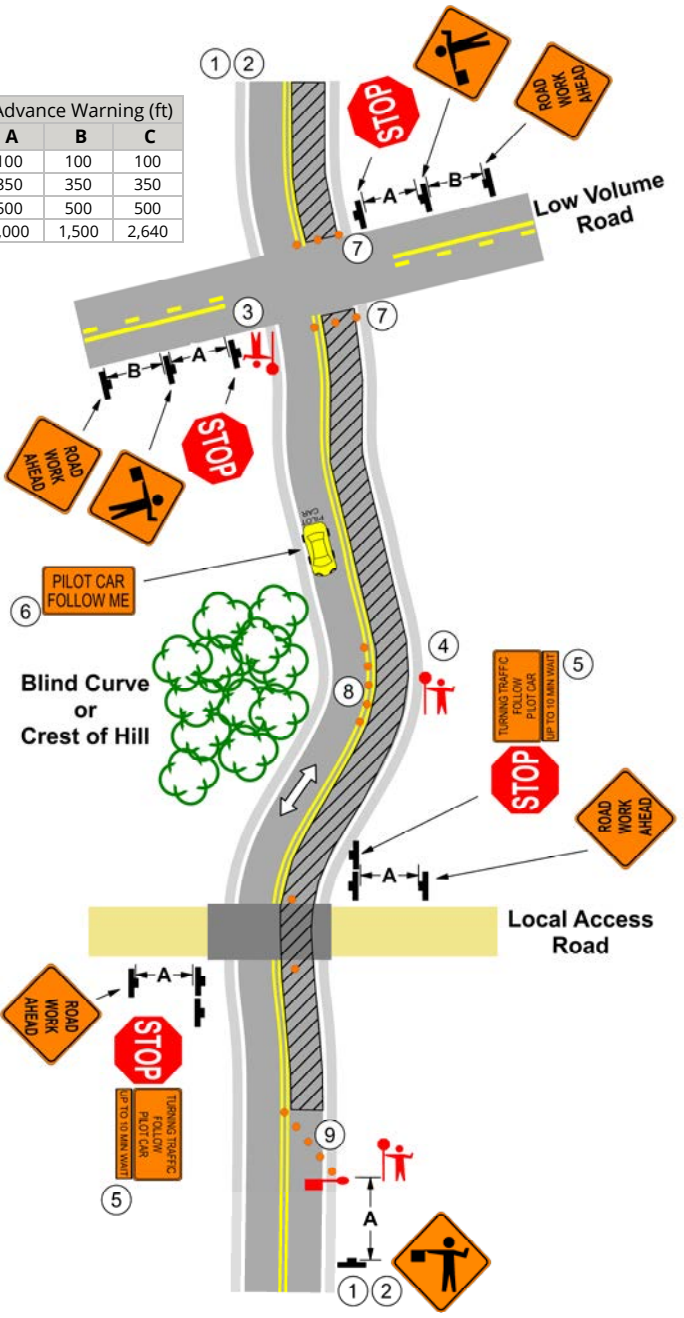
(3) Crossroads and Blind Curves

NOTES:

1. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
2. Full flagging station signing and pilot car turn-around areas shall be located at both ends of the work area.
3. When a flagger is positioned at a low volume intersection, they:
   a. Shall have 2-way radio communications with the pilot car and/or flaggers; and
   b. May need additional flaggers to direct traffic when the crossroad consistently has multiple vehicles per direction waiting each pilot car cycle.
4. A flagger may be placed at a blind curve, crest of a hill or other site obstruction where traffic might enter from other driveways or entrances to warn the pilot car that there may be oncoming traffic. When used, the flagger:
   a. Shall be located to clearly see traffic from both directions;
   b. Shall not be positioned in the open traffic lane;
   c. Shall have 2-way radio communications with the pilot car;
   d. Shall have a flagger paddle; and
   e. Should have a means to warn an errant driver such as an air horn.
5. This sign may be used in work areas where pilot car brochures have been distributed to the local residents and businesses.
6. This sign shall be mounted on the pilot car.
7. Channelizers shall be placed near intersections and flagging stations.
8. Channelizers are optional with pilot car operations.
9. The two-way taper should be 50 feet using a minimum of 5 equally spaced channelizing devices.
10. Advance traffic control for pilot operations shall be as shown in the layout.

(3) Crossroads and Blind Curves

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640



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Two-Lane, Two-Way

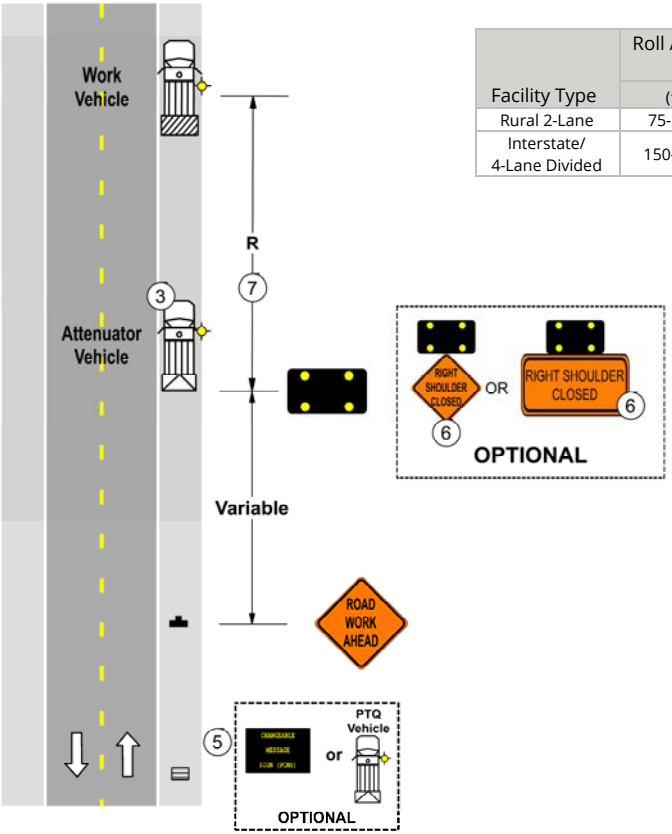
NOTES

(4) Shoulder Closure – Mobile and Short Duration
Two-Lane, Two-Way

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by an Attenuator vehicle at a distance of R. The Attenuator vehicle shall be equipped with a flashing arrow panel and have a truck or trailer mounted attenuator.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The Attenuator vehicle or PTQ vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. Any vehicle not displaying a flashing arrow board shall display high-intensity rotating, flashing, oscillating, or strobe lights.
5. The PCMS shall be used for nighttime operations.
6. When the PCMS is used, the RIGHT (LEFT) SHOULDER CLOSED sign becomes optional.
7. The distance between the work area and the Attenuator vehicle should be adjusted between R and F based on traffic volume and sight distance.

Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5



(5) Shoulder Closure – Work On or Near Shoulder
Two-Lane, Two Way

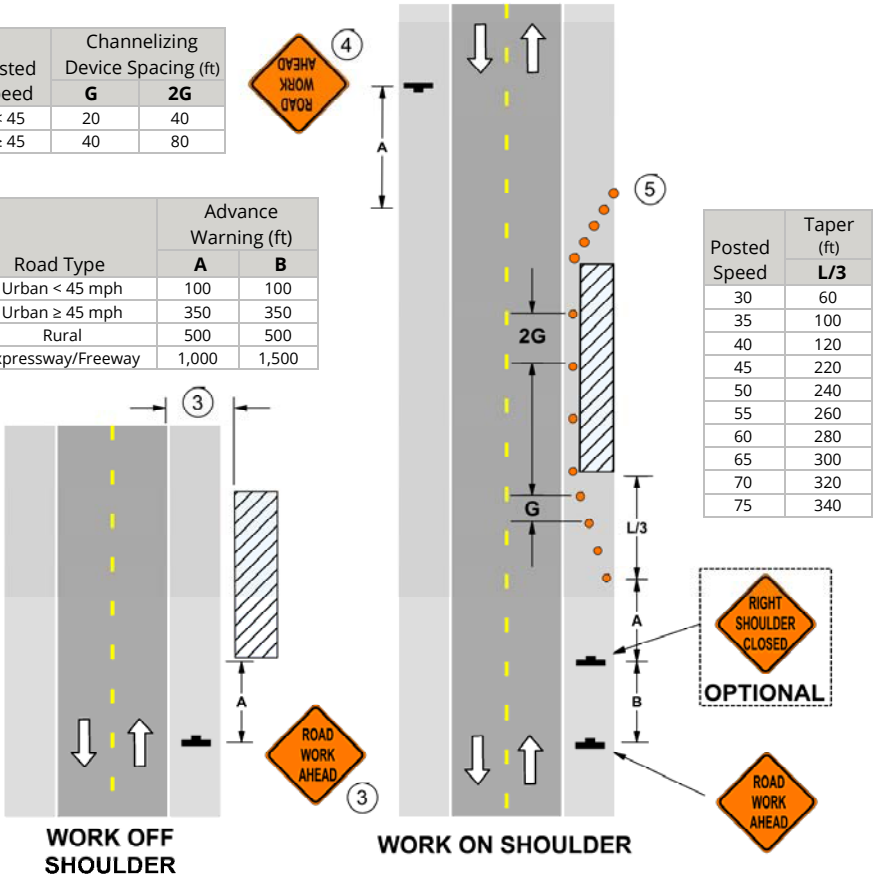
NOTES:

1. All signs, barricades and channelizing devices may be omitted when the work occupies an isolated shoulder location for less than one hour and it has little or no interference with traffic.
2. An operation which moves between workspaces that are less than the Decision Sight Distance along the shoulder should use a stationary or mobile shoulder closure.
3. The ROAD WORK AHEAD sign may be omitted for short term daylight operations if:
   a. the distance from curb face to the workspace is at least 2 feet, or
   b. the distance from the edge of travel way to the workspace is at least 15 feet **and** a vehicle displaying a 360-degree flashing beacon is operating.
4. The ROAD WORK AHEAD sign shall be installed on two-lane, two-way roads if traffic control devices are installed for a workspace in the opposite shoulder.
5. The downstream taper should be 50-100 feet using five equally spaced channelizing devices.

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Road Type	Advance Warning (ft)	
	A	**B**
Urban < 45 mph	100	100
Urban ≥ 45 mph	350	350
Rural	500	500
Expressway/Freeway	1,000	1,500

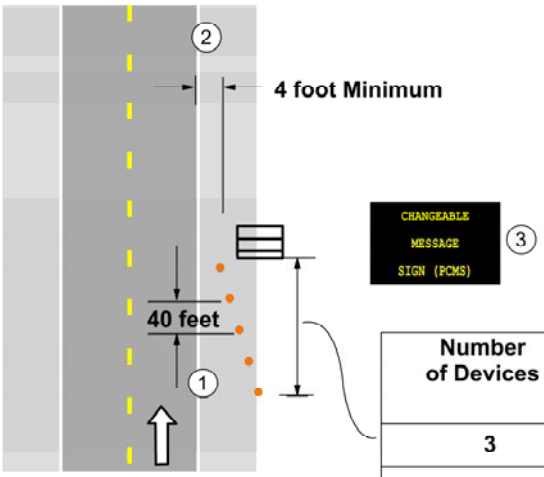
Posted Speed	Taper (ft)
	L/3
30	60
35	100
40	120
45	220
50	240
55	260
60	280
65	300
70	320
75	340



(6) Partial Shoulder Closure – Device Placement
Two-Lane, Two Way

NOTES:

1. Type B channelizing devices shall be used in the shoulder taper regardless of the location on the shoulder or the width of the shoulder.
2. Truck or trailer mounted traffic control devices shall be placed at least 4 feet from the edge of the traveled lane. If the 4 feet clearance cannot be met, then a full shoulder closure shall be provided, as in the “Shoulder Closure” Layout.
3. Typical trailer mounted traffic control devices may include flashing arrow boards, automated flagging assistance devices (AFADs), portable signals, portable changeable message signs, portable dynamic speed display signs, communications equipment, or other data collection devices.

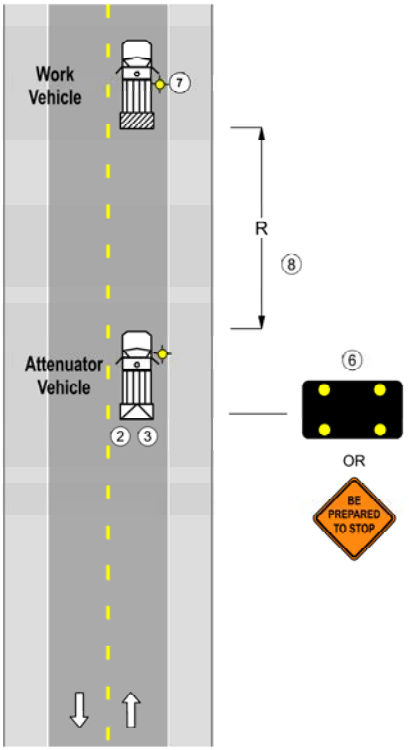


Number of Devices	Device Spacing (feet)	Speed Limit (mph)
3	40	0 - 40
5	40	45 - 75

(7) Lane Closure – With Random Work Areas
Two-Lane, Two Way

NOTES:

1. If the workspace is not visible for at least the Decision Sight Distance, the motorists cannot see beyond the workspace or traffic volumes do not allow passage, the appropriate mobile layout shall be used.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The Attenuator vehicle or PTQ vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. If the workspace does not move at least the Decision Sight Distance every 15 minutes, the appropriate stationary layout should be used.
5. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.
6. For nighttime operations, the flashing arrow board shall be used.
7. The slow moving or stopped work vehicle and PTQ vehicle should keep the traffic lane as wide as possible by using the shoulder space whenever practical.
8. The distance between the work area and the PTQ vehicle should be adjusted between R and F based on traffic volume and sight distance.



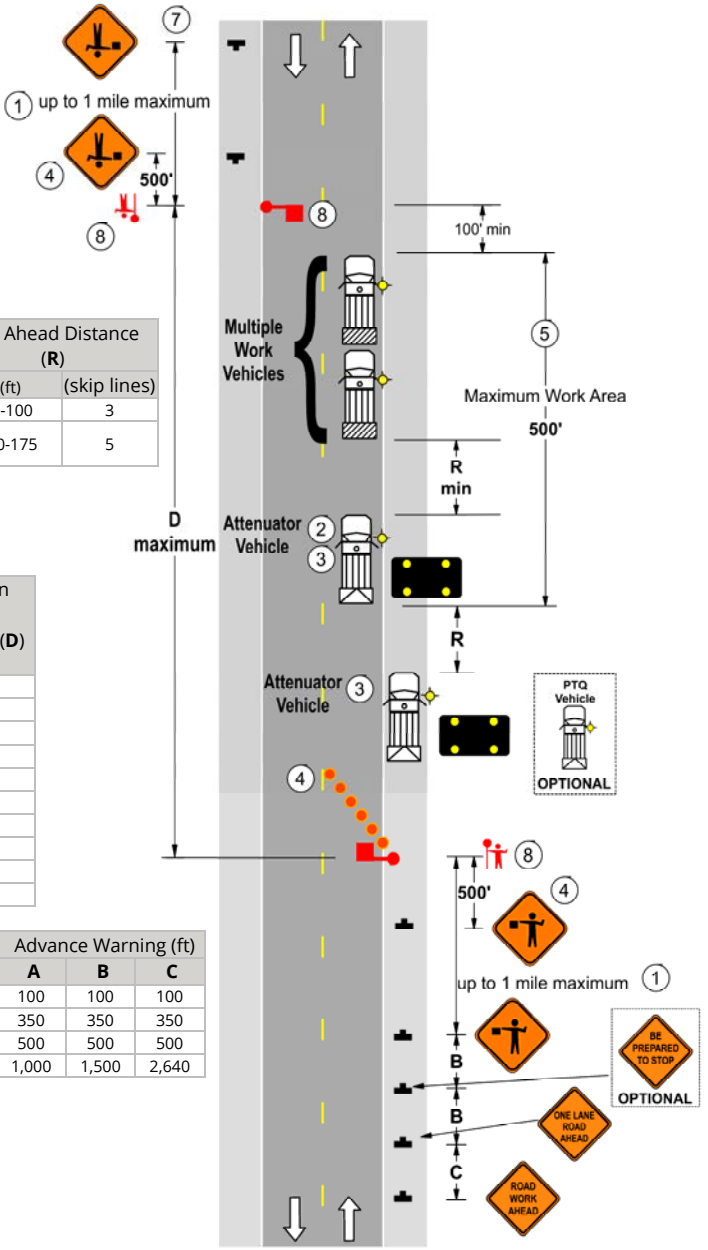
Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

(8) Lane Closure – With a Moving Work Area
Two-Lane, Two Way

NOTES:

1. The advance warning signs should be moved or reset after each major road intersection or after each mile, whichever comes first.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. In the case of shoulders less than 8-feet wide, one attenuator truck minimum is required and the PTQ vehicle, if used, shall remain clear of obstructing motorist visibility of the flagger, taper, and buffer. Acceptable locations include the edge of the roadway of the closed lane as far outside the travel lane as practical. Where shoulders are greater than 8-feet wide, a second attenuator or PTQ vehicle should be located on the shoulder as to not block visibility of the flagger and a distance, F, from the downstream attenuator.
4. The two-way taper should be 50 feet using 5 equally spaced channelizing devices.
5. A compact work area should be maintained with minimum space allowed between work vehicles. When the work area extends beyond 500 feet in total length, other traffic control layouts should be considered.
6. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.
7. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
8. Flaggers shall be used when the approach sight distance is restricted, the motorists cannot see beyond the work area, or traffic volumes do not allow safe passage.
9. Keep the work zone area as compact as possible to reduce driver confusion and accidental re-entry into mobile lane closure.

(8) Lane Closure – With a Moving Work Area
Two-Lane, Two Way



Facility Type	Roll Ahead Distance (**R**) (ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

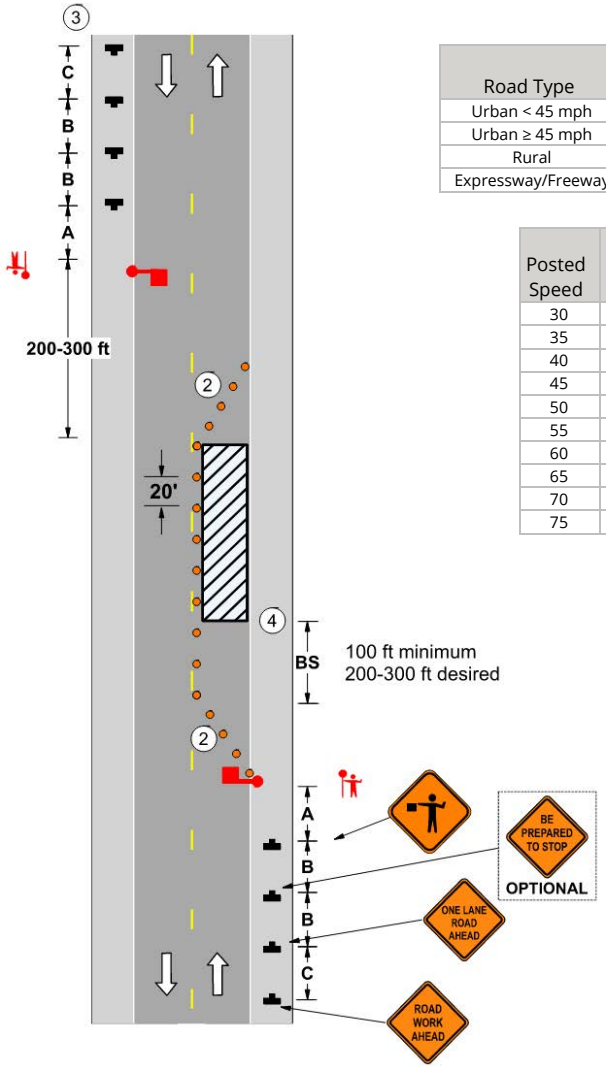
Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

(9) Lane Closure – Two Flaggers
Two-Lane, Two Way

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
2. The two-way taper should be 50 feet and the downstream taper should be 50 to 100 feet and using five equally spaced channelizing devices.
3. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
4. On roadways with speed limits greater than 45 mph, an Attenuator vehicle is required between Buffer Space (BS) and work zone.



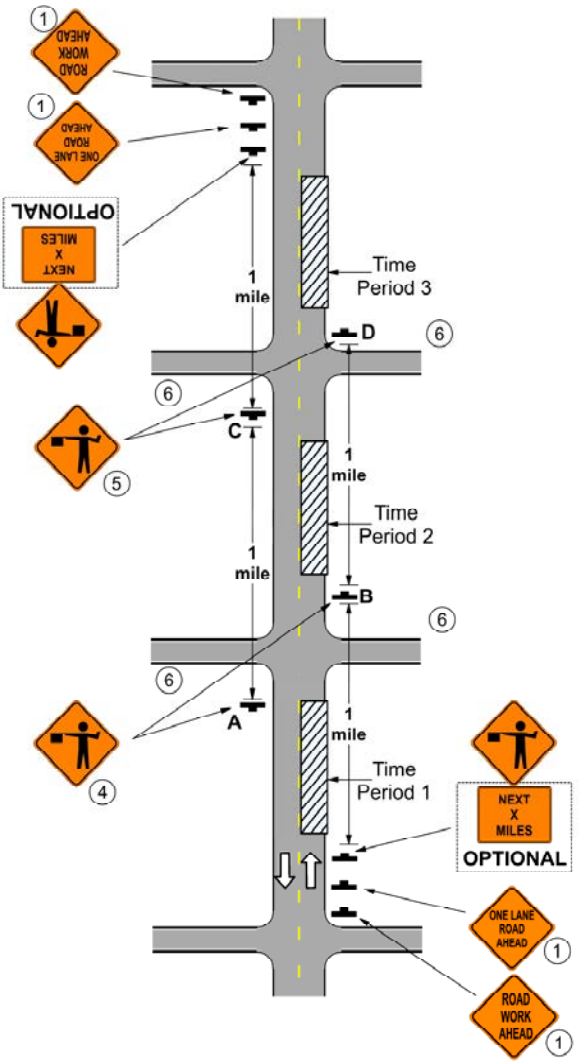
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

(10) Moving Workspaces – Multiple Locations
Two-Lane, Two Way

NOTES:

1. Flagger coordination and communication is critical for this application to be successful. This layout shall be used with the appropriate flagger layout to select the location of additional required traffic control devices.
2. This layout may be used for those short-term stationary traffic control zones that cover a relatively long segment of highway in a short period of time but do not meet the requirements for a mobile traffic control zone. It is intended to be used to eliminate the multiple movement of signs along a corridor
3. The maximum distance for a traffic control zone is 2 miles.
4. This Flagger Ahead symbol sign shall be used at Location A during Time Period 1 and at Location B during Time Periods 2 and 3.
5. This Flagger Ahead symbol sign shall be used at Location C during Time Periods 1 and 2 and at Location D during Time Period 3.
6. For advance warning signs on crossroads, see "Crossroad & Confirmation Signing" Layout on page 117.



(11) Lane Closure on Minor Road Before Intersection of Major Road Two-Lane, Two Way

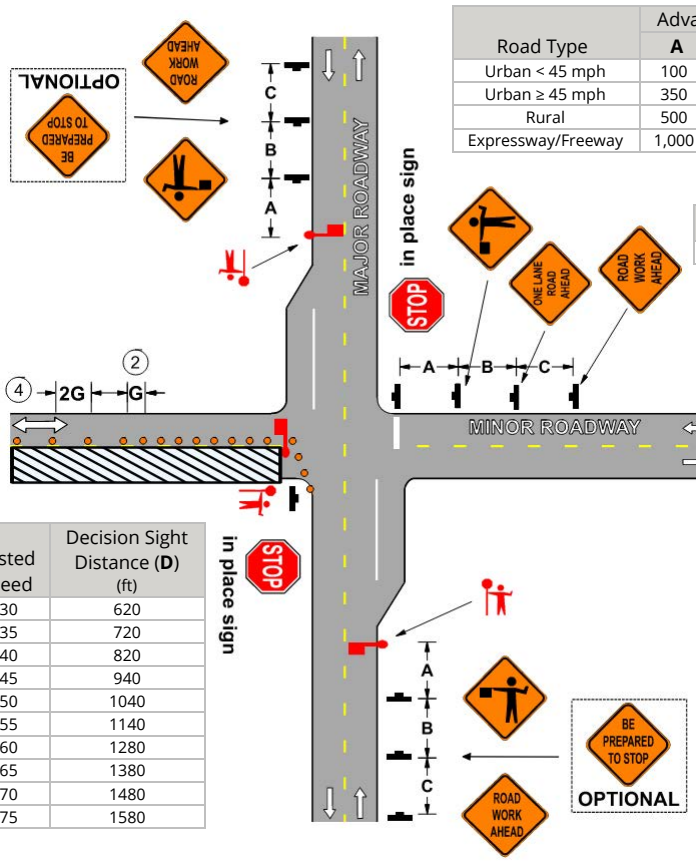
NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
2. The spacing between devices should be reduced to G or less when the workspace is within 300 feet of the intersection. This will help keep motorists from entering into the workspace near the intersection.
3. When the traffic volume of the minor road exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
   a. Control the traffic at the intersection with a law enforcement officer;
   b. Restrict vehicle turns from the major roadway with flagging, signing, and/or closing the turn lanes; or
   c. Completely close a leg of the minor roadway until the workspace has left the area near the intersection. (Local traffic only)
4. For other TTC devices in advance of the workspace, see “Lane Closure, Two Flaggers” Layout on page 56.

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

G (ft)	**2G** (ft)
20	40

Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

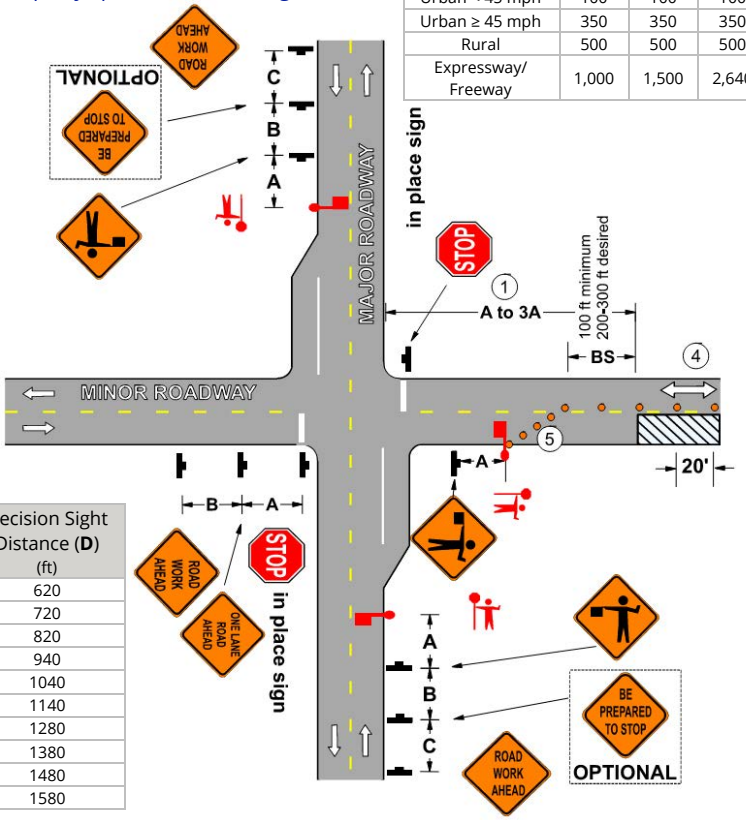


(12) Lane Closure on Minor Road Beyond Intersection of Major Road Two-Lane, Two Way

NOTES:

1. When the workspace is located between A and 3A beyond a controlled intersection, the normal sign and buffer spacing in the approach area may be reduced during daylight operations. The Flagger sign should be centered between the flagger station and the intersection.
2. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
3. When the traffic volume of the minor road exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
   a. Control the traffic at the intersection with a law enforcement officer;
   b. Restrict vehicle turns from the major roadway with flagging, signing, and/or closing the turn lanes; or
   c. Completely close a leg of the minor roadway until the workspace has left the area near the intersection. (Local traffic only)
4. For other temporary traffic control devices in advance of the workspace, see "Lane Closure, Two Flaggers" Layout on page 56.
5. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640

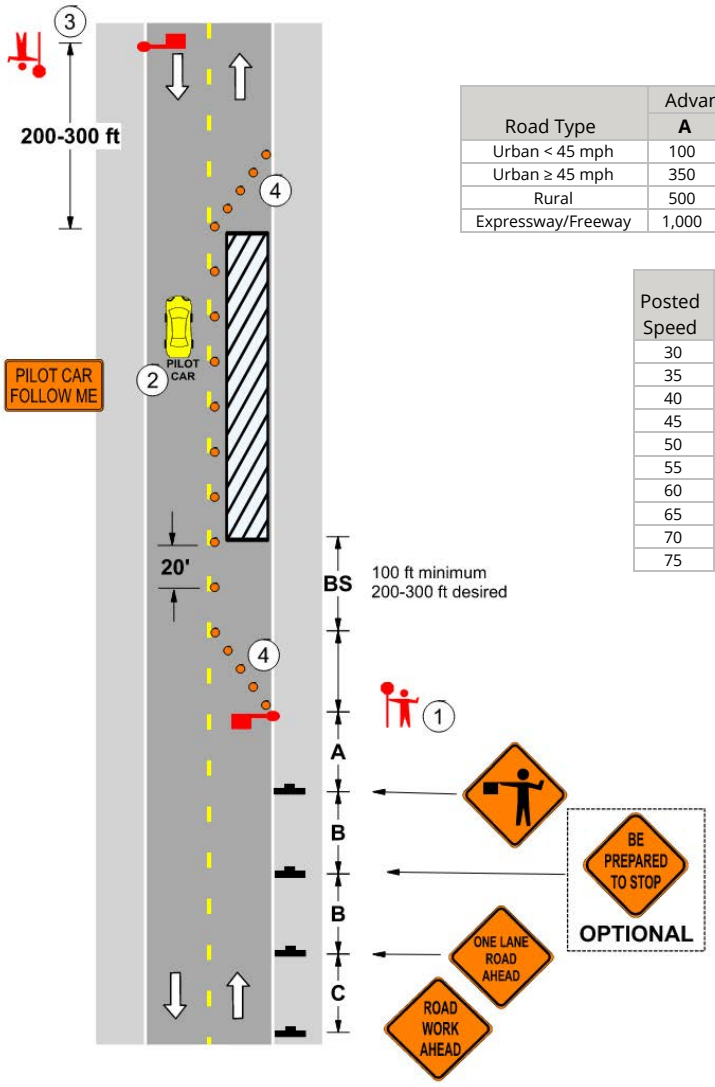


Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

(13) Lane Closure – Pilot Car Method
Two-Lane, Two Way

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
2. Pilot cars should lead traffic through the work zone at a safe speed.
3. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
4. The two-way taper should be 50 feet in length and the downstream taper should be 50 to 100 feet using five equally spaced channelizing devices.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

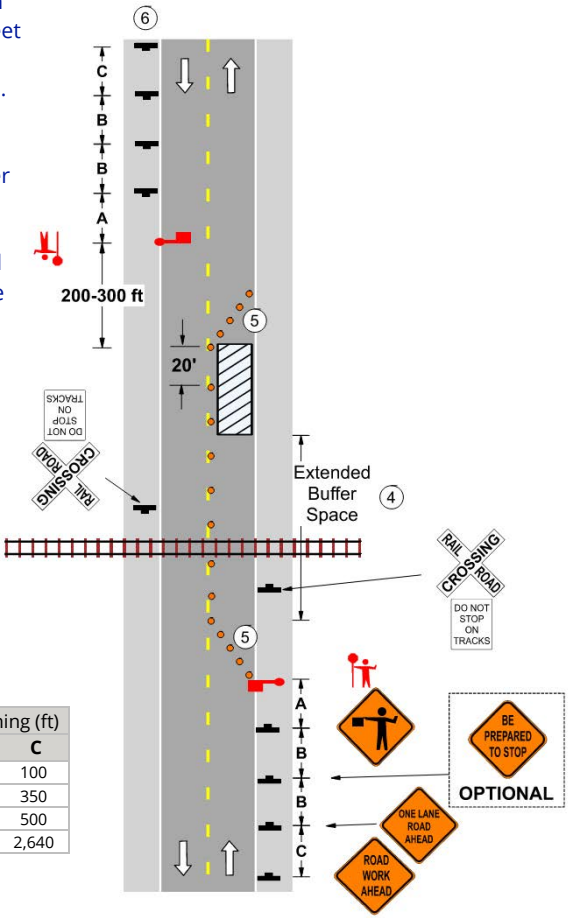
(14) Lane Closure – Near At-Grade Railroad Crossing
Two-Lane, Two Way

NOTES:

1. Early coordination with the railroad company or light rail transit agency should occur before work starts. District Leadership and Regional Traffic shall be contacted before performing a lane closure at a railroad crossing.
2. If the backup of vehicles across active railroad tracks cannot be avoided, a law enforcement officer or a flagger shall be provided at the grade crossing to prevent vehicles from stopping within the railroad crossing (considered as 15 feet on either side of the closest and farthest rail) even if automatic warning devices are in place.
3. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
4. The buffer space of the activity area should be extended beyond upstream of the grade crossing (as shown) so that a queue created by the flagging operation will not extend across the grade crossing.
5. The two-way taper should be 50 feet and the downstream taper should be 50 to 100 feet in length using five equally spaced channelizing devices.
6. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
7. The DO NOT STOP ON TRACKS sign should be used on all approaches to a grade crossing within the limits of a TTC zone.

Posted Speed	Buffer Space (**BS**) (ft)	Decision Sight Distance (**D**) (ft)
30	200	620
35	260	720
40	320	820
45	360	940
50	440	1040
55	500	1140
60	580	1280
65	660	1380
70	740	1480
75	820	1580

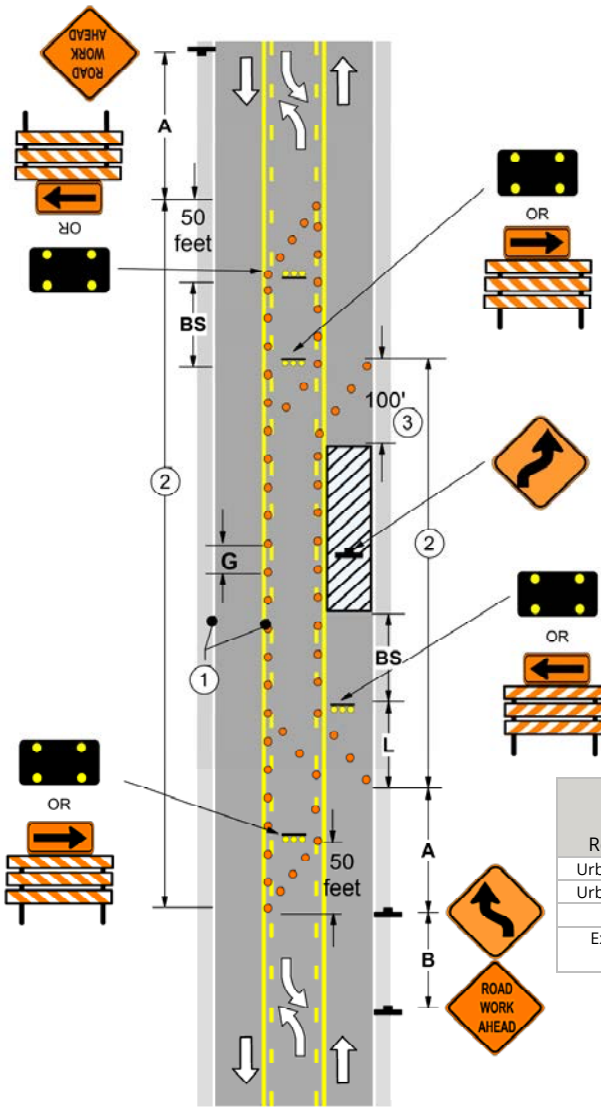
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640



(15) Lane Closure – With Two-Way Left Turn Lane
Two-Lane, Two Way

NOTES:

1. The minimum paved lane width from channelizing devices to edge of pavement or outside edge of paved shoulder or face of curb shall be 10 feet.
2. Parking, stopping, and left turning movements may be prohibited along the workspace and taper.
3. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

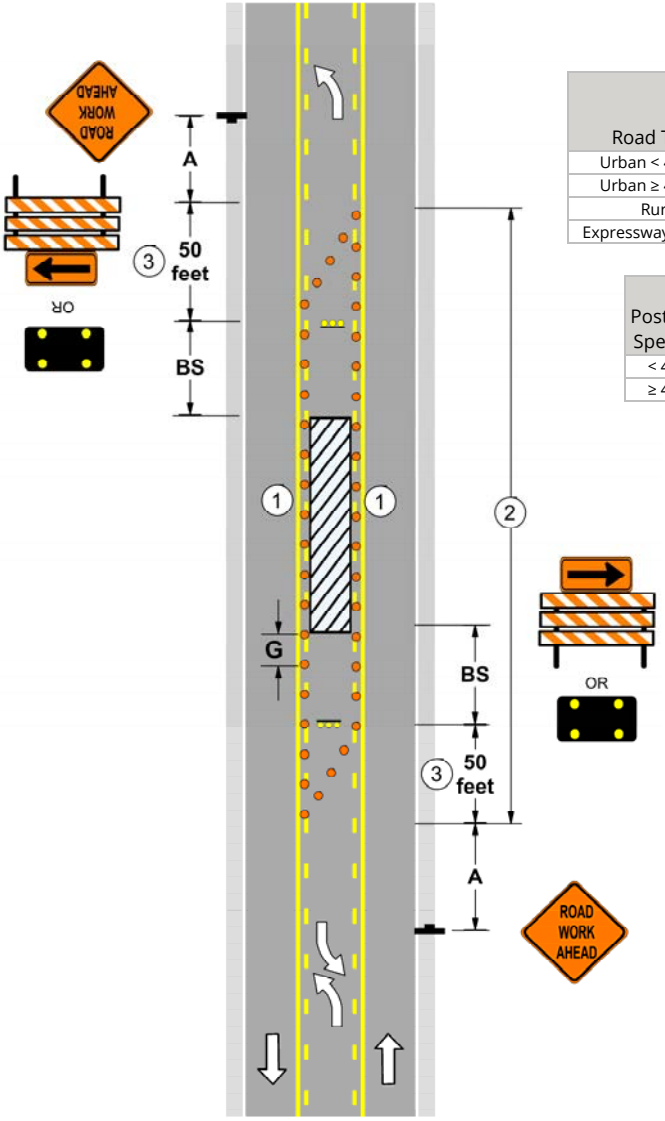
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Road Type	Advance Warning (ft)	
	A	**B**
Urban < 45 mph	100	100
Urban ≥ 45 mph	350	350
Rural	500	500
Expressway/ Freeway	1,000	1,500

(16) Turn Lane Closure – With Two-Way Left Turn Lane
Two-Lane, Two Way

NOTES:

1. The minimum paved lane width from channelizing devices to edge of pavement or outside edge of paved shoulder or face of curb shall be 10 feet.
2. Parking, stopping, and left turning movements may be prohibited along the workspace and taper.
3. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.



Road Type	Advance Warning (ft) **A**
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Buffer Space (**BS**) (ft)
30	200
35	260
40	320
45	360
50	440
55	500
60	580
65	660
70	740
75	820

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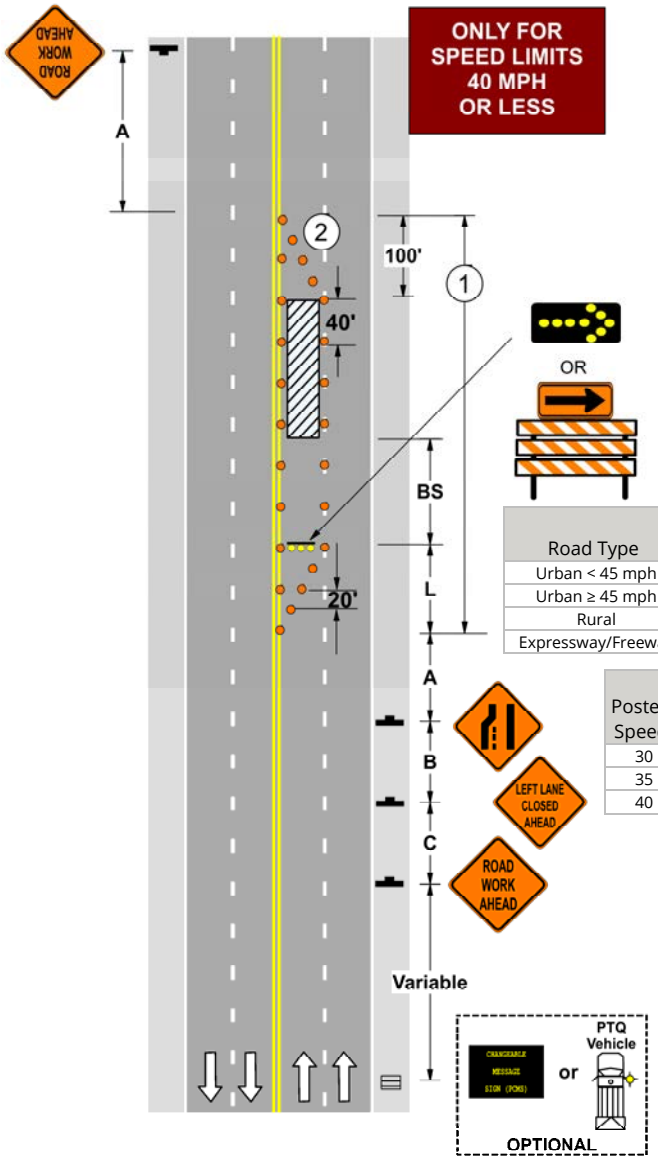
Multi-Lane, Undivided

NOTES

(17) Left Lane Closure
Multi-Lane, Undivided

NOTES:

1. Parking, stopping and left turning vehicles may be prohibited along the workspace and taper.
2. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



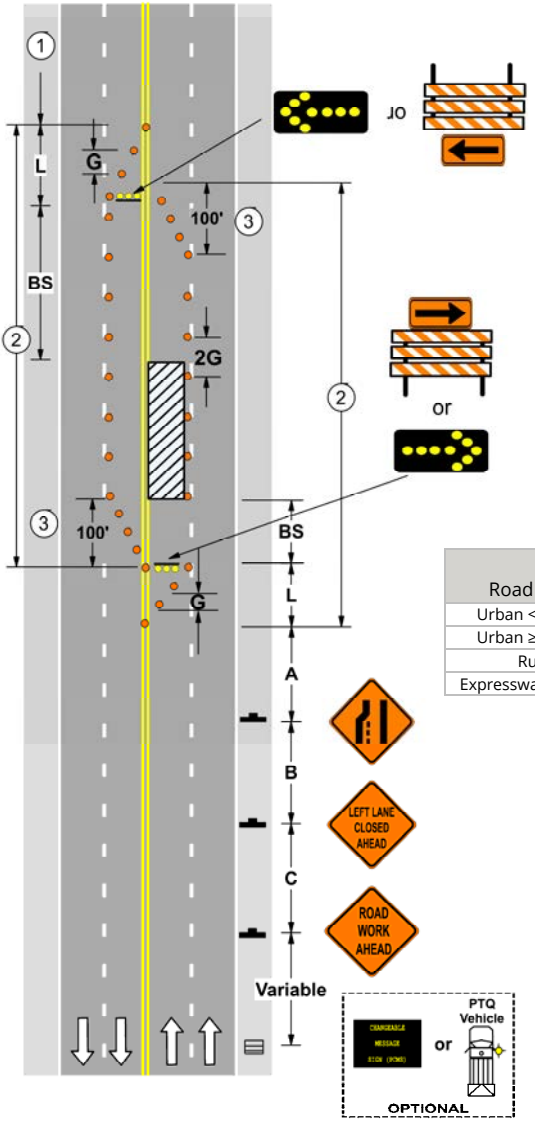
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320

(18) Left Lane Closure – Both Sides of Road
Multi-Lane, Undivided

NOTES:

1. The advance warning sign sequence is shown for one-way direction only. Signing from the other direction shall be identical.
2. Parking, stopping and left turning vehicles may be prohibited along the workspace and taper.
3. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

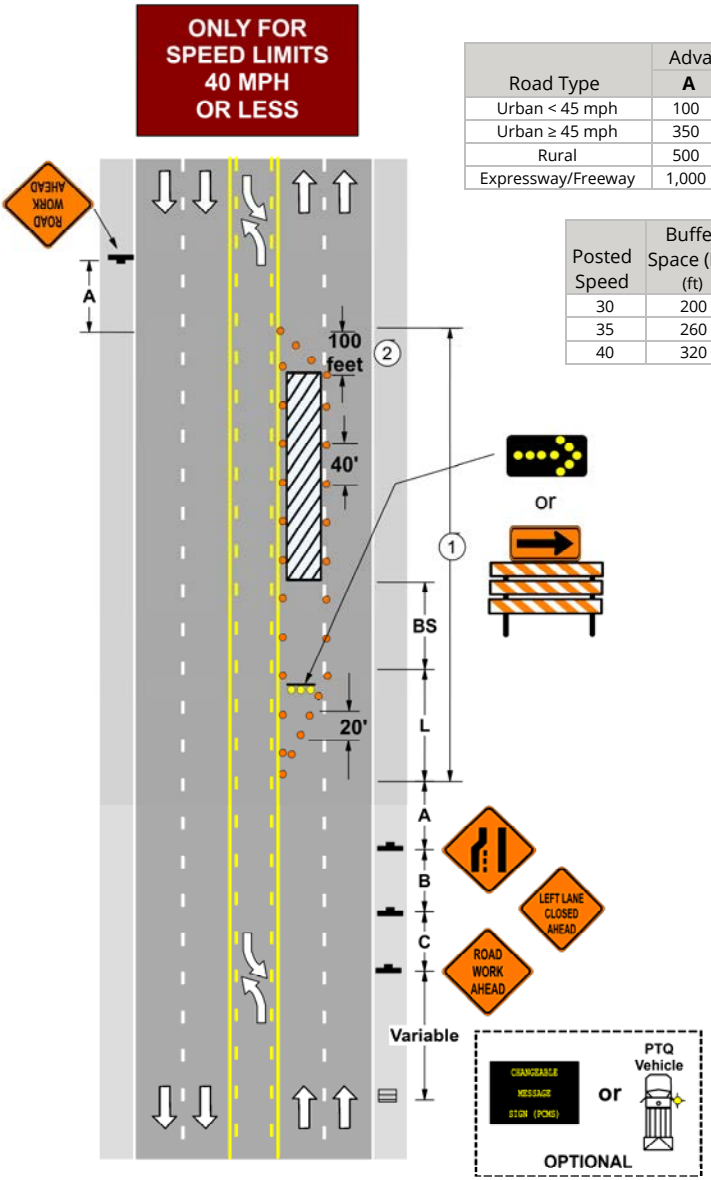
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

(19) Left Lane Closure – With Two-Way Left Turn Lane
Multi-Lane, Undivided

NOTES:

1. Parking, stopping and left turning vehicles may be prohibited along the workspace and taper.
2. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



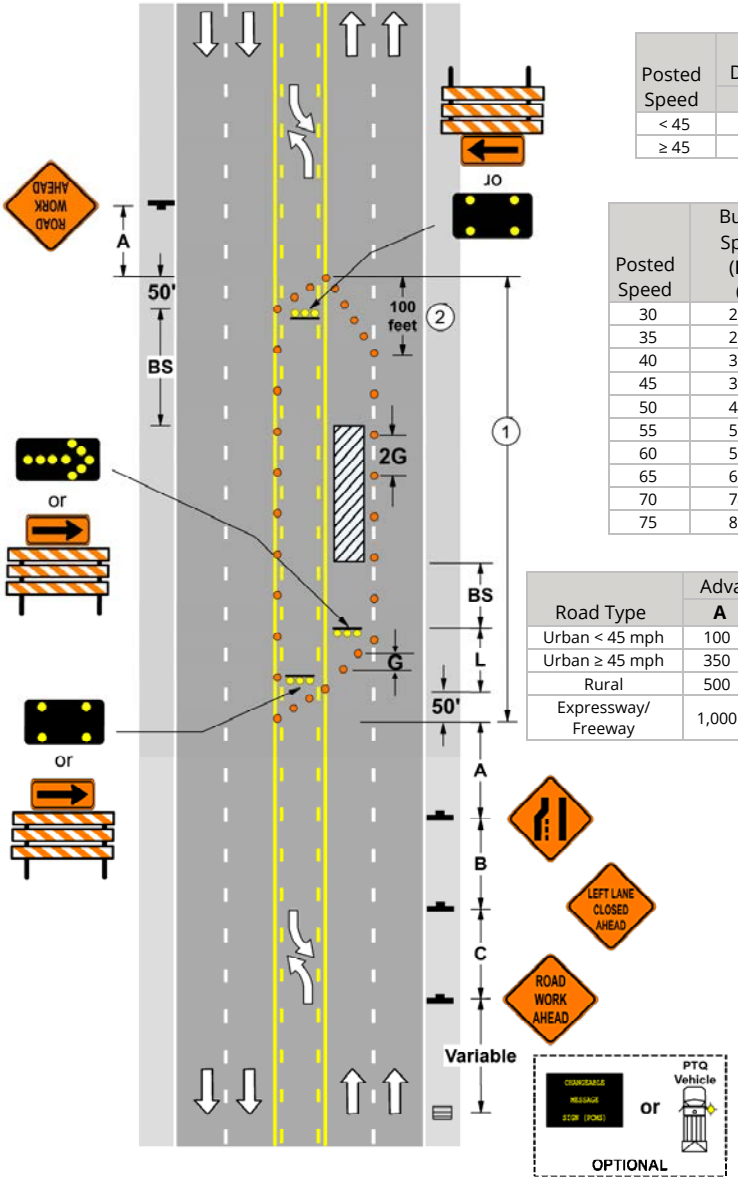
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320

(20) Left Lane Closure – With Two-Way Left Turn Lane
Multi-Lane, Undivided

NOTES:

1. Parking, stopping and left turning vehicles may be prohibited along the workspace and taper.
2. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

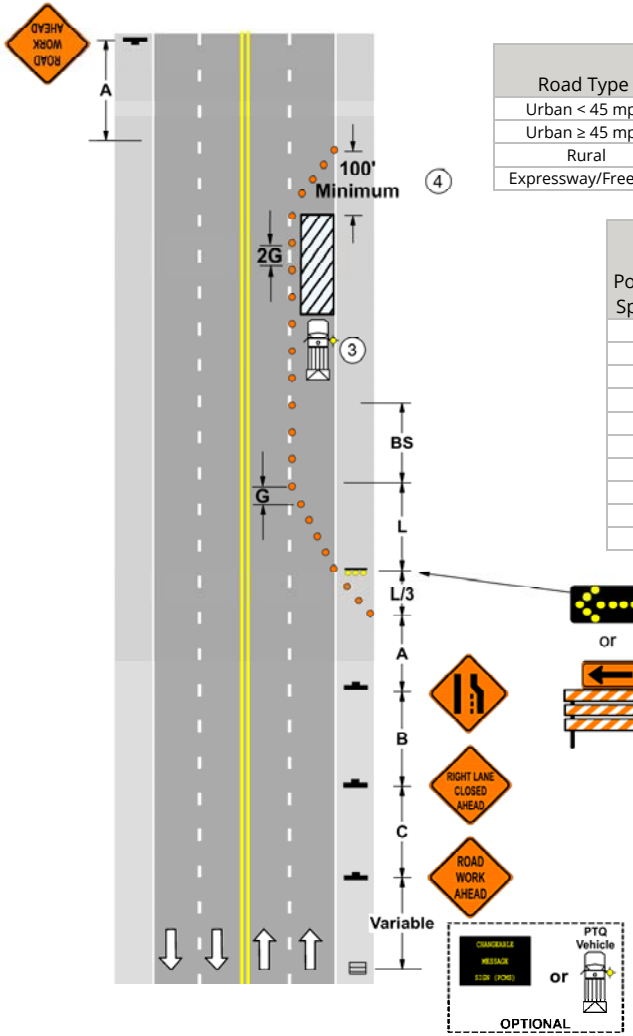
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640

(21) Right Lane Closure
Multi-Lane, Undivided

NOTES:

1. When paved shoulders having a width of 8 feet or more are closed, channelizing devices should be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.
2. An arrow board shall be used when a freeway lane is closed. When more than one freeway lane is closed, a separate arrow board shall be used for each closed lane.
3. An Attenuator vehicle may be used at the beginning of the work zone. The Attenuator vehicle shall be equipped with a truck or trailer mounted attenuator.
4. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

(22) Double Lane Closure
Multi-Lane, Undivided

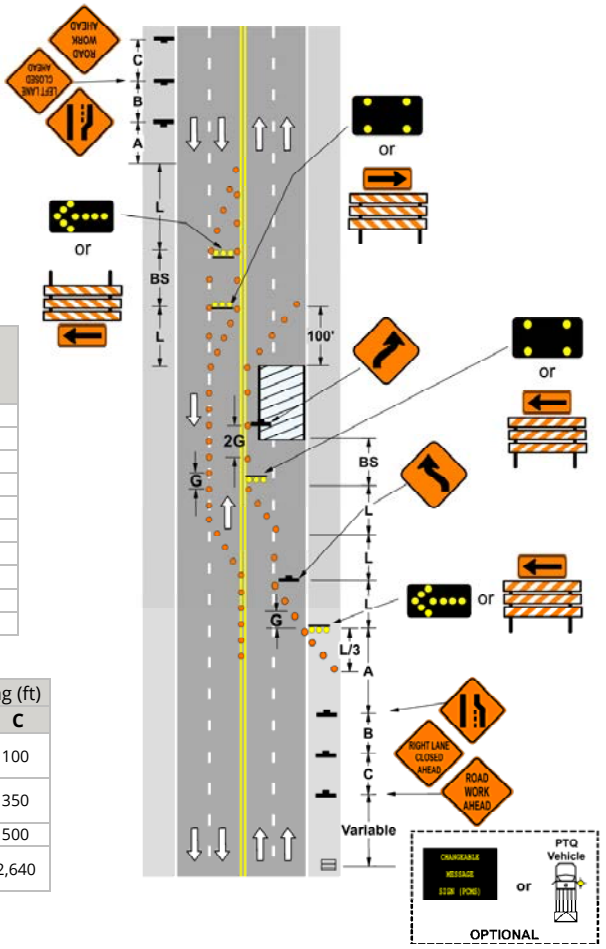
NOTES:

1. For short-term situations where it is not feasible to remove and restore pavement markings, channelization shall be made dominant by using a very close device spacing.
2. When paved shoulders having a width of 8-feet or more are closed, channelizing devices should be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.
3. Extensive planning is required for this layout. **Regional Operations Engineer or Traffic Engineer approval is required.**
4. The Double Reverse Curve (W24-1 Series) sign may be used where the tangent distance between two reverse curves is less than 600 feet, thus making it difficult for a second Reverse Curve sign to be placed between the curves. If the design speed of the curves is 30 mph or less, Double Reverse Turn signs should be used, as shown in the layout.

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640



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Multi-Lane, Divided

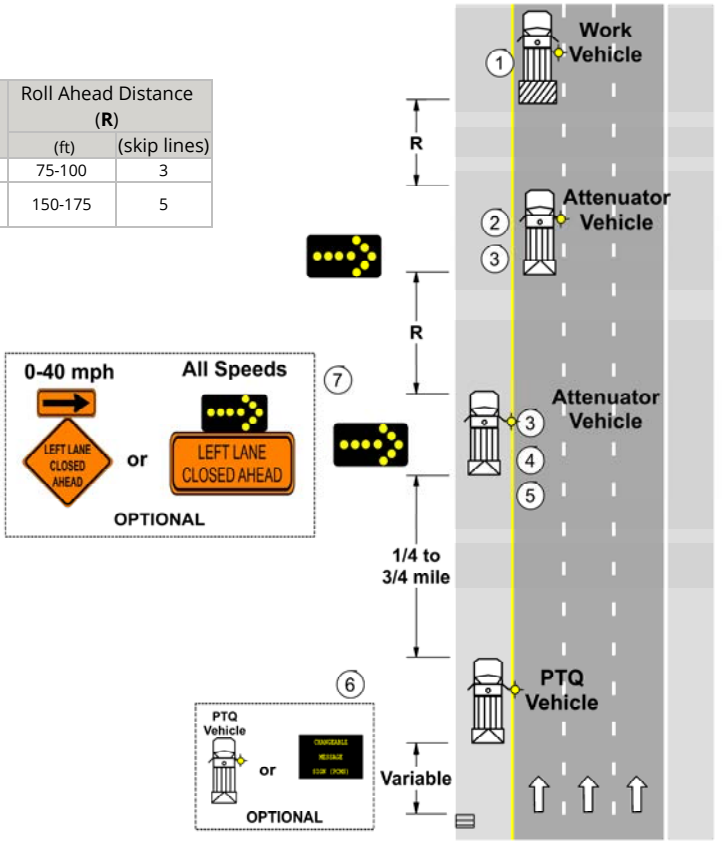
NOTES

(23) Mobile Inside Shoulder > 8ft Closure
Multi-Lane, Divided

NOTES:

1. The work vehicle may either occupy the shoulder or the left travel lane.
2. A work vehicle without a flashing arrow board shall be followed by an Attenuator vehicle at a distance of R. The Attenuator vehicle shall be equipped with a flashing arrow board and have a truck or trailer mounted attenuator.
3. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
4. The lateral placement of the Attenuator Vehicle may be adjusted to create a taper when an Attenuator vehicle is used.
5. If the operation does not move at least the Decision Sight Distance, D, every 15 minutes, the appropriate stationary layout should be used.
6. The PCMS shall be used for nighttime operations.
7. When the PCMS is used, the LEFT LANE CLOSED sign becomes optional.
8. The presence of a law enforcement officer in the work zone is optional.

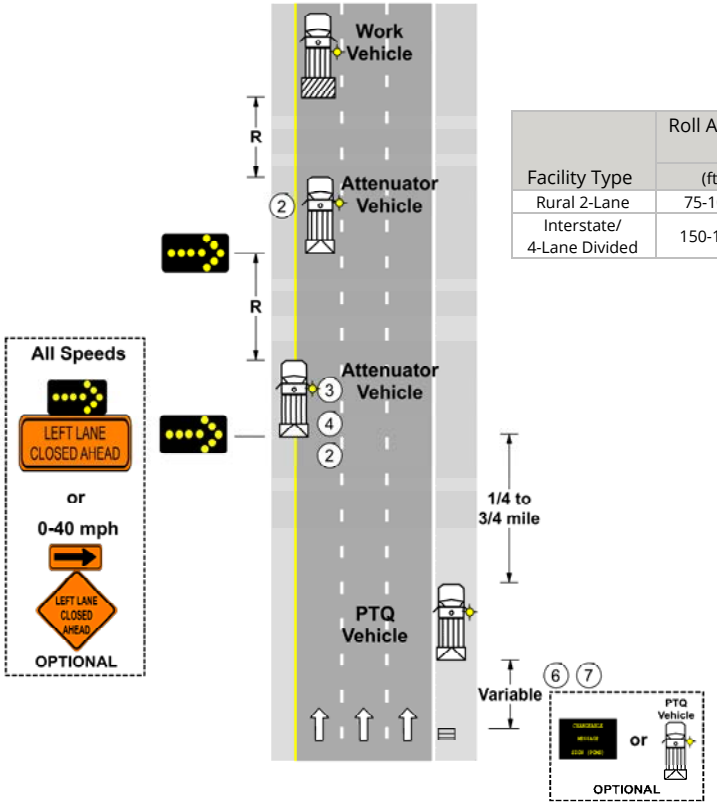
Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5



(24) Mobile Inside Shoulder < 8ft Closure
Multi-Lane, Divided

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by an Attenuator vehicle at a distance of R. The Attenuator vehicle shall be equipped with a flashing arrow board and have a truck or trailer mounted attenuator.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The lateral placement of the Attenuator vehicle may be adjusted to create a taper when an Attenuator vehicle is used.
4. The Attenuator vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
5. If the operation does not move at least the Decision Sight Distance, D, every 15 minutes, the appropriate stationary layout should be used.
6. The PCMS shall be used for nighttime operations.
7. The use of a second PTQ vehicle is recommended for additional advanced warning when sight distance challenges exist.
8. The presence of a law enforcement officer in the work zone is optional.

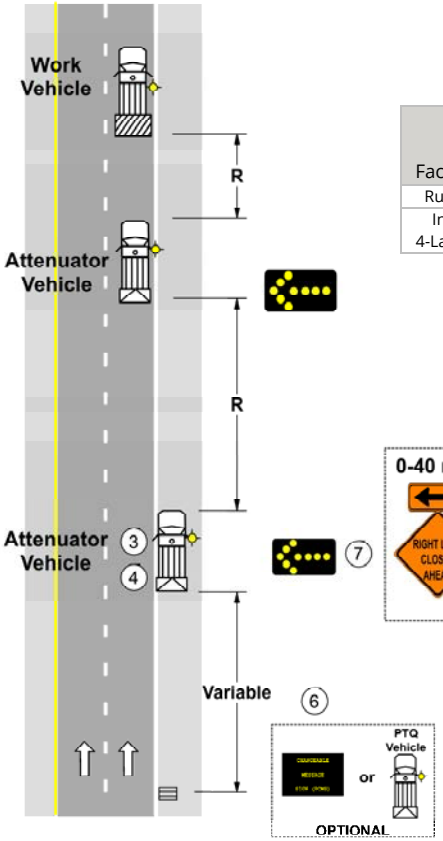


Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

(25) Mobile Lane Closure
Multi-Lane, Divided and Undivided

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by an Attenuator vehicle at a distance of R. The Attenuator vehicle shall be equipped with a flashing arrow board and have a truck or trailer mounted attenuator.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The lateral placement of the Attenuator vehicle may be adjusted to create a taper when an Attenuator vehicle is used.
4. The Attenuator vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
5. If the operation does not move at least the Decision Sight Distance, D, every 15 minutes, the appropriate stationary layout should be used.
6. The PCMS shall be used for nighttime operations.
7. When the PCMS is used, the RIGHT LANE CLOSED sign becomes optional.
8. The presence of a law enforcement officer in the work zone is optional.

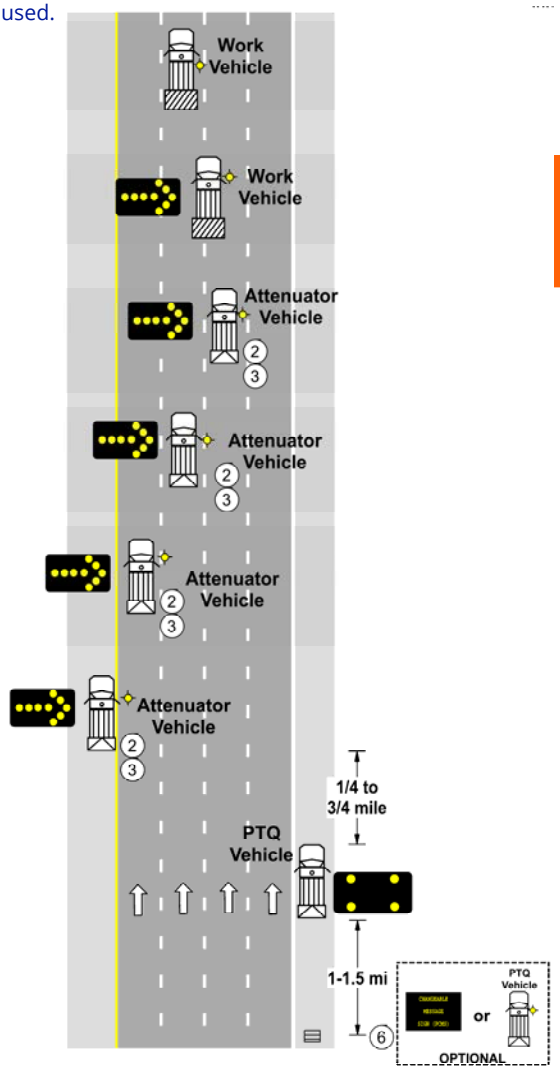


Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

(26) Mobile Freeway Double Lane Closure
Multi-Lane, Divided

NOTES:

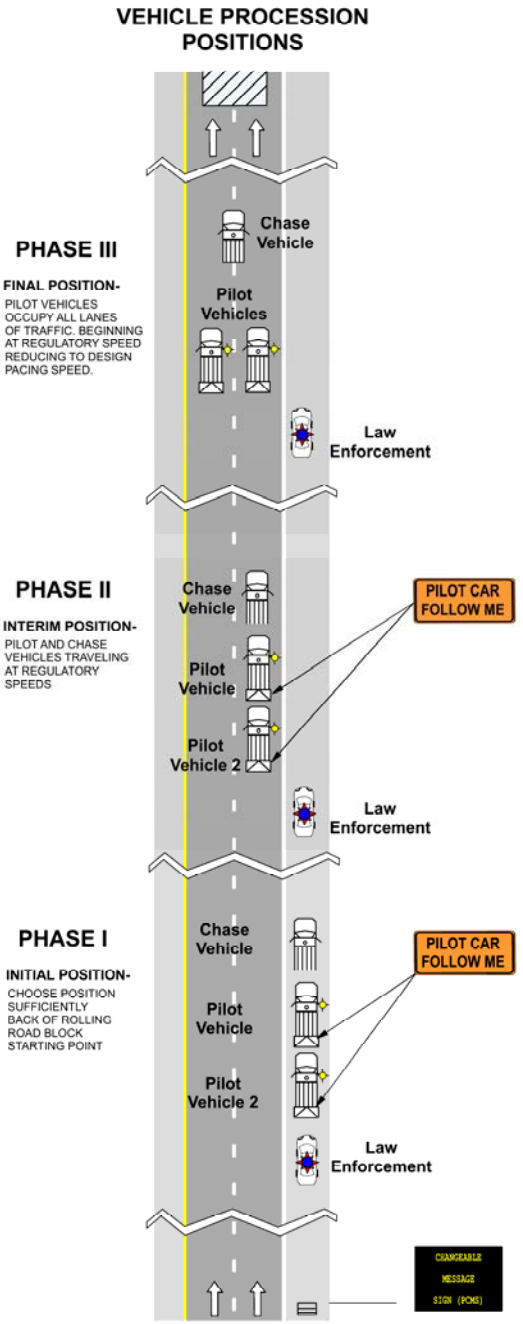
1. A work vehicle without a flashing arrow board shall be followed by an Attenuator vehicle equipped with a flashing arrow board and have a truck or trailer mounted attenuator.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The lateral placement of the Attenuator vehicle may be adjusted to create a taper when an Attenuator vehicle is used.
4. A second work vehicle should occupy the space between the first Attenuator vehicle and the primary work vehicle. The second work vehicle should straddle the working lane and the Attenuator vehicle lane as to create a visual taper and prevent traffic from reentering the work area.
5. The Attenuator vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
6. The PCMS shall be used for nighttime operations.
7. Extensive planning is required for this layout. **Regional Operations Engineer or Traffic Engineer approval is required.**
8. The presence of a law enforcement officer in the work zone is optional.



(27) Rolling Roadblock
Multi-Lane, Divided

NOTES:

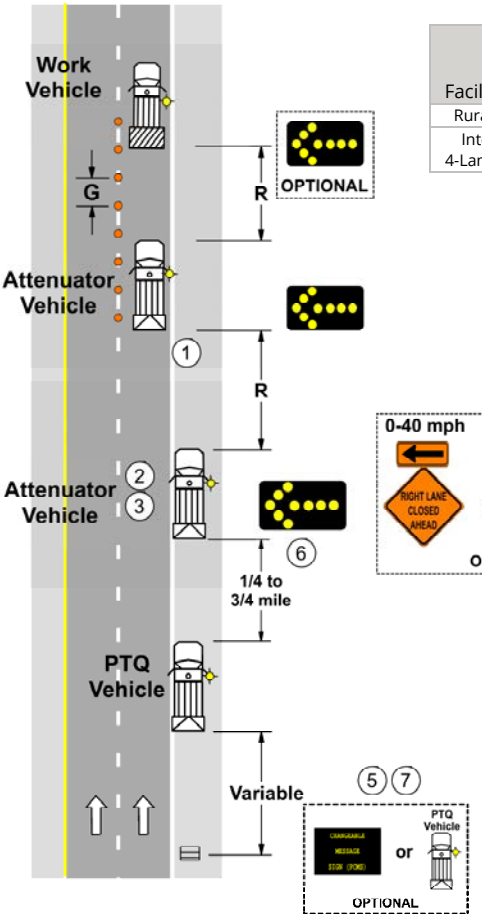
1. Extensive planning is required for this layout. **Regional Operations Engineer or Traffic Engineer approval is required.**
2. This layout shows the vehicle procession positions.
3. See TDOT Standard Drawing T-WZ-61 for the detailed notes and setup for this application.
4. The presence of a law enforcement officer in the work zone is required.
5. Include PTQ messaging upstream to reduce potential for "End of Queue" collisions.



(28) Short Duration Lane Closure
Multi-Lane, Divided

NOTES:

1. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
2. The lateral placement of the Attenuator vehicle may be adjusted to create a taper.
3. The Attenuator vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. If the operation does not move at least the Decision Sight Distance, D, once each hour, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.
6. When the PCMS is used, the RIGHT LANE CLOSED sign becomes optional.
7. A typical message should be ROAD WORK AHEAD and RIGHT LANE CLOSED.
8. The presence of a law enforcement officer in the work zone is optional.



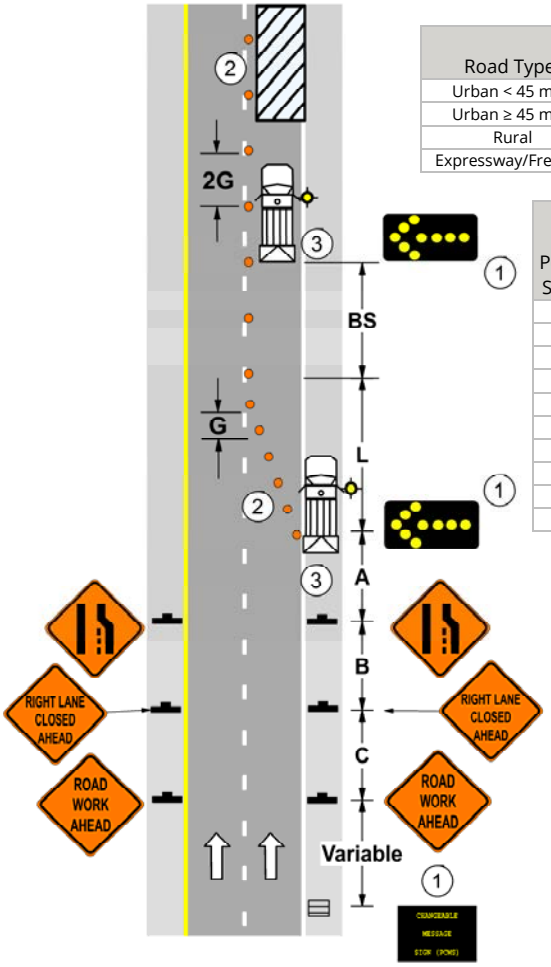
Facility Type	Roll Ahead Distance (**R**) (ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

Posted Speed	Channelizing Device Spacing (ft) **G**	**2G**
< 45	20	40
≥ 45	40	80

(29) Lane Closure – Occupied Nighttime Workspace Multi-Lane, Divided

NOTES:

1. In order to use this layout, two flashing arrow boards, at least one PCMS, and advance warning signs shall be used. If these devices are not available, the "Right Lane Closure, Multi-Lane Divided Road" Layout on page 82 should be used.
2. When using a combination of cones (28-inch minimum height) and Direction Indicator Barricades, every third device in the merge taper and every tenth device in the tangent area shall be a Directional Indicator Barricade.
3. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
4. The presence of a law enforcement officer in the work zone is optional.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

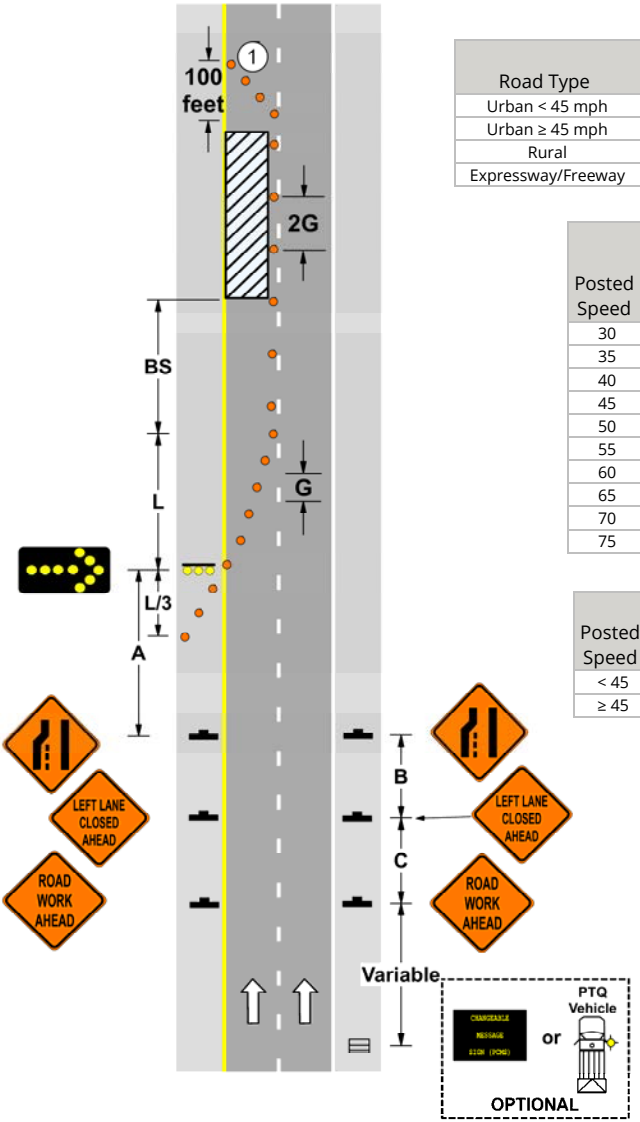
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

(30) Left Lane Closure
Multi-Lane, Divided

NOTES:

1. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.
2. This layout should be used for lower speed roadways. For high speed roadways, refer to the "Lane Closure with Left Hand Merge and Lane Shift" Layout on page 83.
3. The presence of a law enforcement officer in the work zone is optional.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

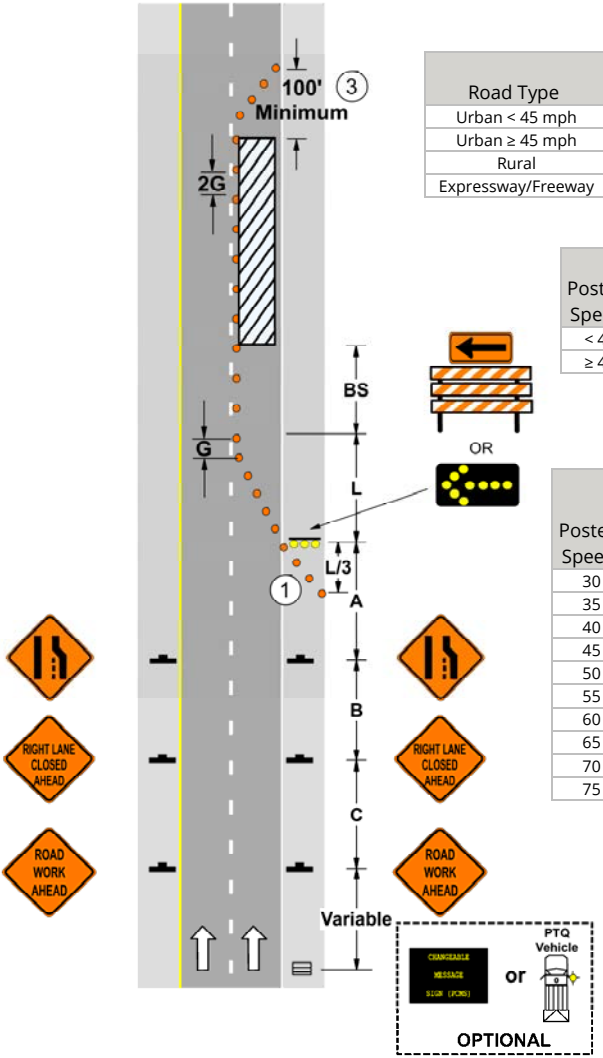
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

(31) Right Lane Closure
Multi-Lane, Divided

NOTES:

1. When paved shoulders having a width of 8 feet or more are closed, channelizing devices should be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.
2. An arrow board shall be used when a freeway lane is closed. When more than one freeway lane is closed, a separate arrow board shall be used for each closed lane.
3. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.
4. The presence of a law enforcement officer in the work zone is optional.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

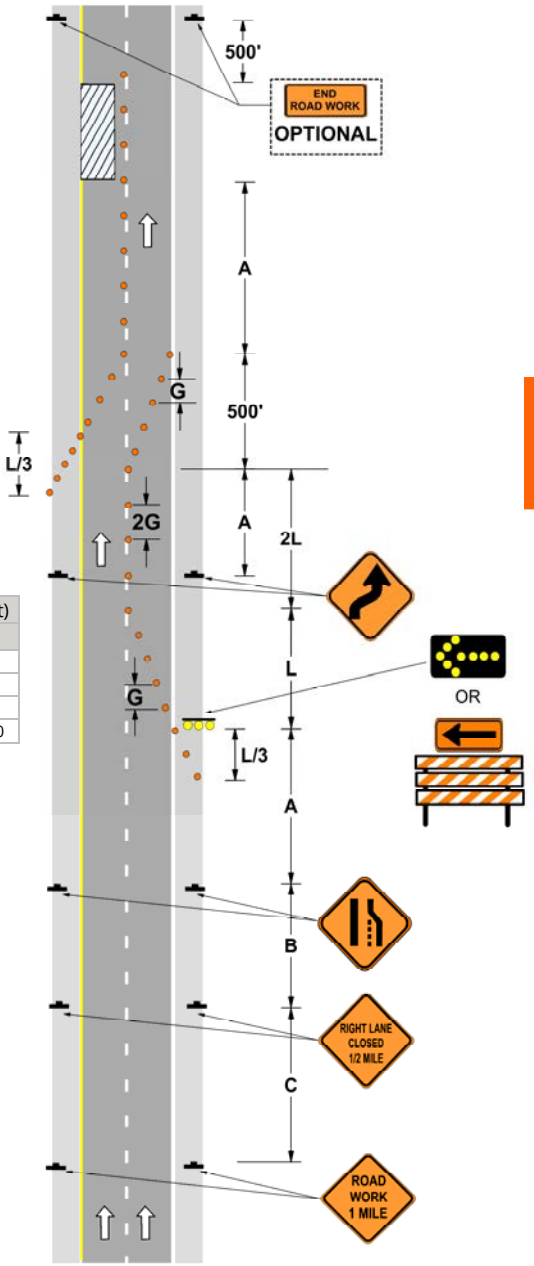
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (ft)	
		(L)	**(L/3)**
30	200	180	60
35	260	260	100
40	320	320	120
45	360	660	220
50	440	720	240
55	500	780	260
60	580	840	280
65	660	900	300
70	740	960	320
75	820	1020	340

(32) Lane Closure with Left Hand Merge and Lane Shift
Multi-Lane, Divided

NOTES:

1. This configuration should be used on roadways where excessive speed and volumes are a concern because a right lane closure is a more typical merge for drivers. For low speed roadways, refer to the "Left Lane Closure" Layout on page 81.
2. Lane widths shall be a minimum of 11 feet with 2-foot shoulders.
3. Extensive planning is required for this layout. **Regional Operations Engineer or Traffic Engineer approval is required.**
4. The presence of a law enforcement officer in the work zone is optional.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Taper Length (ft)	
	(L)	**(L/3)**
30	180	60
35	260	100
40	320	120
45	660	220
50	720	240
55	780	260
60	840	280
65	900	300
70	960	320
75	1020	340

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

(33) Left Two Lanes Closed
Multi-Lane, Divided

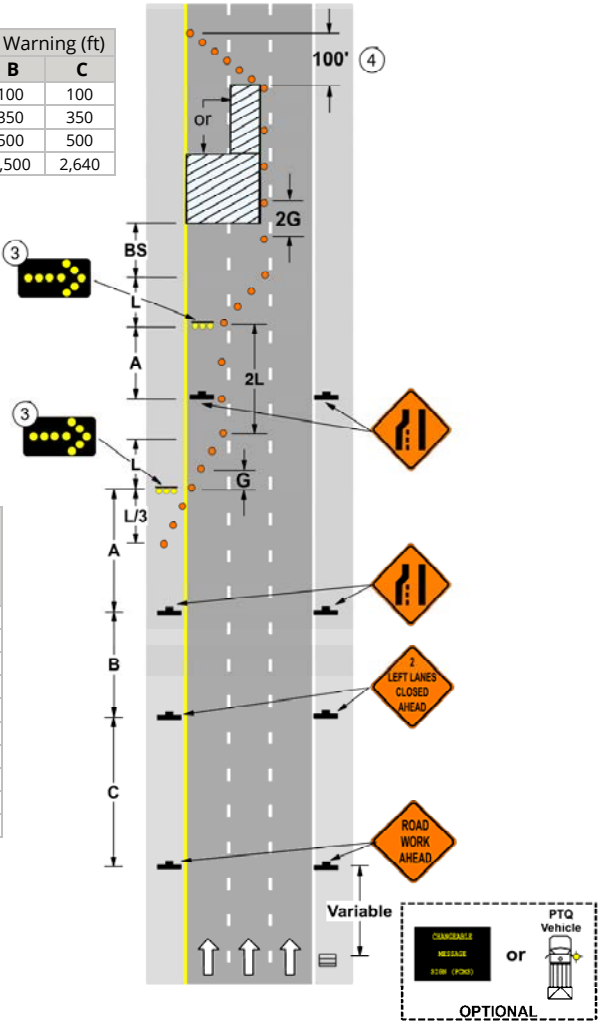
NOTES:

1. If the flashing arrow board will not fit entirely on the left shoulder, it should be placed behind the taper, encroaching on the lane as little as possible.
2. When the Lane Drop symbol sign is used, the same sign shall be used for both lane closures in each direction.
3. Directional Indicator Barricades are optional substitutions for the flashing arrow board.
4. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.
5. The presence of a law enforcement officer in the work zone is optional.

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

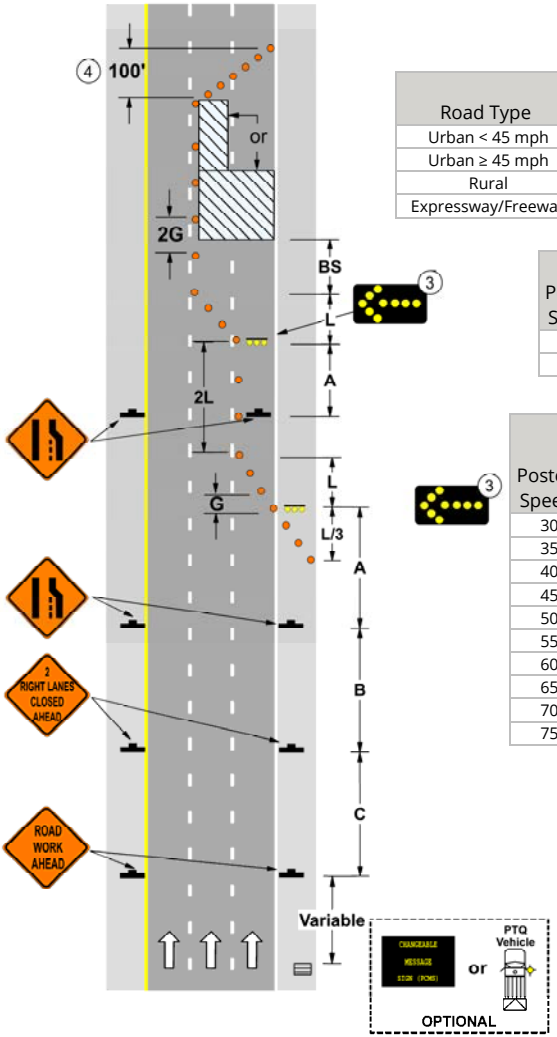
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020



(34) Right Two Lanes Closed
Multi-Lane, Divided

NOTES:

1. If the flashing arrow board will not fit entirely on the right shoulder, it should be placed behind the taper, encroaching on the lane as little as possible.
2. When the Lane Drop symbol sign is used, the same sign shall be used for both lane closures in each direction.
3. Directional Indicator Barricades are optional substitutions for the flashing arrow board.
4. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.
5. The presence of a law enforcement officer in the work zone is optional.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

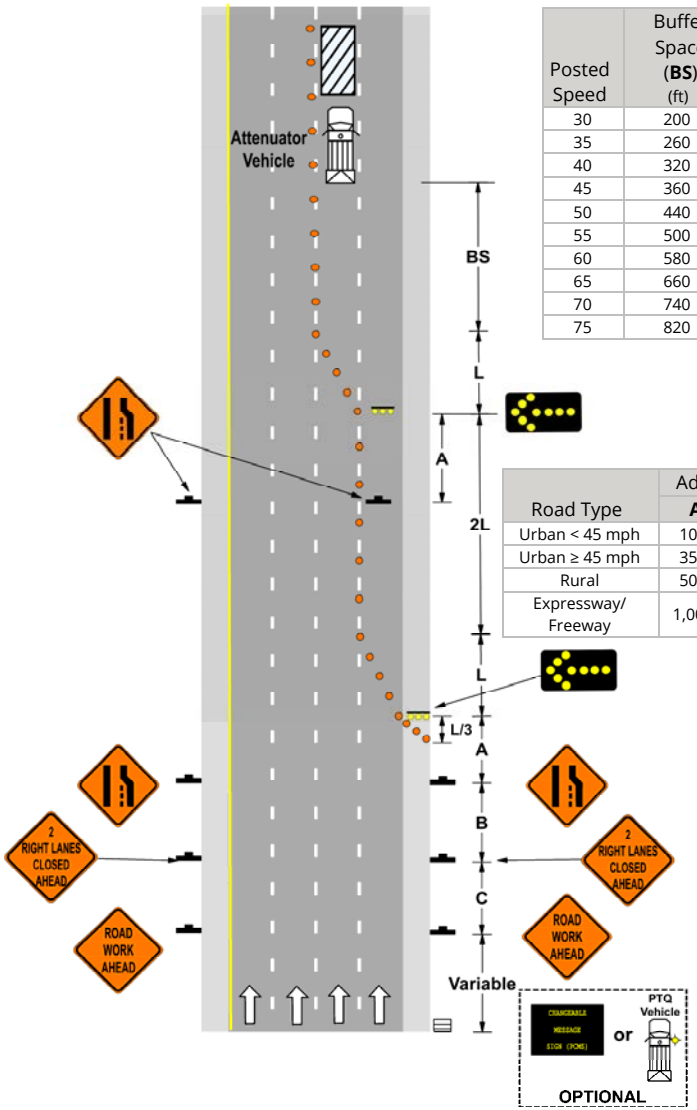
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

(35) Freeway Double Lane Closure
Multi-Lane, Divided

NOTES:

1. When the Lane Drop symbol is used, ensure that signs are placed on each side of the roadway and that the same sign shall be used for both lane closures.
2. Channelizing device are to be spaced along the taper at 20 feet (G) and along the centerline at 40 feet (2G) for speeds less than 45 mph. Speeds equal to 45 mph or greater are to have the channelized device spacing at 40 feet (G) and 80 feet (2G).



Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (ft)	
		(**L**)	(**L/3**)
30	200	180	60
35	260	260	100
40	320	320	120
45	360	660	220
50	440	720	240
55	500	780	260
60	580	840	280
65	660	900	300
70	740	960	320
75	820	1020	340

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640

Intersections

NOTES

(36) Turn Lane Closures

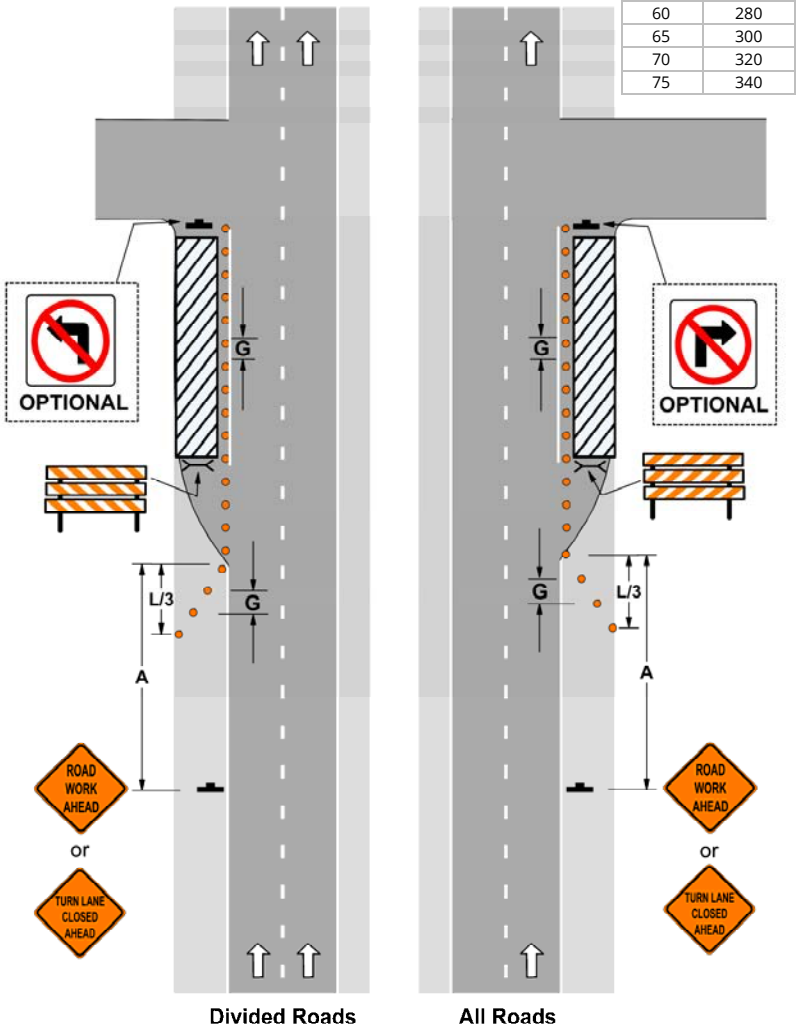
NOTES:

1. Contact the appropriate road authority for signal timing modifications before beginning work at any signalized intersection.

Road Type	Advance Warning (ft) **A**
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

Posted Speed	Channelizing Device Spacing (ft) **G**	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Taper Length **(L/3)** (ft)
30	60
35	100
40	120
45	220
50	240
55	260
60	280
65	300
70	320
75	340

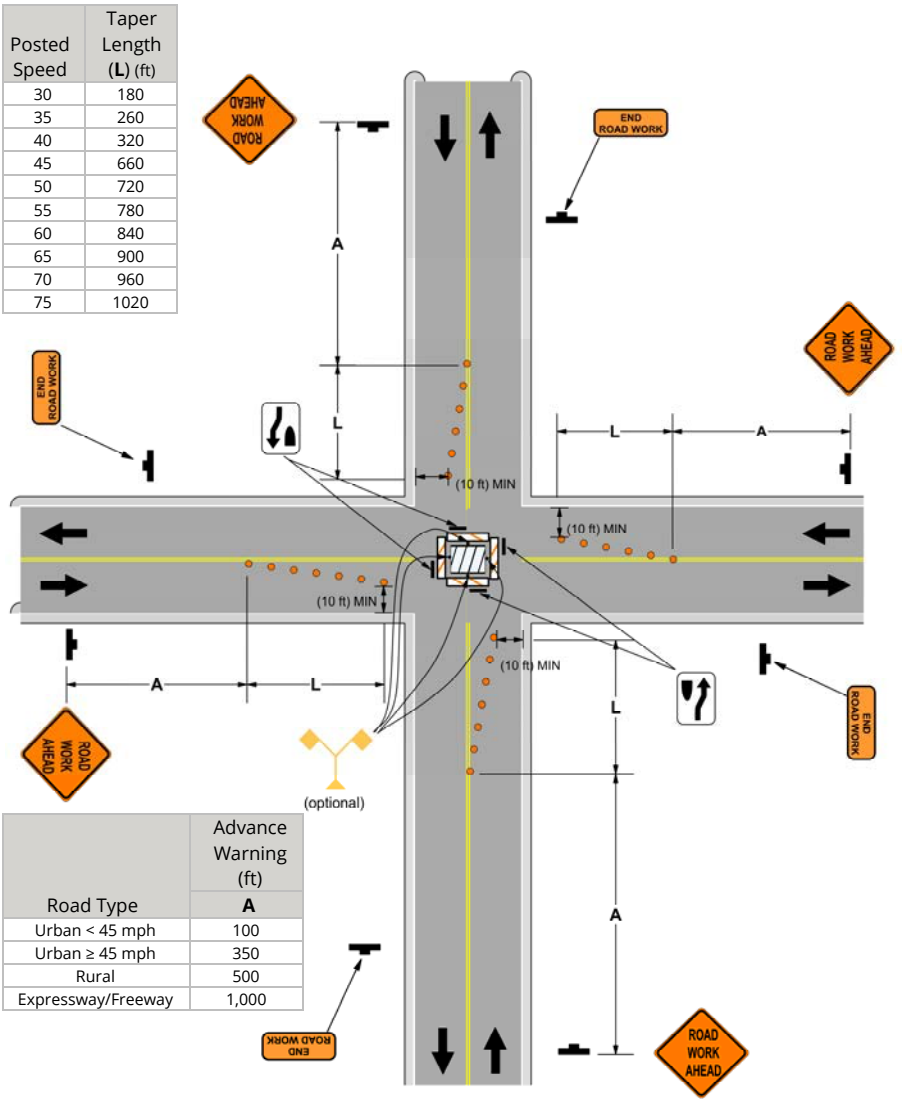


(37) Closure in Center of Intersection

NOTES:

1. All lanes should be a minimum of 10 feet in width as measured to the near face of the channelizing devices.
2. For short-term use on low-volume, low speed roadways with vehicular traffic that does not include longer and wider heavy commercial vehicles, a minimum lane width of 9 feet may be used.
3. Flashing warning lights and/or flags may be used to call attention to advance warning signs.

Posted Speed	Taper Length (**L**) (ft)
30	180
35	260
40	320
45	660
50	720
55	780
60	840
65	900
70	960
75	1020

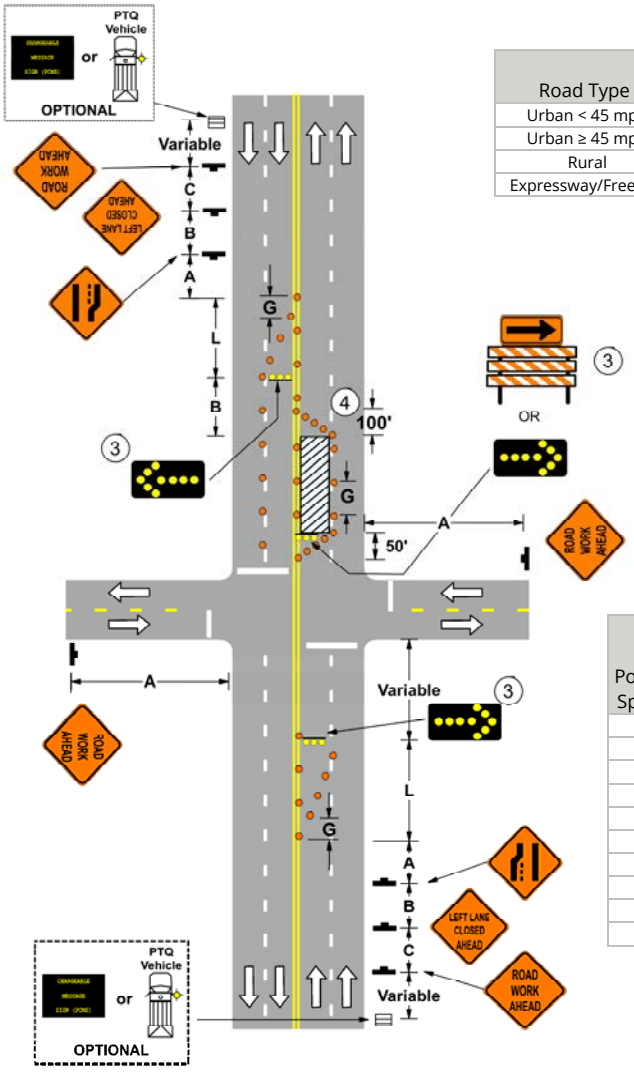


Road Type	Advance Warning (ft) **A**
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

(38) Left Lane Closure at Intersection

NOTES:

1. If the work area extends across a crosswalk, the crosswalk should be closed using the information and devices shown in *MUTCD Figure 6H-29*.
2. The normal procedure is to close on the near side of the intersection any lane that is not carried through the intersection. However, when this results in the closure of a left lane having significant left-turning movements, then the left lane may be reopened as a turn bay for left turns only.
3. Directional Indicator Barricades are optional substitutions for flashing arrow board.
4. The downstream tape should be 100 feet in length using five equally spaced channelizing devices.



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

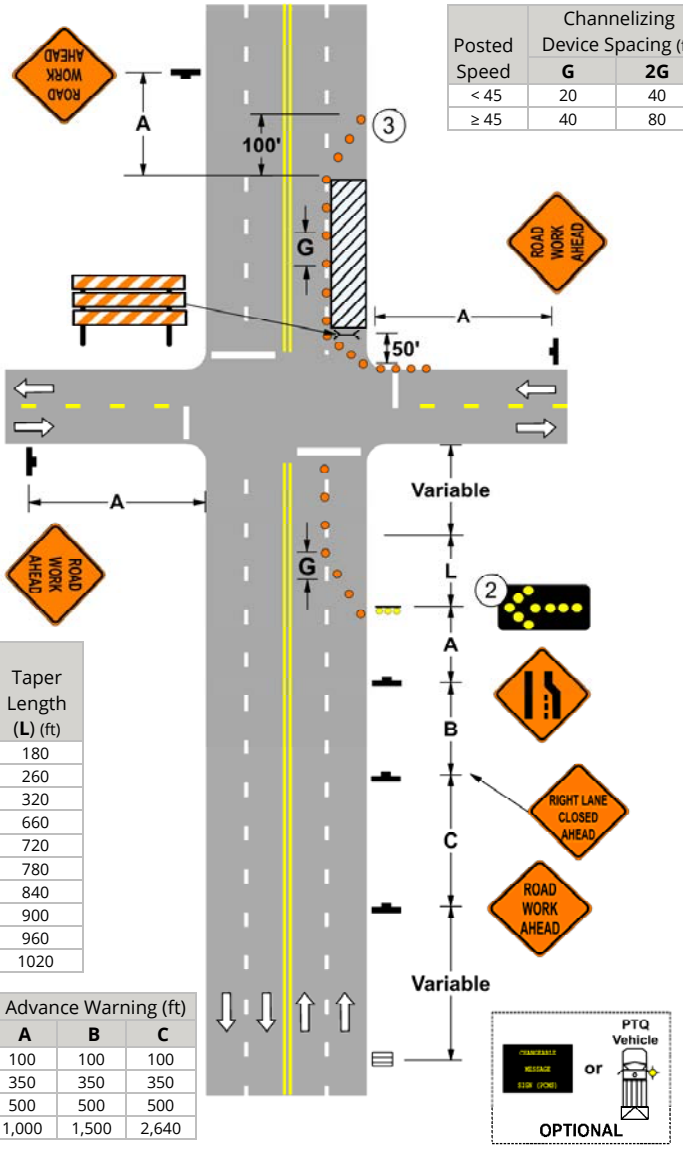
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

(39) Right Lane Closure at Intersection

NOTES:

1. If the work area extends across a crosswalk, the crosswalk should be closed using the information and devices shown in *MUTCD Figure 6H-29*.
2. Directional Indicator Barricades are optional substitutions for flashing arrow board.
3. The downstream taper should be 100 feet in length using five equally spaced channelizing devices.



Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

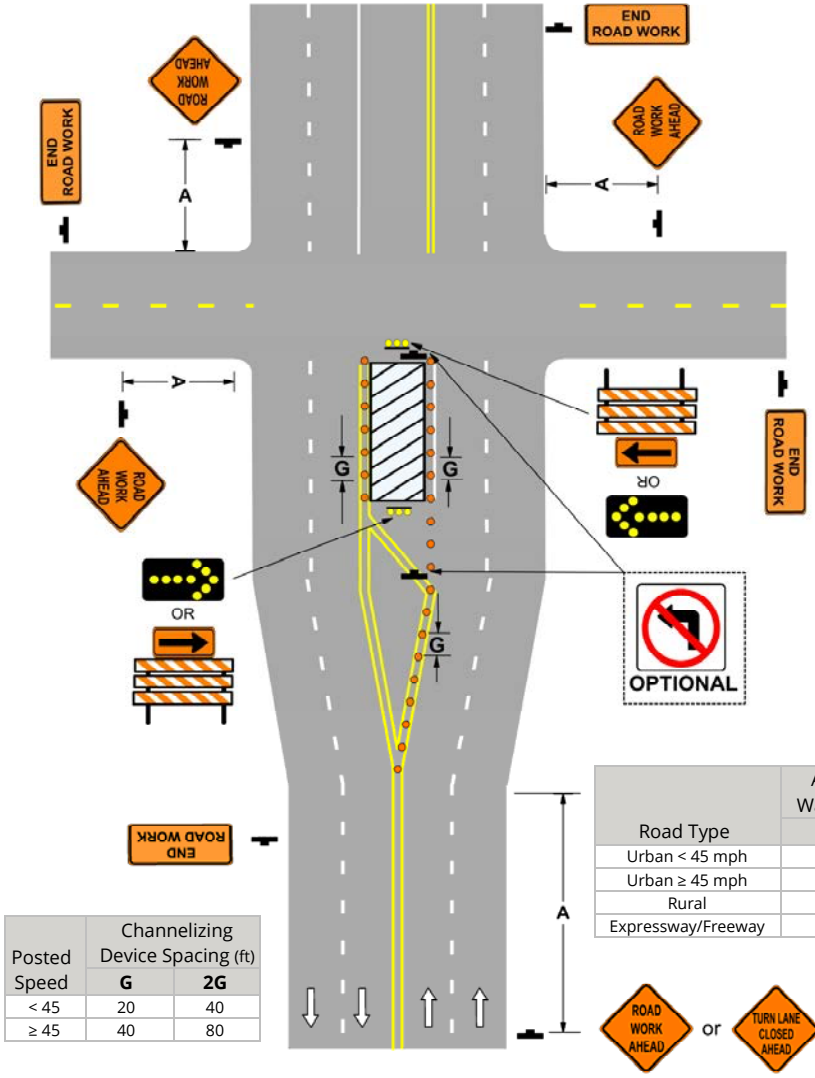
Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

(40) Left Turn Lane Closure at Intersection

NOTES:

1. Contact the appropriate road authority for the placement of temporary STOP signs or signal timing modifications before beginning work at any signalized intersection.
2. **Regional Traffic Office should be contacted before using this Typical Application**
3. If the workspace extends across a crosswalk, the crosswalk should be closed using the information and devices shown in *MUTCD Figure 6H-29*.
4. If there is a significant left-turn volume, then the NO LEFT TURN sign can be used so that left-turning vehicles will not impede through motor vehicle traffic.



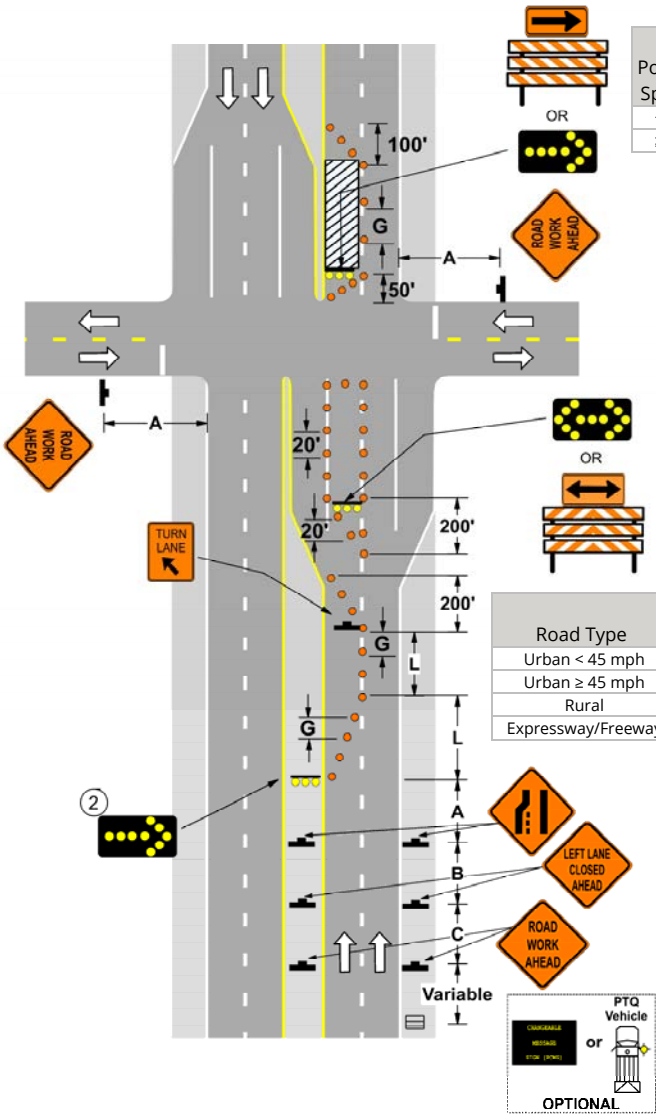
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Road Type	Advance Warning (ft)
	A
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

(41) Left Lane Closure – Workspace Beyond Intersection

NOTES:

1. If the workspace extends across a crosswalk, the crosswalk should be closed using the information and devices shown in *MUTCD Figure 6H-29*.
2. Directional Indicator Barricades are optional substitutions for flashing arrow board.
3. The normal procedure is to close any lane on the near side of the intersection that is not carried through the intersection. However, when this results in the closure of a through lane leading up to a left-turn lane, the left lane may be reopened to allow left-turning vehicles into the left-turn lane.



Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Taper Length (**L**) (ft)
30	180
35	260
40	320
45	660
50	720
55	780
60	840
65	900
70	960
75	1020

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

(42) Right Lane Closure – Workspace Beyond Intersection

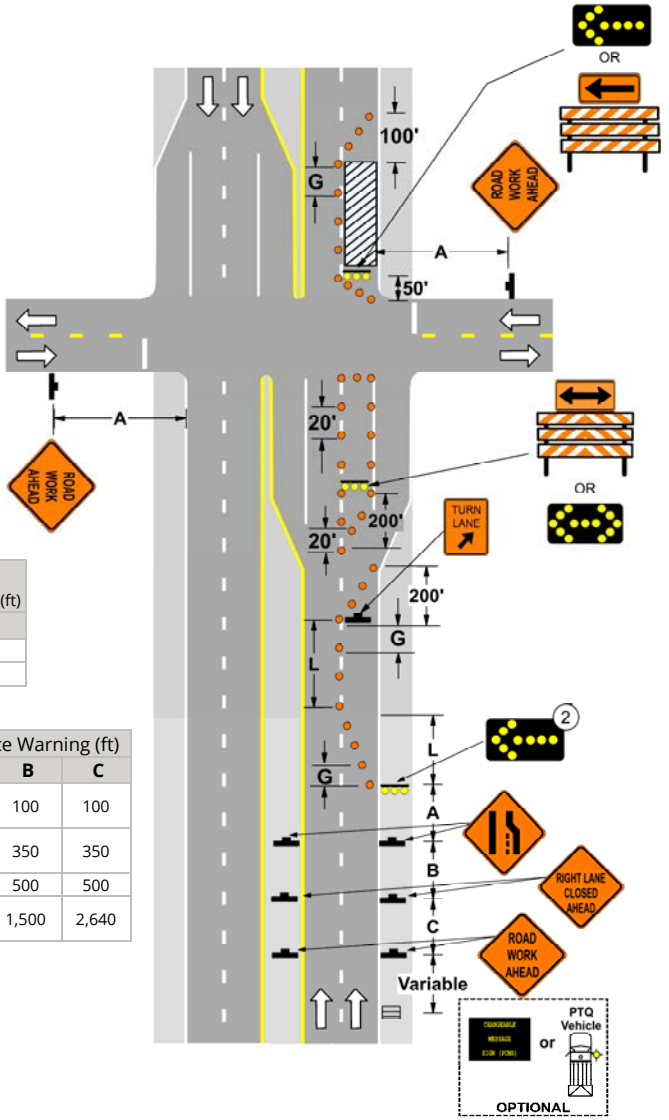
NOTES:

1. If the workspace extends across a crosswalk, the crosswalk should be closed using the information and devices shown in *MUTCD Figure 6H-29*.
2. Directional Indicator Barricades are optional substitutions for flashing arrow board.
3. The normal procedure is to close any lane on the near side of the intersection that is not carried through the intersection. However, when this results in the closure of a through lane leading up to a right-turn lane, the right lane may be reopened to allow right-turning vehicles into the right-turn lane.

Posted Speed	Taper Length (**L**) (ft)
30	180
35	260
40	320
45	660
50	720
55	780
60	840
65	900
70	960
75	1020

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

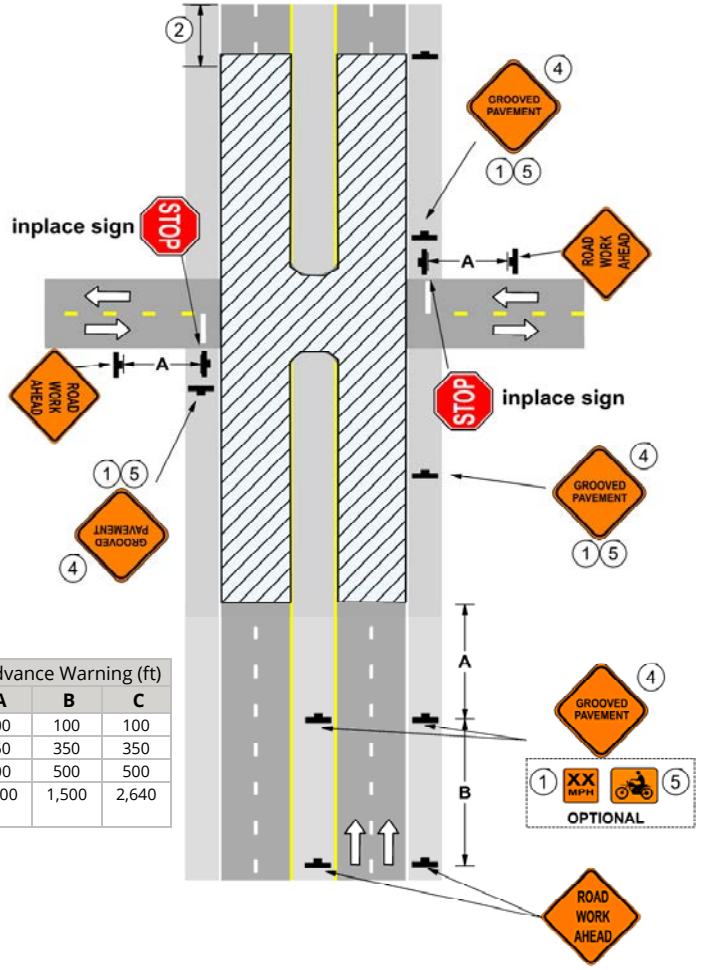
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640



(43) Resurfacing Operation

NOTES:

1. Advisory Speed plaques may be installed below the appropriate warnings.
2. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
3. For single lane work, use the appropriate flagger application or lane closed warning signs shown in the "Temporary Road Closure" Layouts on pages 109 and 110.
4. Use the appropriate advance warning sign for the roadway condition, i.e., GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD, STEEL PLATE AHEAD.
5. A Motorcycle plaque may be installed below the appropriate advance warning sign if the warning is directed primarily to motorcyclists.
6. Extensive planning is required for this layout. **Regional Operations Engineer or Traffic Engineer approval is required.**



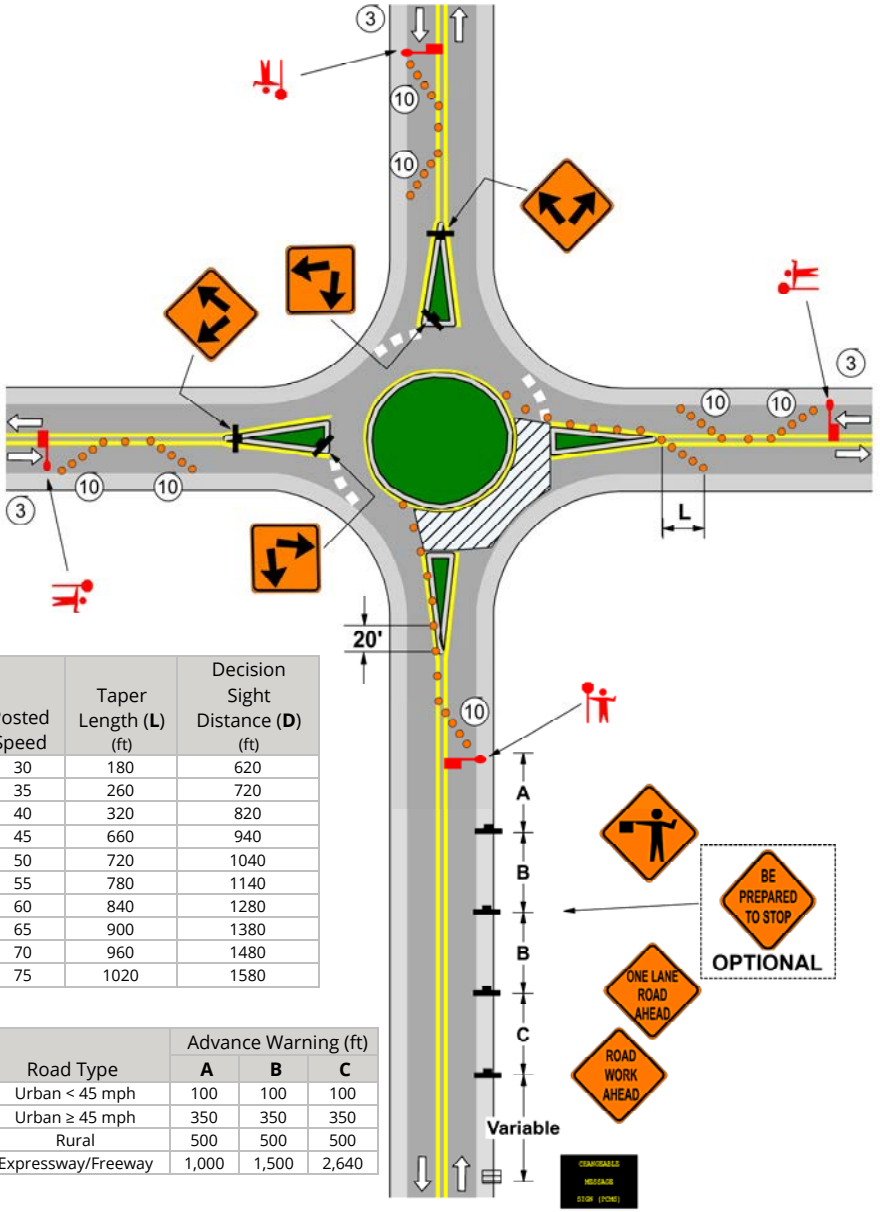
Road Type	Advance Warning (ft)		
	A	B	C
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/ Freeway	1,000	1,500	2,640

(44) Lane Closure in Roundabout

NOTES:

1. Each roundabout is unique, and the traffic control shall be developed to meet the specific conditions of the location and the work operation. A detour could better serve traffic movement and shall be considered as an alternative to the flagger operation.
2. For special circumstances, the Local Traffic Office will provide additional guidance.
3. Approach signs and devices are the same in all directions.
4. Flagger operations may not be necessary when working on the shoulders or in the island of the roundabout. If a driving lane(s) width of at least 10 feet can be maintained while shoulder work on an approach is being conducted, the driving lane(s) may remain open to traffic.
5. Flaggers shall control traffic flow on all approaches of the one-lane roundabout.
6. A lead flagger shall be designated, and radio communication shall be used by the flaggers.
7. Only one approach of traffic shall be released at a time.
8. At night, flagger stations shall be illuminated. Streetlights and vehicle headlights shall not be used to illuminate the flagger station.
9. Type B channelizers may be used.
10. The two-way taper should be 50 feet using 5 equally spaced channelizing devices.
11. A PCMS sign should be considered as part of this operation to provide clear guidance to motorists on all approaches of the roundabout, especially approaches that must reverse traffic flow.
12. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.

(44) Lane Closure in Roundabout



Posted Speed	Taper Length (**L**) (ft)	Decision Sight Distance (**D**) (ft)
30	180	620
35	260	720
40	320	820
45	660	940
50	720	1040
55	780	1140
60	840	1280
65	900	1380
70	960	1480
75	1020	1580

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

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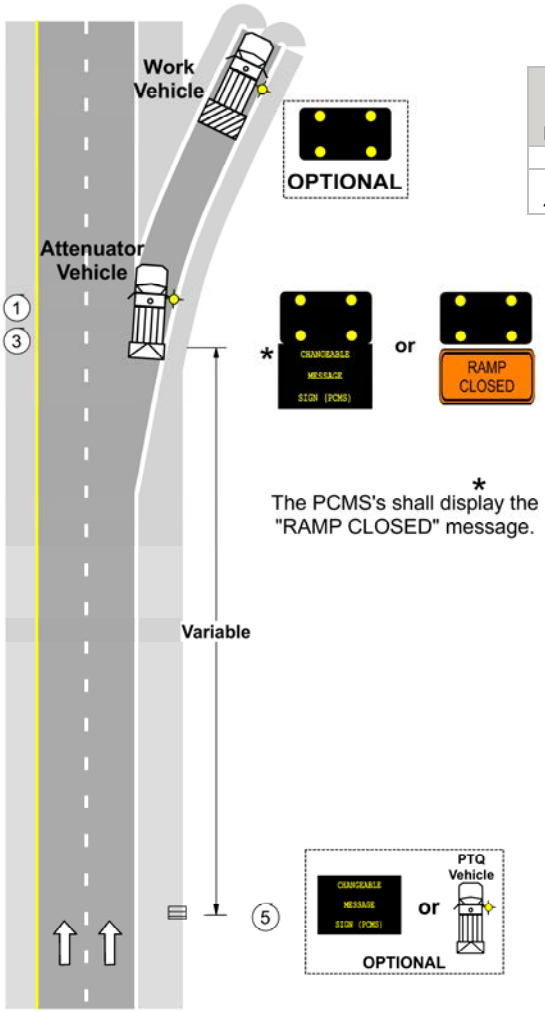
Ramps

NOTES

(45) Mobile Ramp Closure

NOTES:

1. The Attenuator vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If an Attenuator vehicle follows the work vehicle up the ramp, then it shall remain a minimum distance R from the work area.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic.
4. If the ramp cannot be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.

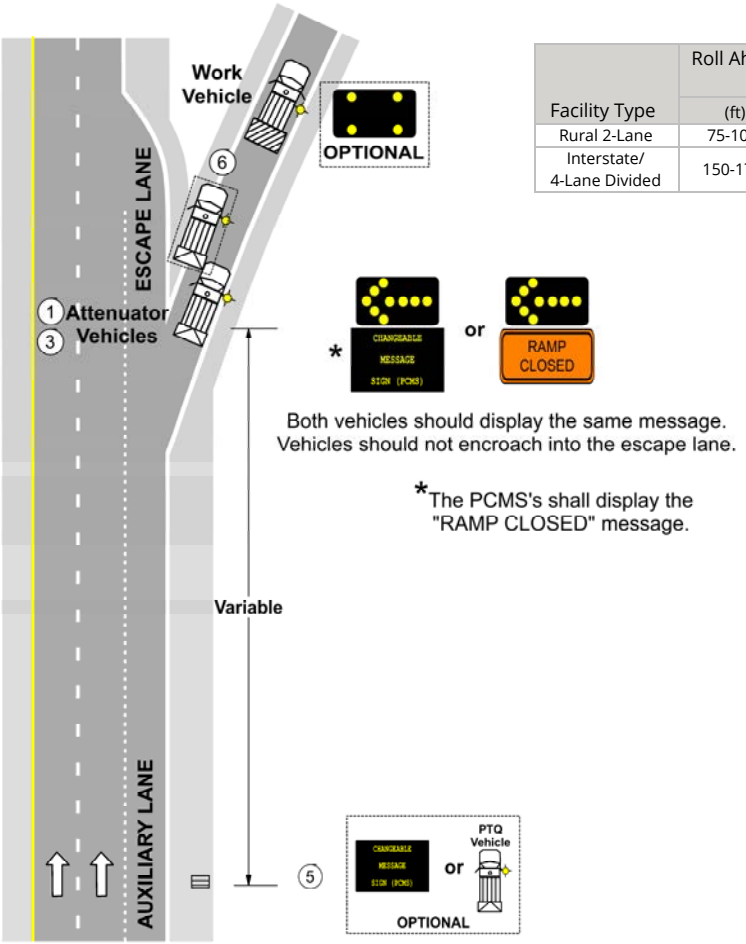


Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

(46) Mobile Ramp Closure with Escape Lane

NOTES:

1. The Attenuator vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If an Attenuator vehicle follows the work vehicle up the ramp, then it shall remain a minimum distance R from the work area.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic and should allow traffic to use the escape lane.
4. If the ramp cannot be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.
6. The optional second Attenuator vehicle may be needed to block wider exit ramps.



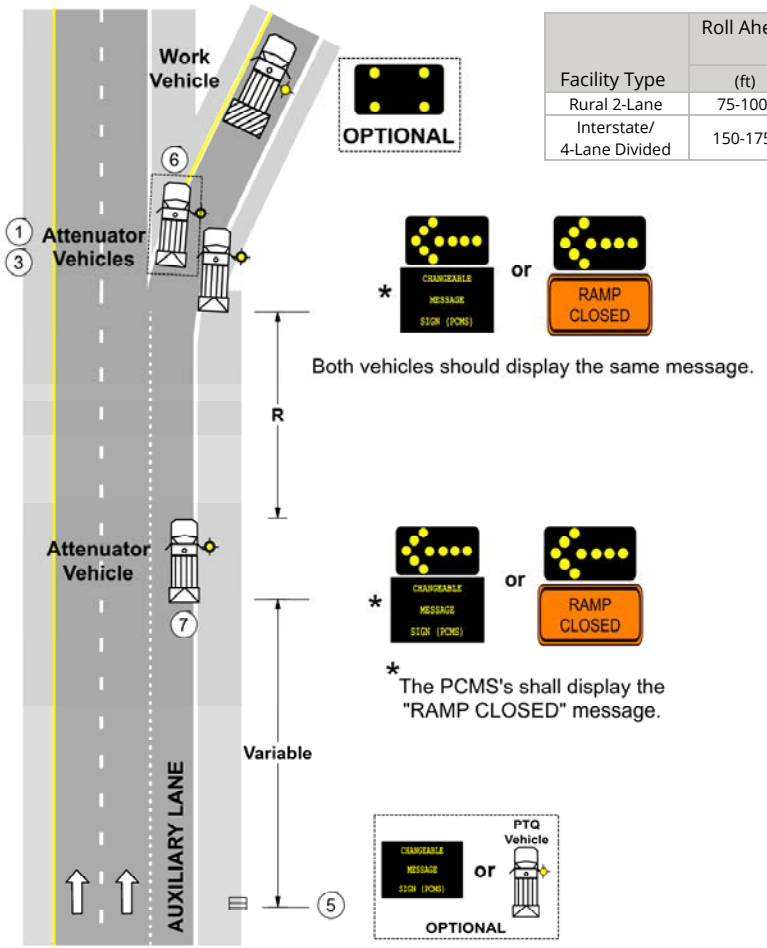
Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5

(47) Mobile Ramp Closure with Lane Drop

NOTES:

1. The Attenuator vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If an Attenuator vehicle follows the work vehicle up the ramp, then it shall remain a minimum distance R from the work area.
2. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic.
4. If the ramp cannot be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.
6. The optional second Attenuator vehicle may be needed to block wider exit ramps.
7. The lateral placement of the PTQ vehicle may be adjusted to create a taper.

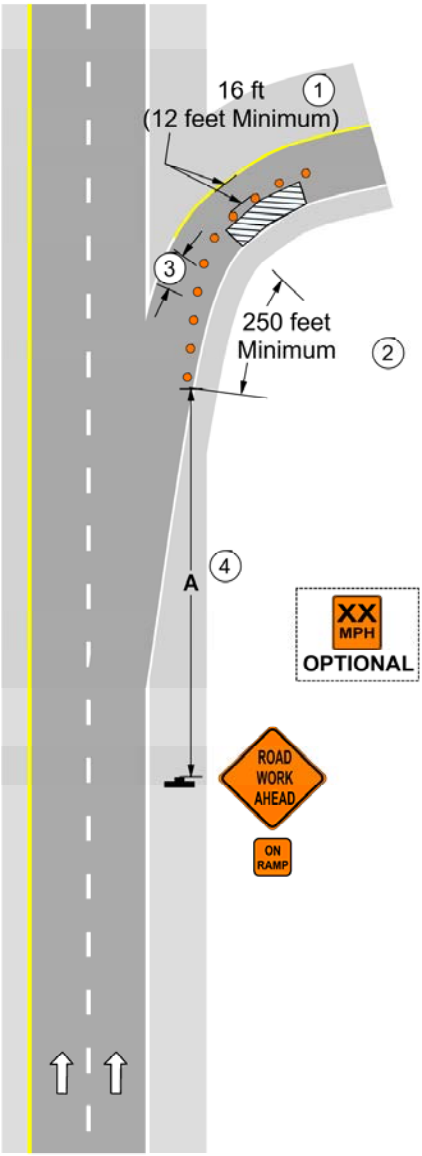
Facility Type	Roll Ahead Distance (**R**)	
	(ft)	(skip lines)
Rural 2-Lane	75-100	3
Interstate/ 4-Lane Divided	150-175	5



(48) Partial Ramp Closure

NOTES:

1. Truck off-tracking should be considered when determining whether the 12-foot minimum lane width is adequate, if not, 16-feet should be used.
2. Adjust buffer space and taper length as ramp length allows.
3. Use 20-foot spacing between devices.
4. The spacing for advance warning signs is dependent on the design of the interchange and the location of in place signing.



Posted Speed	Buffer Space (**BS**) (ft)	Taper Length (**L**) (ft)
30	200	180
35	260	260
40	320	320
45	360	660
50	440	720
55	500	780
60	580	840
65	660	900
70	740	960
75	820	1020

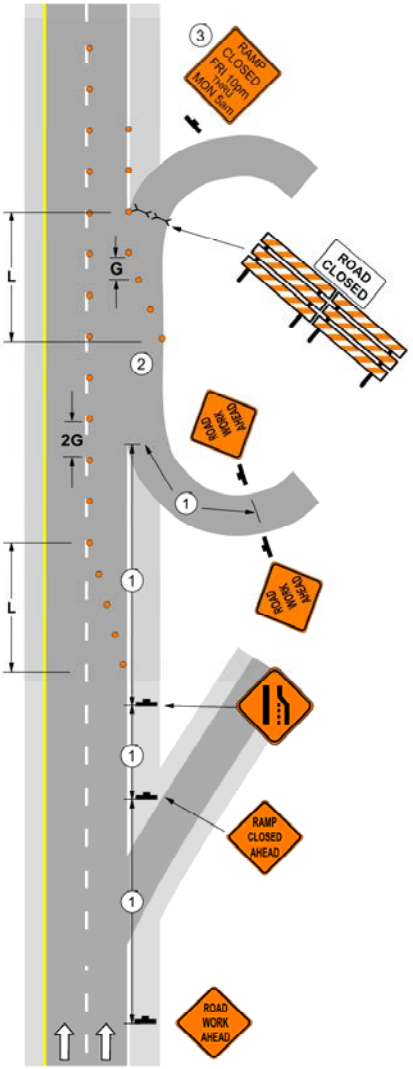
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

See Road Authority for appropriate speed.

(49) Exit Loop Ramp Closure

NOTES:

1. The spacing for advance warning signs is dependent on the ramp length and design as well as the location of in place signing. The spacing should be as long as practical.
2. The acceleration lane length is dependent on traffic speeds and volumes and should be as long as practical.
3. Detour signing should be considered if the ramp is closed for an hour or greater.
4. **Requires clearance from Regional Operations Engineer or Regional Traffic Engineer.** Also, requires coordination, communication, and lane/ramp closure approvals. May include hour or time restrictions.



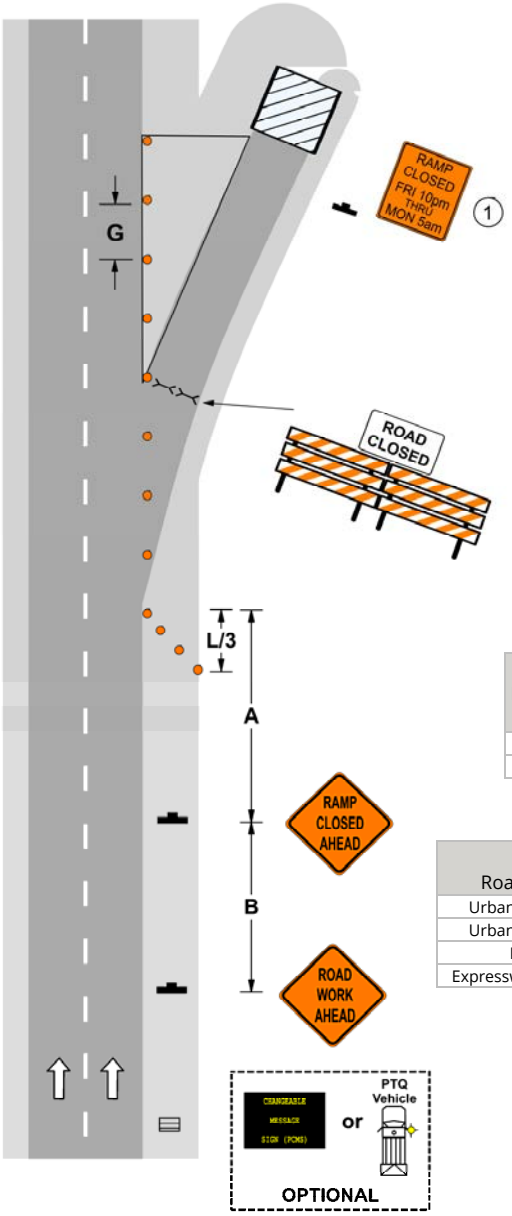
Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Posted Speed	Taper Length (**L**) (ft)
30	180
35	260
40	320
45	660
50	720
55	780
60	840
65	900
70	960
75	1020

(50) Exit Ramp Closure

NOTES:

1. Detour signing should be considered if the ramp is closed for an hour or greater.
2. **Requires clearance from Regional Operations Engineer or Regional Traffic Engineer.** Also, requires coordination, communication, and lane/ramp closure approvals. May include hour or time restrictions.



Posted Speed	Taper Length (**L/3**) (ft)
30	60
35	100
40	120
45	220
50	240
55	260
60	280
65	300
70	320
75	340

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

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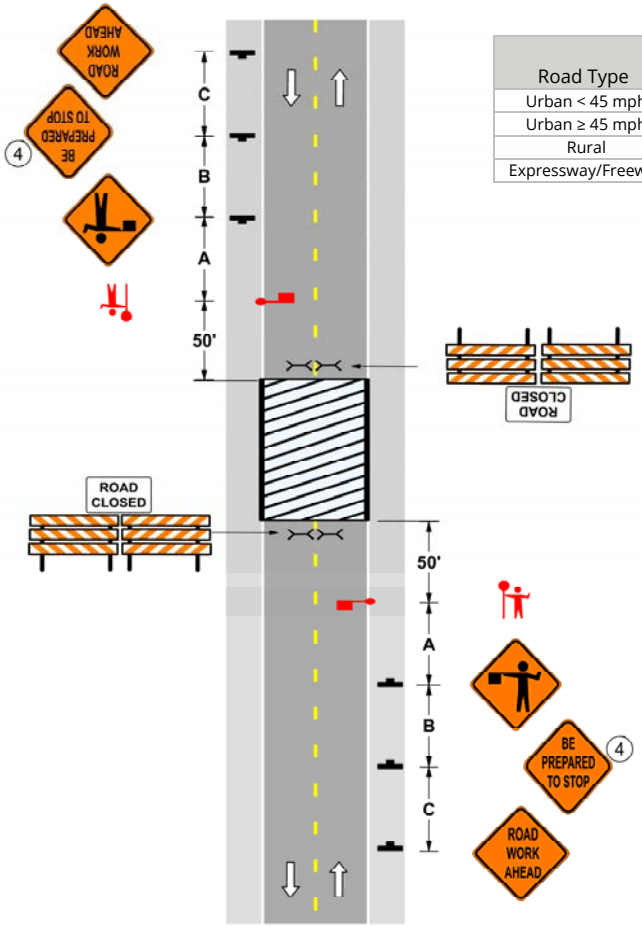
Road Closures

NOTES

(51) Temporary Road Closure

NOTES:

1. Communicate with Regional Public Information Officer (PIO) to determine necessary local contacts.
2. Obtain lane closure approvals. The traffic from both lanes should not be stopped for more than 15 minutes.
3. Detour signing should be considered if the road is closed for an hour or greater. Coordination of detour routes with local officials may be necessary.
4. The BE PREPARED TO STOP sign may be omitted when the posted speed limit is 40 mph or less.
5. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
6. Conditions represented are for work during daytime hours only.
7. For night closures, the following should be used:
   a. Law enforcement officers with squad car for flaggers.
   b. A changeable message sign in each direction.



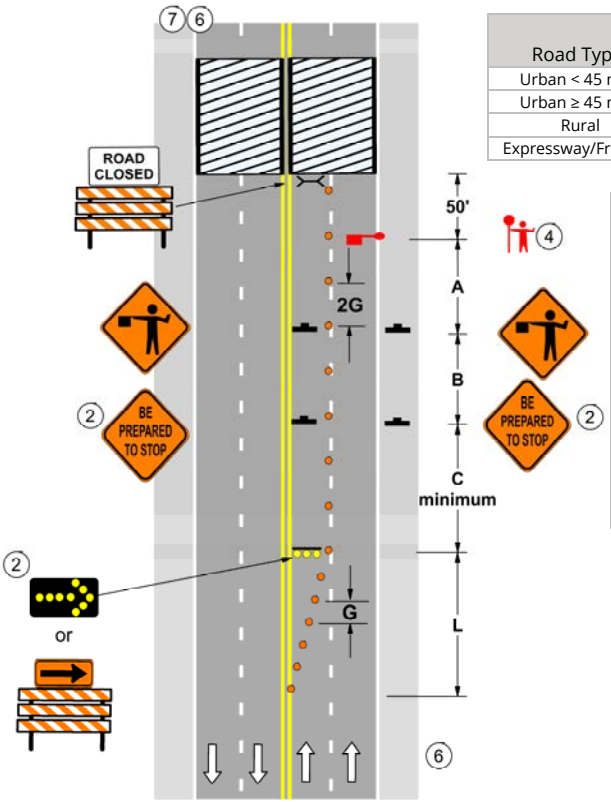
Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Decision Sight Distance (**D**) (ft)
30	620
35	720
40	820
45	940
50	1040
55	1140
60	1280
65	1380
70	1480
75	1580

(52) Temporary Road Closure
Multi-Lane, Undivided

NOTES:

1. The traffic from both lanes should not be stopped for more than 15 minutes. Detour signing should be considered if the road is closed for an hour or greater. Coordination of detour routes with local officials may be necessary.
2. The BE PREPARED TO STOP sign and the flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
3. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
4. A law enforcement officer with a marked vehicle shall be used instead of a flagger during night operations.
5. For roads with 3 or more lanes of traffic in one direction, use the appropriate stationary layout.
6. Advance traffic control devices for a left lane closure shall be as shown in the "Left Lane Closure" Layout on page 66.
7. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
8. **Requires clearance from Regional Operations Engineer or Regional Traffic Engineer.**



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

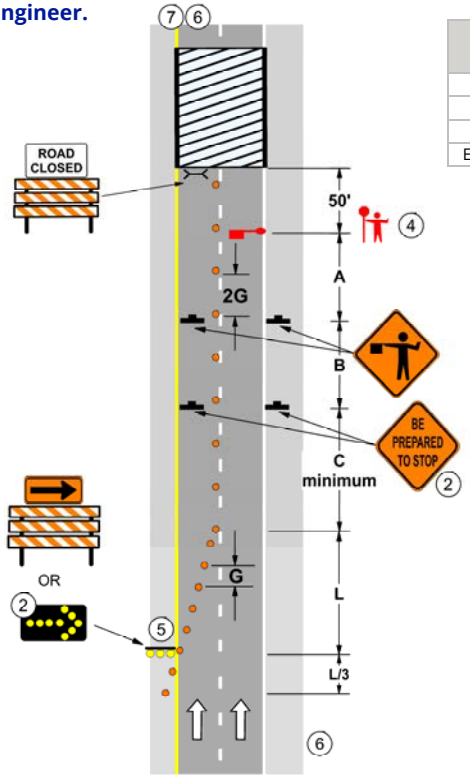
Posted Speed	Taper Length (**L**) (ft)	Decision Sight Distance (**D**) (ft)
30	180	620
35	260	720
40	320	820
45	660	940
50	720	1040
55	780	1140
60	840	1280
65	900	1380
70	960	1480
75	1020	1580

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

(53) Temporary Road Closure
Multi-Lane, Divided

NOTES:

1. The traffic from both lanes should not be stopped for more than 15 minutes. Detour signing should be considered if the road is closed for an hour or greater. Coordination of detour routes with local officials may be necessary.
2. The BE PREPARED TO STOP sign and the flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
3. For roads with 3 or more lanes of traffic in one direction, use the appropriate stationary layout.
4. A law enforcement officer with a marked vehicle shall be used instead of a flagger during night operations.
5. An arrow board shall be placed on the inside shoulder at the beginning of the merging taper.
6. Advance traffic control devices for a left lane closure shall be as shown in the "Left Lane Closure" Layout on page 81.
7. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.
8. The approach sight distance to the flagger shall be at least the Decision Sight Distance, D, or 500 feet, whichever is greater.
9. **Requires clearance from Regional Operations Engineer or Regional Traffic Engineer.**



Road Type	Advance Warning (ft)		
	A	**B**	**C**
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Taper Length (**L**) (ft)	Taper Length (**L/3**) (ft)	Decision Sight Distance (**D**) (ft)
30	180	60	620
35	260	100	720
40	320	120	820
45	660	220	940
50	720	240	1040
55	780	260	1140
60	840	280	1280
65	900	300	1380
70	960	320	1480
75	1020	340	1580

Posted Speed	Channelizing Device Spacing (ft)	
	G	**2G**
< 45	20	40
≥ 45	40	80

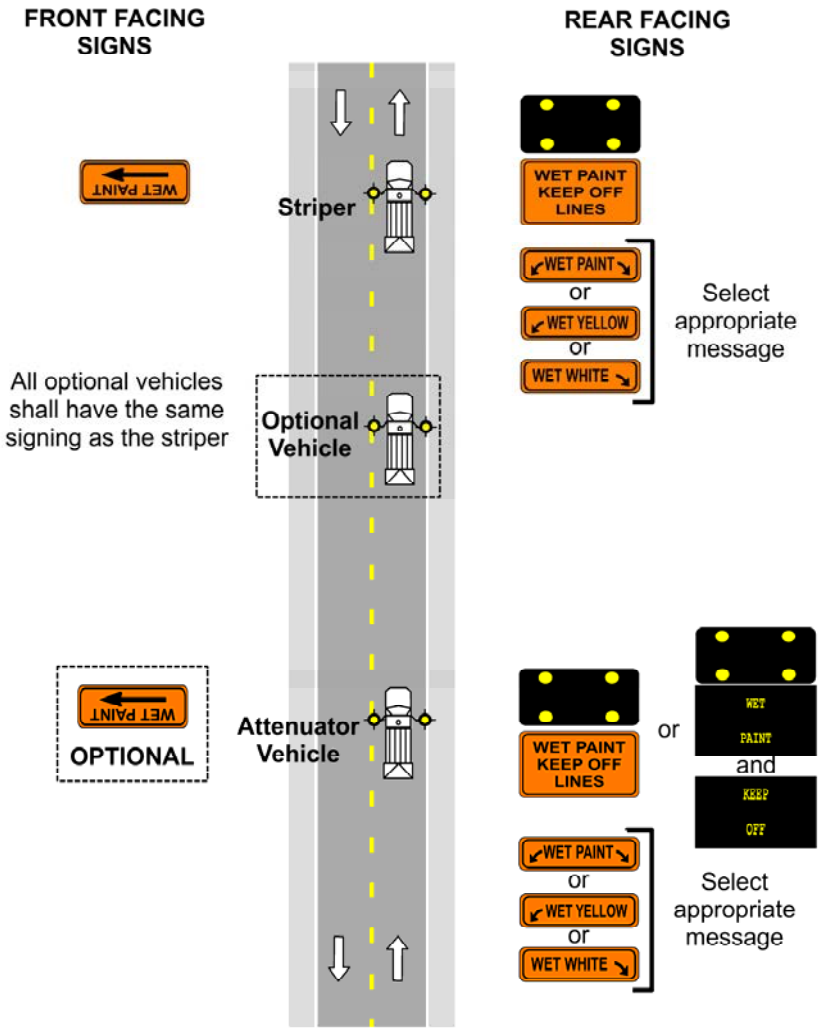
Miscellaneous

NOTES

(54) Striping Operations

NOTES:

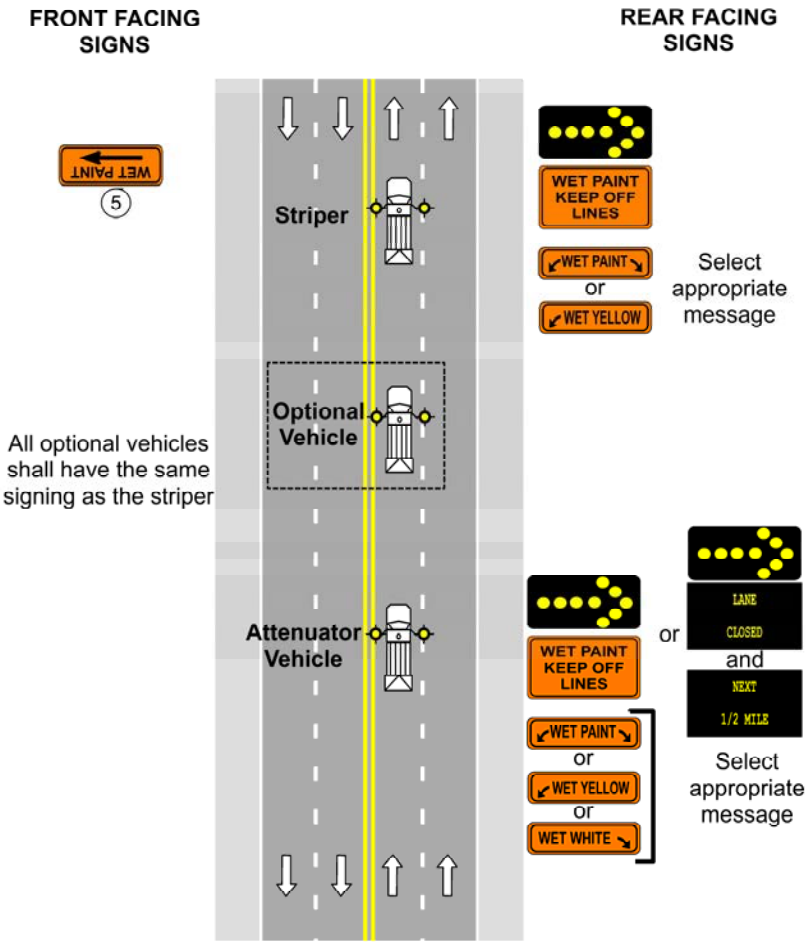
1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the striper and the last PTQ vehicle should be determined by the track free time of the pavement marking material.
3. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "WET PAINT" signs should be considered.



(55) Striping Operations

NOTES:

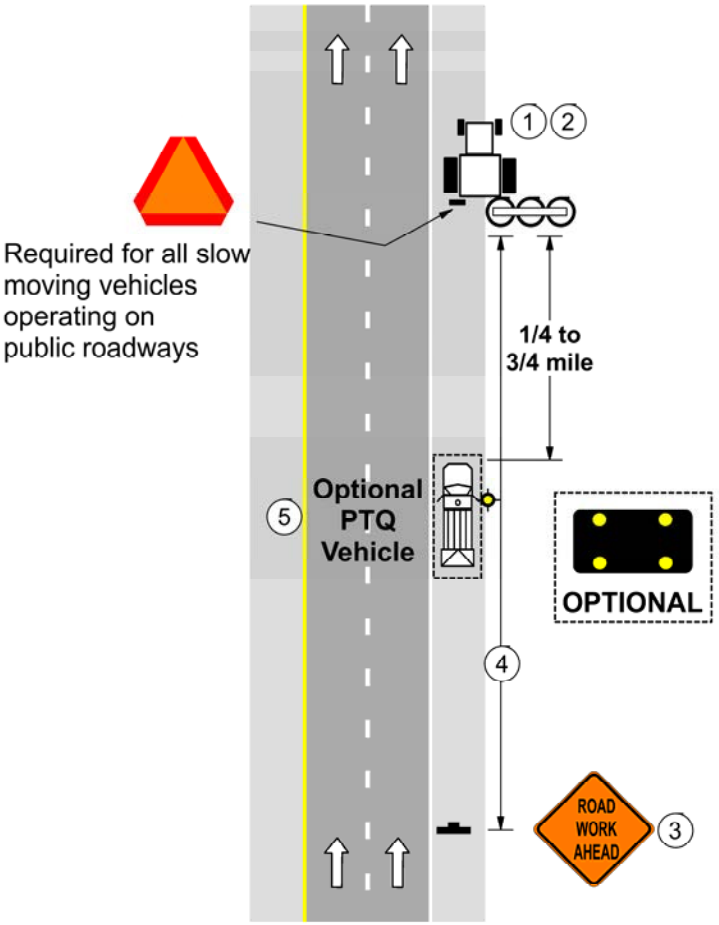
1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the striper and the last PTQ vehicle should be determined by the track free time of the pavement marking material.
3. Any Attenuator vehicle or PTQ vehicle operating totally or partially in a traffic lane shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "WET PAINT" signs should be considered.
5. Remove sign when operating this vehicle in the right lane.



(56) Work Off Roadway

NOTES:

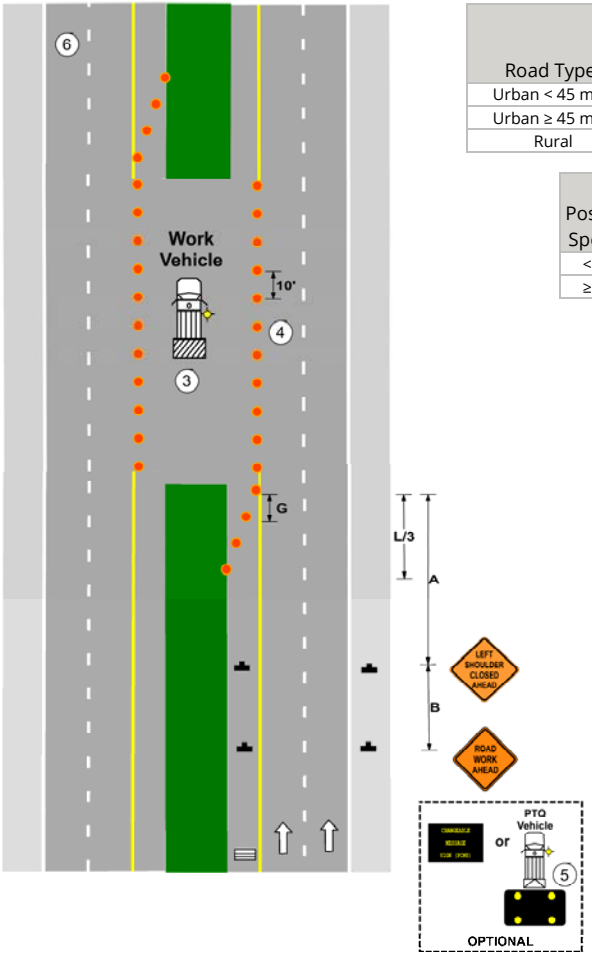
1. The operations should be scheduled and completed during daylight work shifts and have little or no interference with traffic. The work should be suspended during periods of poor weather or visibility.
2. All vehicles shall be equipped with a flashing vehicle light visible 360-degrees around the vehicle when viewed from a distance of 60 feet.
3. The ROAD WORK AHEAD sign may be omitted when there is an adequate approach decision sight distance to the equipment along the majority of the route.
4. When advance warning signs are used, the signs should be no more than 2 miles from the work vehicle. The location of the signs should be determined by the sources of traffic, such as major crossroads.
5. On roadways where decision sight distance is restricted and the equipment must encroach into the traffic lane routinely, a PTQ vehicle may be used as shown.



(57) Median Closure

NOTES:

1. This layout applies to multi-lane divided roadways with paved median openings for U-turn use only. Do not use this layout for openings with side street access or openings that function within a J-turn intersection.
2. If the median opening includes a left-turn lane, the turn lane shall be closed by channelization devices the full extent of the turn lane.
3. The work vehicle must be able to be oriented parallel to travel lanes.
4. The spacing between devices should be 10 feet within the median closure.
5. If the PTQ vehicle is used instead of the PCMS, it shall be equipped with a truck or trailer mounted attenuator following the requirements in *TDOT's SOG 477-01* and the *Truck and Trailer Mounted Attenuators Manual*. It shall also be equipped with an Advance Warning Arrow Board set on Flashing Four Corners.
6. The advance warning sign sequence is shown for one-way direction only. The other direction shall be identical.



Road Type	Advance Warning (ft) A	B
Urban < 45 mph	100	100
Urban ≥ 45 mph	350	350
Rural	500	500

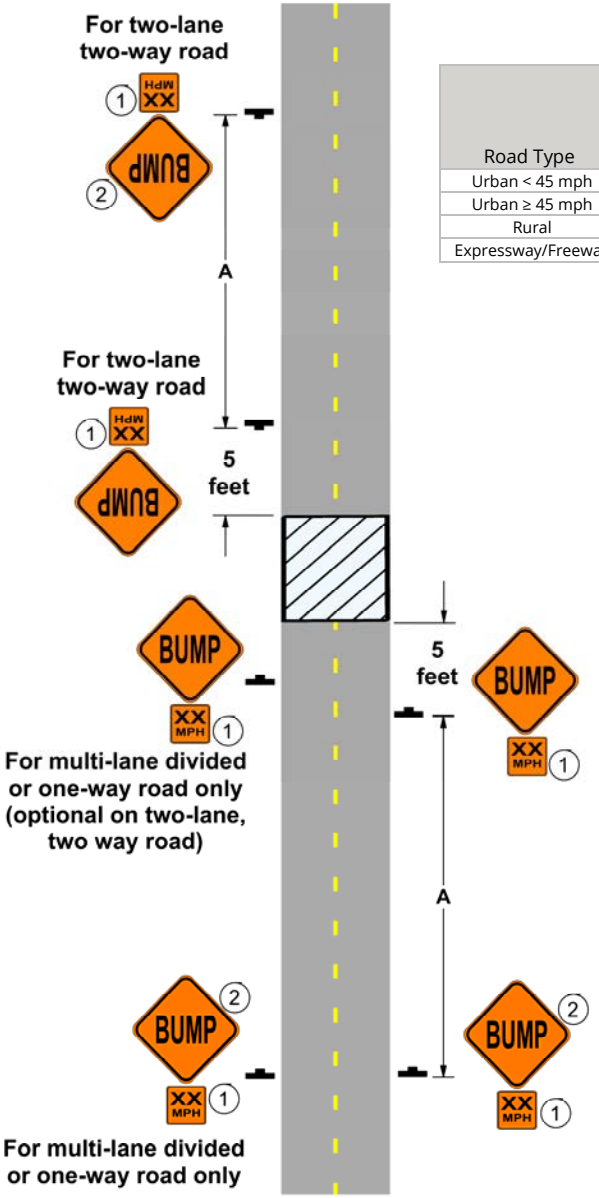
Posted Speed	Channelizing Device Spacing (ft) G	2G
< 45	20	40
≥ 45	40	80

Posted Speed	Taper (ft) L/3
30	60
35	100
40	120
45	220
50	240
55	260
60	280
65	300
70	320
75	340

(58) Typical Bump Signing

NOTES:

1. When used, Advisory Speed plaques shall be installed below the appropriate warnings.
2. These devices may be omitted when the posted speed limit is 40 mph or less.
3. This layout would also apply to signage for the use of High Water, Rumble Strips, etc.

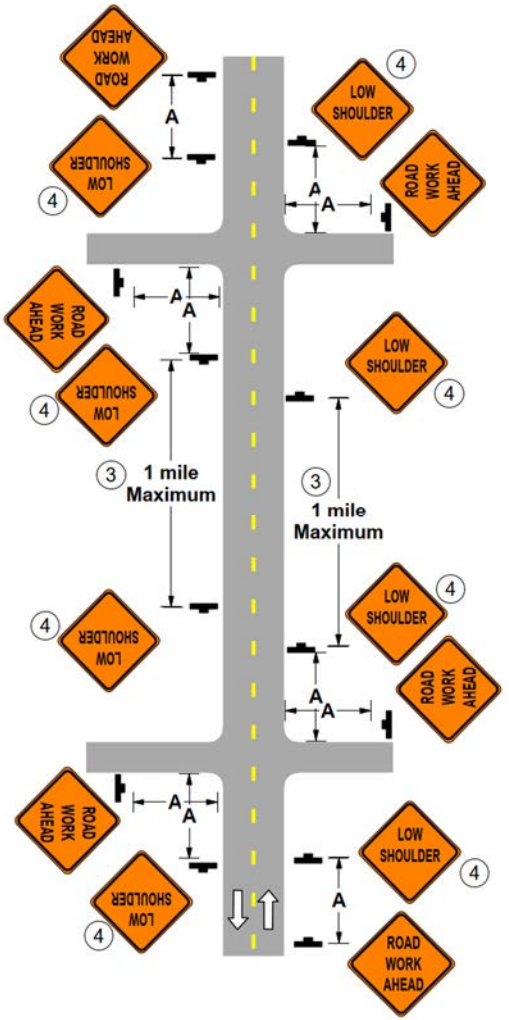


Road Type	Advance Warning (ft) **A**
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

(59) Crossroad & Confirmation Signing

NOTES:

1. This layout should be used for those stationary temporary traffic control zones that extend over a relatively long segment of roadway.
2. The appropriate layout shall be used for the active workspace (such as area of paving, etc.).
3. Confirmation signing for a continuous condition should be placed at approximately 1 mile spacing.
4. Use the appropriate advance warning sign for the roadway condition, i.e., GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD, STEEL PLATE AHEAD. A Motorcycle plaque may be installed below the appropriate advance warning sign if the warning is directed primarily to motorcyclists.



Road Type	Advance Warning (ft) **A**
Urban < 45 mph	100
Urban ≥ 45 mph	350
Rural	500
Expressway/Freeway	1,000

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DEVICE QUALITY STANDARDS

Introduction

Traffic control devices are a necessary part of a TTC zone to warn motorists of hazards, direct them through the zone, delineate closed areas, and separate them from workers. The devices communicate information to drivers visually, and this communication relies on the devices being in good condition. Since it is not practical to require new devices at all times, standards are needed to evaluate the condition of the devices to assure their continued effectiveness.

This guide divides the condition of TTC zone devices into three classes:

Acceptable: Meets all MUTCD requirements such as design, size, color, weight, etc., and clearly performs its intended function.

Marginal: Negligible flaws are evident, but the device still clearly performs its intended function.

Unacceptable: Wear and tear affect the ability of the device to meet the MUTCD requirements and perform its intended function.

The following standards have been developed to help determine the condition of different temporary traffic control devices. The device's condition should be evaluated at several stages: while in storage, during preparation for delivery to the temporary traffic control zone, during initial set up, and periodically during the course of work. Suppliers and contractors are encouraged to apply this standard prior to delivery of devices to the jobsite. Doing so will minimize agency involvement and reduce costs related to on-site replacement.

These standards are intended to address the day-to-day operations of traffic control within a TTC zone and are not meant to cover the needs of emergency situations.

Warning Signs

Acceptable

Acceptable warning signs meet all of these conditions:

- Some abrasions, but very little loss of lettering.
- No touchup of the lettering.
- The message is legible both day and night.
- The back side is free of any reflective materials except small logos or identification markings and has a bare surface or is painted a uniform color as approved by the local road authority.

Marginal

Marginal warning signs meet either of these conditions:

- Some abrasions, but only a few are within the individual letters of the message.
- Some color fading may be evident, but the background color and retroreflectivity are still apparent at night.

Unacceptable

Unacceptable warning signs meet any of these conditions:

- Material residue on the face of the sign.
- Portions of letters are missing.
- The message is illegible.
- There is noticeable color fading or loss of retroreflectivity at night.
- Signs are damaged or defaced in a way that they no longer have the same shape as a new sign.

Acceptable

Marginal

Unacceptable

Type A & B Channelizing Devices

Acceptable

Meet all of these conditions:

- In original shape and is free standing in its normal position.
- No punctures or abrasions.
- Surface is free of material residue and can be washed.
- The reflective bands have little or no loss of retroreflectivity, with only minor tears and scratches.
- Any dents do not seriously reduce the retroreflectivity of the sheeting

Marginal

Meet any of these conditions:

- Small areas of abrasions and discoloration that may not be readily cleaned.
- The reflective bands have numerous tears and scratches, but no large areas of residue or missing reflective material.
- Dents do not reduce the strength or stability of the device.

Unacceptable

Meet any of these conditions:

- Punctures, abrasions, or large areas of staining that cannot be cleaned.
- Noticeable fading of the device's color.
- Large areas of missing or stained reflective material.
- Substantial deformation that reduces the original dimensions, or loss of original shape.
- Multiple dents or fractures that affect stability or the ability to retain the reflective sheeting.

Type I, II, or III Barricade or Vertical Panels

Acceptable

Meet all of these conditions:

- Panels are not deformed.
- Minimal abrasions that do not reduce reflectivity of sheeting.
- The orange is vivid, and the stripes provide contrast.

Marginal

Meet any of these conditions:

- Numerous surface abrasions.
- Some color fading, but no large areas of residue or missing reflective material.

Unacceptable

Meet any of these conditions:

- Most of the surface is damaged.
- There is a noticeable loss of retroreflectivity or fading.
- The reflective material is missing or covered.
- Barricades are bent, twisted, or otherwise deformed so that the panel is not parallel to the roadway surface.

Acceptable

Marginal

Unacceptable

Warning Lights

Type A: Low-Intensity Flashing Warning Lights

Type B: High-Intensity Flashing Warning Lights

Type C: Steady-Burn Warning Lights

Type D: 360-degree Steady-Burn Warning Lights

Acceptable

Acceptable Warning Lights meet all of these conditions:

- 100% of all warning lights operate properly and have the correct alignment.
- Type A/C/D: visible on a clear night from a distance of 3000 feet.
- Type B: visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1000 feet.

Marginal

Marginal Warning Lights meet any of these conditions:

- Type A/C/D: 90% of the warning lights operate properly with no more than three (3) adjacent lights failing.
- Type B: one (1) light failing.

Unacceptable

Unacceptable Warning Lights meet any of these conditions:

- Type A/C/D: less than 90% of the warning lights operate properly, or more than three (3) adjacent lights failing.
- Type B: more than one (1) light failing.

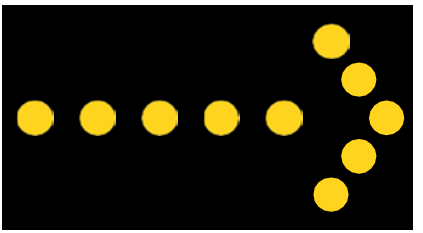
Flashing Arrow Boards

Flashing Arrow Mode

Acceptable

Acceptable Flashing Arrow Mode meets all of these conditions:

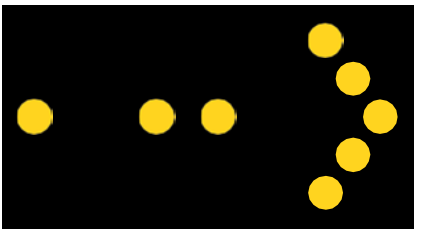
- All lamps properly aligned for the intended driver's line of vision.
- No lamps are burnt out.
- All lamps dim properly.
- All lamps are the same level of intensity.



Marginal

Marginal Flashing Arrow Mode meets this condition:

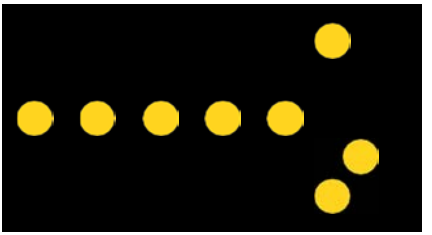
- Up to two (2) lamps are out in the stem and no lamps out in the head.



Unacceptable

Unacceptable Flashing Arrow Mode meets any of these conditions:

- Any lamp out in the head.
- More than two (2) lamps out in the stem.

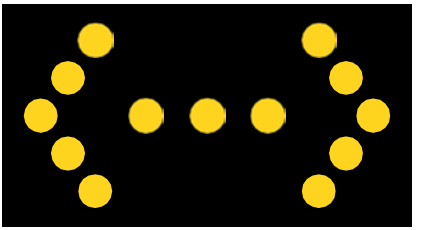


Double Arrow Mode

Acceptable

Acceptable Double Arrow Mode meets all of these conditions:

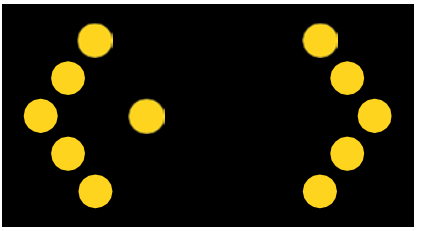
- All lamps properly aligned for the intended driver's line of vision.
- No lamps are burnt out.
- All lamps dim properly.
- All lamps are the same level of intensity.



Marginal

Marginal Double Arrow Mode meets this condition:

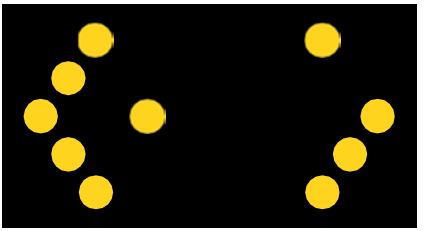
Up to two (2) lamps out in the stem and no lamps out in the heads.



Unacceptable

Unacceptable Double Arrow Mode meets any of these conditions:

- Any lamp out in the head.
- More than two (2) lamps out in the stem.

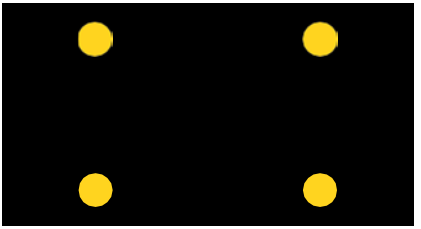


Caution Mode (Flashing Four Corners)

Acceptable

Acceptable Caution Mode meets all of these conditions:

- All lamps properly aligned for the intended driver's line of vision.
- No lamps are burnt out.
- All lamps dim properly.
- All lamps are the same level of intensity.



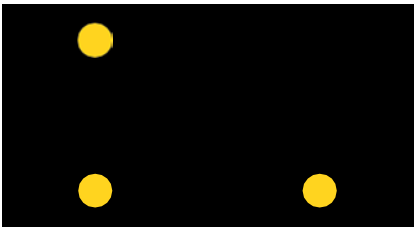
Marginal

There are no marginal conditions for Caution Mode in Flashing Arrow Boards.

Unacceptable

Unacceptable Caution Mode meets any of these conditions:

- Less than four (4) lamps function properly.
- Lamps do not dim properly.
- Lamps are not the same level of intensity.



Portable Changeable Message Signs (PCMS)

Acceptable

Acceptable PCMS meet all of these conditions:

- 100% of the LED pixels per character module operate properly.
- All LED displays dim properly.
- The PCMS is properly aligned for the intended driver's line of vision.

Marginal

Marginal PCMS meet this condition:

- 90% of the LED pixels per character module operate properly.

Unacceptable

Unacceptable PCMS meet any of these conditions:

- Less than 90% of the pixels per character module operate properly.
- The PCMS is not properly aligned for the intended driver's line of vision.
- The PCMS message is not legible.

Trailer Mounted Electronic Traffic Control Devices

This includes devices such as Automated Flagger Assistance Devices (AFADs), Portable Traffic Signals, and Dynamic Speed Display Signs.

Acceptable

Acceptable Trailer Mounted Electronic Traffic Control Devices meet all of these conditions:

- The device operates correctly for its intended usage within allowable tolerances and with all fail-safes properly functioning.
- All lamps, LED displays and signs are properly aligned for the intended driver's line of vision.
- 100% of the LED pixels per character module operate properly.
- 100% of the lamps are operational.
- All lamps and LED displays dim properly.
- The signs meet the quality standards for acceptable "Warning Signs".

Marginal

Marginal Trailer Mounted Electronic Traffic Control Devices meet all of these conditions:

- 90% of the LED pixels per character module operate properly.
- The signs meet the quality standards for marginal "Warning Signs".

Unacceptable

Unacceptable Trailer Mounted Electronic Traffic Control Devices meet any of these conditions:

- The device is malfunctioning for any of its intended functions including but not limited to signal operations, radio communications, detection, or message display.
- Any of the lamps are burned out.
- Less than 90% of the LED pixels per character module operate properly.
- The device is not properly aligned for the intended driver's line of vision.
- The lamps and LED displays do not dim properly.

NOTES

DEFINITIONS

Expressway
Any multi-lane, divided highway for through traffic with partial control of access and generally with at-grade intersections.

Freeway
Any divided highway with full control of access (i.e., has ramps and no at-grade intersections).

High Speed Road
A roadway where the posted speed limit is 45 miles per hour or higher.

Low Speed Road
A roadway where the posted speed limit is lower than 45 miles per hour.

Rural Highway
A highway where traffic is normally characterized by lower volume, higher speed, fewer turning conflicts and fewer conflicts with pedestrians.

Urban Street
A type of street normally characterized by relatively low speed, wide ranges in traffic volume, narrower roadway lanes, frequent intersections, significant pedestrian traffic, and more roadside obstacles.

The following are categories of work duration and their time at a location:

Mobile Operation
When an operation is continuously moving or stopped in one location for periods of 15 minutes or less. The traffic control devices are typically vehicle-mounted. The work area should change by at least the decision sight distance for it to be considered a change in location.

Short Duration
When an operation stays in one location during daylight conditions from 15 minutes to one hour, such that minimal TTC devices are deployed.

Short Term
When an operation stays in one location during daylight conditions from one hour to 12 hours, such that advance signing and channelizing devices are required.

Intermediate Term/Night
When an operation stays in one location during daylight conditions from one hour to no more than 3 days, or stays in one location during hours of darkness. Advance signing and larger channelizing devices (Type B) are required.

Long Term
When an operation stays in one location for more than 3 days. A project specific Traffic Control Plan is typically required.

Reference Lists

Personal Protective Equipment (PPE) Policy

Warning Light Manual

Manual on Uniform Traffic Control Devices

TDOT Standard Operating Guide (SOG) 477-01

Truck and Trailer Mounted Attenuators Manual

4Us Checklist

Temporary Portable Rumble Strip Evaluation Guideline

Automated Flagging Assistance Device Evaluation Guideline

Flagging Guidance Training Presentation

Protect the Queue (PTQ) Guidance Presentation

PTQ SOG

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CHECKLISTS

Establishing a Temporary Traffic Control Zone

COMPLETED	ITEM
☐	Determine the activity being performed.
☐	Determine the type of roadway.
☐	Determine the duration of work.
☐	Select the appropriate layout(s) using the **Activity Matrix** on page 5.
☐	Determine internal traffic control plan and select hours of work to avoid peak periods.
☐	Determine any modifications to typical layout(s).
☐	Check decision sight distance.
☐	Advance signing distance.
☐	If possible, maintain access to intersections, parking areas, and driveways (public and private)
☐	Allow for **Buffer Space (BS)** free of obstructions.
☐	Contact the proper road authority if the work zone interferes with normal signal operation in the area.
☐	Check the condition of devices. (See the **Device Quality Standards** starting on page 119)
☐	Install devices beginning with the first device the driver will see.
☐	Conduct a drive thru to check for problems. (See the **Special Considerations** on page 6)
☐	Document temporary traffic control zone, problems, and major modifications to the layouts.
☐	Traffic should be observed to see if the taper is working correctly.
☐	Remove the devices as soon as work is completed, beginning with the last device seen by the motorist.

Checklist for Flagger Operations

- ☐ **Remember:** Your job is the most important one on the crew. The lives of all individuals in the workspace depends on YOU!
- ☐ For your personal safety as a flagger, NEVER turn your back on or stand in the path of moving traffic.
- ☐ CLOTHING:
  - Any flagger on a TDOT project shall be attired with high-visibility safety apparel that meets the Performance Class 3 requirements of the ANSI 107-2015 standard. Refer to *Table A* in *TDOT Policy 305-01* for required clothing for maintenance activities.
- ☐ TOOLS:
  - Standard STOP/SLOW paddle (in good condition) shall be used unless it is not available in an emergency situation.
    - 24" x 24" minimum LED octagon with letters at least 6 inches high
    - 7-foot minimum staff (to bottom of the sign), 9-foot is recommended
    - Fully retroreflective in standard colors
  - Illuminated station and flashlights with wand if flagging at night.
  - Two-way radios for multiple flagger situations.
  - Warning signs posted in proper position ahead of the flagger.
- ☐ Flagging position on the roadway following Flagging Guidance on page 18:
  - Be alert, remain **STANDING** at all times.
  - Face oncoming traffic. **NEVER** turn your back to oncoming traffic or stand in the path of moving traffic.
  - A flagger's normal station is on the shoulder of the road.
  - Park your vehicle off the road, away from your station. A flagger is difficult to see when next to a vehicle. Never sit in or on your vehicle while flagging.
  - Know proper hand and flag signals as shown in the Field Manual
  - Stand alone. Do not mingle with work crew or motorists.
  - Make sure you are visible to approaching traffic, not standing where the sun is obstructing visibility or in a shadow.
  - Review the decision sight distance chart in the Work Zone Field Manual. The driver should be able to recognize you as a flagger for at least the decision sight distance. Avoid blind spots past curves in the roadway or just over hills.
  - Emergency vehicles have "priority rights". Allow them to pass as quickly and safely as possible.

Installing Lane Closures

Stationary lane closures should be installed with the flow of traffic in the following sequence:

- ☐ Install all advance warning signs.
- ☐ Install shoulder taper if necessary.
- ☐ Place arrow board on the shoulder at the beginning of the merging taper.
- ☐ Install channelizing devices to form a merging taper.
- ☐ Install channelizing devices along the buffer space.
- ☐ Continue placing channelizing devices along the work area at the appropriate spacing.
- ☐ Install channelizing devices for the termination area.
- ☐ Install the “END ROAD WORK” sign approximately 500 feet beyond the last device in the lane closure.
- ☐ Place a TMA vehicle, if required, 80-120 feet from the first work crew or hazard approached by motorists.
- ☐ Perform a “ride through” through the entire lane closure and make adjustments to the traffic control devices if needed.
- ☐ Document any major adjustments to the work zone.

Removing Lane Closures

Stationary lane closures should be removed against the flow of traffic in the following sequence:

- ☐ Remove channelizing devices from downstream of closure back to the widest part of the merging taper.
- ☐ Place removal vehicle on shoulder and remove devices from taper by hand onto the work vehicle.
- ☐ Remove arrow board after ensuring roadway is clear.
- ☐ Moving with the flow of traffic, remove all of the advance warning signs beginning with the “ROAD WORK AHEAD” sign and ending with the “END ROAD WORK” sign.
- ☐ When the shoulder provides availability, use a TMA vehicle for installing and removing lane closures.
- ☐ When a trailer mounted attenuator is used on the PTQ vehicle, all devices may be removed with the flow of traffic.
- ☐ Workers should not run across an open lane of traffic unless slow roll temporary traffic control operations are being performed.

4Us Checklist

- ☐ **PPE**: Crew to collect PPE per MMS Activity Number using *TDOT Policy 305-01 Table A*.
- ☐ **TTC Inspection/Loading**: Ensure that all TTC complies with the *2009 Manual on Uniform Traffic Control Devices* and any supplemental TDOT policies or procedures.
- ☐ **Vehicle Pre-Trip Inspection**: Perform pre-trip checklist on all vehicles.
- ☐ **Equipment Pre-Trip Inspection**: Perform pre-trip checklist on all equipment.
- ☐ **Attenuator Pre-Trip Inspection**: Perform pre-trip inspection on all attenuators.
- ☐ **Required Tools**: Ensure that all tools needed for the project are loaded and are in good working condition.
- ☐ **Materials and Supplies**: Confirm that all needed supplies for the project have been located and loaded.
- ☐ **Water/First Aid**: Ensure that water, first aid, and preventative measures for job site conditions are available to employees at the project site.

APPENDICES

Appendix A – PCMS Abbreviations

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	---
Congested	CONG	Traffic	---
Construction	CONST	---	Ahead
Crossing	XING	---	---
Do Not	DONT	---	---
Downtown	DWNTN	---	Traffic
Eastbound	E-BND	---	---
Emergency	EMER	---	---
Entrance, Enter	ENT	---	---
Exit	EX	Next	---
Express	EXP	---	Lane
Frontage	FRNTG	---	Road
Hazardous	HAZ	---	Driving
Highway-Rail Grade	RR XING	---	---
Interstate	I-*	---	(Number)
It is	ITS	---	---
Lane	LN	(Roadway Name)*, Right,	---
Left	LFT	---	---
Local	LOC	---	Traffic
Lower	LWR	---	Level
Maintenance	MAINT	---	---
Major	MAJ	---	Accident
Minor	MNR	---	Accident
Normal	NORM	---	---
Northbound	N-BND	---	---
Oversized	OVRSZ	---	Load
Parking	PKING	---	---
Pavement	PVMT	Wet	---
Prepare	PREP	---	To Stop
Quality	QLTY	Air	---
Right	RT	Keep, Next	---
Right	RT	---	Lane
Roadwork	RDWK	---	Ahead, (Distance)

(continued)

Word Message	Standard Abbreviation	Prompt Word That Should Precede the Abbreviation	Prompt Word That Should Follow the Abbreviation
Route	RT,RTE	Best	---
Service	SERV	---	---
Shoulder	SHLDR	---	---
Slippery	SLIP	---	---
Southbound	S-BND	---	---
Speed	SPD	---	---
State, county, or other non-US or non-Interstate numbered route	(Route Abbreviation determined by highway agency)**	---	Number
Tires with Lugs	LUGS	---	---
Traffic	TRAF	---	---
Travelers	TRVLRS	---	---
Two-Wheeled Vehicles	CYCLES	---	---
Upper	UPR	---	Level
Vehicle(s)	VEH, VEHS	---	---
Warning	WARN	---	---
Westbound	W-BND	---	---
Will Not	WONT	---	---

* This abbreviation, when accompanied by the prompt word, may be used on traffic control other than portable changeable message signs.
** A space and no dash shall be placed between the abbreviation and the number of the route.

Unacceptable Abbreviations

Abbreviation	Intended Word	Common Misinterpretation
ACC	Accident	Access (Road)
CLRS	Clears	Colors
DLY	Delay	Daily
FDR	Feeder	Federal
L	Left	Lane (Merge)
LT	Light (Traffic)	Left
PARK	Parking	Park
POLL	Pollution (Index)	Poll
RED	Reduce	Red
STAD	Stadium	Standard
TH	Trunk Highway	(misunderstood)
WRNG	Warning	Wrong