$5.00

Minnesota Temporary Traffic Control Field Manual

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MN MUTCD Part 6K
mndot.gov/mnmutcd


No job is so important in maintenance or construction, and no service so urgent, that we cannot take time to perform our work safely.
MINNESOTA

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* See inside front cover of each section for specific index to layouts.

This document as well as the Flagging Handbook and other documents are available on the MnDOT Traffic Engineering website: www.dot.state.mn.us/trafficeng

Introduction

This Field Manual is a chapter of Part 6 of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD). It has been reprinted as a separate document for use in field operations. This Field Manual contains general Temporary Traffic Control (TTC) standards. The user should refer to the MN MUTCD - Part 6 for more details and follow any TTC plans, specifications, and special provisions written for a specific project. Any work that affects road users (including vehicles, bicycles, and pedestrians) requires proper Temporary Traffic Control (TTC) plans.

The goal of the Temporary Traffic Control (TTC) zone is to provide for the safe and efficient movement of traffic around a location where the normal function of the roadway is temporarily suspended. To accomplish this, the respect of the driver must be earned by appropriate and prudent use of traffic control devices. When work is not in progress or the hazard no longer exists, the Temporary Traffic Control (TTC) devices shall be covered, turned away from traffic, or removed from the area.

This Field Manual contains layouts for typical TTC zones ranging from mobile operations to zones which may remain inplace for up to three days. If the TTC zone is to remain in one place for more than three days or involves a detour, road closure, or a situation where the typical layouts do not apply, the road authority's Traffic Engineering staff should be consulted and a project specific TTC plan prepared. Advance planning is necessary for a successful TTC zone.

Prior to starting work on any public roadway right-of-way, permission shall be obtained from the road authority. The use of any regulatory TTC device or sign shall be approved by the road authority prior to installation.

Definition of Shall, Should, and May

Shall

Indicates a statement of required, mandatory, or a specifically prohibitive practice regarding a traffic control device.

Should

Indicates a statement of recommended practice, but not mandatory, in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate.

May

Indicates a statement of practice that is a permissive condition and carries no requirement or recommendation.

Glossary

Activity Area
That part of a Temporary Traffic Control (TTC) zone where the work actually takes place. It consists of the work space, traffic space, and buffer space(s).

Advance Warning Area
The area of a TTC zone used to inform the motorist what to expect ahead. This area may contain devices ranging from a single sign or vehicle warning light on a vehicle to a series of signs and the use of a portable changeable message sign (PCMS). The location of the beginning of the TTC zone is dependent upon its visibility to motorists. Good visibility is achieved where the sight distance is sufficient to meet the Decision Sight Distance (**D**).

Advance Warning Following Distance (F)
The distance in a mobile operation between the Shadow Vehicle and the Work Vehicle. It is used to provide advance warning to traffic that some type of work is being done within the traffic lane. Traffic will have to change lanes, slow down, and wait for a safe time to pass, or adjust their position within the lane to allow for a narrower traffic lane. The Shadow Vehicle shall be equipped with appropriate advance warning signing. Typical Advance Warning Following Distances (**F**) are included in the TTC Distance Charts. This distance is a range with a minimum of the recommended distance between Advance Warning Signs (**A**), and a maximum of the Decision Sight Distance (**D**). These distances are dependent upon the roadway and traffic conditions.

Advance Warning Sign Spacing (A)
The distance between signs or between a sign and some other location or device within the TTC zone. This distance is determined by the posted speed limit. Signs should be placed to allow adequate time for a motorist to read the signs and react accordingly. Typical Advance Warning Sign Spacings (**A**) are included in the TTC Distance Charts.

Advisory Speed
The recommended speed for all vehicles operating on a section of highway based on the highway design, operating characteristics, and conditions.

Alternate Pedestrian Routes (APR)
A temporary pedestrian facility created to replace an existing pedestrian facility impacted by a work zone. The APR must contain accessibility features consistent with the features present in the impacted pedestrian facility.

Approach Sight Distance
The distance by which a motorist can visually identify a work space. This work space may be a flagger station, a lane closure, a slow moving or stopped vehicle, or any other situation requiring adjustments by the motorist.

Attended Work Space

A work space is considered to be attended when the TTC devices are reviewed for knock-downs or other needed adjustments on an hourly basis.

Average Daily Traffic (ADT)

The average 24-hour volume of traffic during a stated time period divided by the number of days in that period.

Buffer Space

The space which separates traffic flow from a work area providing a margin of safety for both the driver and workers. It is important that the buffer space be free of equipment, workers, material, and vehicles.

Clear Zone

The work zone clear zone is the unobstructed (clear of obstructions, hazards, or fixed objects), relatively flat area impacted by construction that extends outward from the edge of the traveled way. Because of the limited horizontal clearance available and the heightened awareness of motorists through work zones, recommended clear zones are less than those for the non-construction conditions. Table 6K-1 gives typical clear zone widths that should be provided when roadside space is available (see Roadside Safety in General Guidelines, page 6K-n for more information).

Table 6K-1: Recommended Clear Zones

Speed (mph)	Width (ft)
60 or greater	30
45-55	20
40	15
35 or less	10

Crashworthy

A characteristic of roadside devices that 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).”

Deadheading

The process of transporting vehicles and equipment between work sites while traveling at less than the minimum speed limit or substantially slower than prevailing traffic, totally or partially in the travel lanes. Deadheading shall be treated as a mobile operation.

Decision Sight Distance (D)

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.

In the Field Manual, the Decision Sight Distance (**D**) is used to determine the minimum distance required for the driver to see a flagger (as the flagger is located in a vulnerable location) or work areas in layouts with minimal signing. It is also used to determine if an operation qualifies as Mobile (see definition of Duration). The required Decision Sight Distances (**D**) are included in the TTC Distance Charts.

Divided Road

A highway or two roadways where opposing traffic is separated by a median (ditch, barrier, curbing, etc.), and where the median is generally wide enough to place TTC devices. Temporary traffic control for divided multi-lane roads may also be used for one-way roadways.

Drivable

Capable of being driven on safely without a significant reduction in speed.

Downstream Taper

The taper at the end of the activity area which guides traffic back into its original lane. When used, this taper is a minimum length of approximately 100 feet with a 20-foot spacing between channelizing devices.

Duration

The length of time any work operation occupies a specific location or causes a traffic obstruction without changing the location. This time is measured from the first disruption to traffic until the total clearing of the area. The following durations are defined in overlapping intervals. Temporary Traffic Control layouts for longer durations may always be used for shorter durations, especially when roadway attributes such as traffic volume and speed, and the work space location may warrant higher levels of traffic control.

- **Mobile** - when an operation is continuously moving or stopped in one location for periods of 15 minutes or less. The Temporary Traffic Control (TTC) devices are typically vehicle-mounted. The work area should change by at least the Decision Sight Distance (**D**) 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 1 hour.

- **Short Term** - when an operation stays in one location during daylight conditions from 15 minutes to twelve hours.
- **Intermediate Term/Night** - when an operation stays in one location during daylight conditions from 15 minutes to no more than three days, or stays in one location during hours of darkness.
- **Long Term** - when an operation stays in one location for more than three days. A project specific traffic control plan is typically required.

Engineering Judgment

The evaluation of available pertinent information, and the application of appropriate principles, standards, guidance, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required.

Expressway

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

Flashing Arrow Board

A device with a matrix of elements displaying either flashing or sequential messages, including caution, arrow, and chevrons. This provides warning and directional information to assist road users navigating through or around a TTC zone.

Fixed Object

Hazards that are firm, unyielding, and greater than 4 inches in height along the roadside such as bridge piers, abutments, footings, walls, posts, trees, construction equipment, supplies, stockpiles, and large boulders.

Following Distance (F)

See Advance Warning Following Distance (**F**).

Freeway

A 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 greater.

Intermediate Volume Road

A roadway with volume between 400 and 1500 ADT.

Lane Closure

A closure of one or more lanes of the roadway to traffic. Work operations that restrict adjacent lane width should consider various lane closure alternatives depending upon volume and speeds on the roadway.

Lane Width
For traffic control purposes, a minimum lane width of 10 feet should be provided. Anything less than 10 feet shall be approved by the road authority.

Lateral Buffer Space
The space that separates the traffic space from the work space. It is typically the extra space provided between traffic and workers, excavations, pavement edge drop-offs, or an opposing lane of traffic. Traffic lanes may be closed to provide for lateral buffer space. See Figure 6K-7, Longitudinal Drop-off Guidelines (pages 6K-aj through 6K-al) for more information.

Longitudinal Buffer Space (**B**)
The distance between the transition area and the work space. If a driver does not see the advance warning or fails to negotiate the transition area, a buffer space provides room to stop before the work space. Typical Longitudinal Buffer Spaces (**B**) are included in the TTC Distance Charts.

Low Speed Road
A roadway where the posted speed limit is 40 miles per hour or less.

Low Volume Road
A roadway with volume less than 400 ADT.

Merging Taper (**L**)
This 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 Tapers (**L**) are included in the TTC Distance Charts.

Motorist
An operator of a motorized vehicle intended to be used on a roadway.

Multi-Lane Road
A roadway where two or more lanes of traffic travel in the same direction. A multi-lane roadway may be classified as either undivided or divided.

Occupied Work Space
A work space is considered to be occupied when workers are present within the work space. Temporary Traffic Control (TTC) devices should continuously be reviewed by workers and adjustments made as needed.

Off Shoulder
A work space located primarily off of the shoulder, or which causes little or no restrictions on the use of the shoulder. This work space should have little or no interference with traffic such that traffic speeds generally are not reduced.

Pilot Car
A specially marked vehicle that leads motorists through a work zone.

Portable Changeable Message Sign (PCMS)
A sign either trailer-mounted or vehicle-mounted that is capable of displaying more than one message, changeable by remote or automatic control.

Posted Speed Limit
The speed limit determined by law and shown on regulatory Speed Limit signs. It is used in the Temporary Traffic Control Distance Charts to determine the spacing of TTC devices and the lengths of various tapers on the TTC layouts.

Protection Vehicle
The vehicle that is placed in advance of the work space and equipment to block errant motorists from entering the work space.

Road, Roadway
That portion of a highway improved, designed, or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other human-powered vehicles.

Road Authority
The roadway agency or private owner having jurisdiction over a road open to public travel.

Roll Ahead Distance (**R**)
The recommended minimum distance from the front of the Protection Vehicle to the beginning of the work space. A Protection Vehicle may be used in a mobile operation to provide extra safety for the workers. Typical Roll Ahead Distances (**R**) are included in the TTC Distance Charts.

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

Shadow Vehicle
Vehicle(s) placed in advance of the work space in a mobile operation to provide advance warning to motorists. Because mobile operations generally have advance warning signing mounted on vehicles, the spacing between vehicles should be the Advance Warning Following Distance (**F**) as included in the Temporary Traffic Control Distance Charts.

Shifting Taper
The taper used to move traffic from the traffic lane onto a by-pass or shoulder. This traffic maneuver generally requires half the distance than a merging taper. See Figure 6K-11, TTC Distance Charts (page 6K-ap or back cover) for the length of a shifting taper (**L/2)**.

Shoulder Closure
A closure of the roadway shoulder for work operations. The shoulder becomes unusable by traffic for vehicle maneuvers or break-downs. TTC layouts for work operations using or on a shoulder are dependent on the type of shoulder usage and duration.

Shoulder Taper
The taper used to close the shoulder to traffic so that shoulder work can be performed or equipment can be placed on the shoulder. Since this taper is used to guide errant traffic back into 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. See Figure 6K-11, TTC Distance Charts (page 6K-ap or back cover) for the length of a shoulder closure taper (**L/3)**.

Spotter
A person on the work crew whose sole duty is to warn the work crew of impending danger. The Spotter is not a Flagger. The Flagger's role is to direct traffic.

TMA (Truck/Trailer Mounted Impact Attenuator)
Energy-absorbing devices attached to the rear of vehicles in work zones that primarily reduce the severity of impacts from errant vehicles.

Temporary Pedestrian Access Route (TPAR)
A temporary, continuous, and unobstructed walkway within a pedestrian circulation path that provides accessibility.

Temporary Traffic Control (TTC) Plan
A plan describing the traffic controls to be used for facilitating vehicle and pedestrian movements through a Temporary Traffic Control zone.

Temporary Traffic Control (TTC) Zone
An area of a highway where road user conditions are changed because of a work zone or incident by the use of Temporary Traffic Control devices, flaggers, uniformed law enforcement officers, or other authorized personnel. See Figures 6K-9 and 6K-10, Component Parts of a Temporary Traffic Control Zone.

Termination Area
That part of a TTC zone located beyond the work space which guides traffic back into its normal traffic path. A longitudinal buffer space may be used between the end of the work space and the beginning of the downstream taper.

Traffic Control Device
A sign, signal, marking, or other device used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, pedestrian facility, or shared-use path by authority of a public agency having jurisdiction.

Traffic Space

That part of the roadway open to traffic that is next to the activity area. Traffic routing is provided with channelizing devices of various sizes and shapes. For a description of the various types of channelizing devices and their general uses, see the Temporary Traffic Control Devices section starting on page 6K-r.

Transition Area

That part of the TTC zone that moves traffic from its normal path or lane into the traffic space. This movement of traffic is done through the use of channelizing devices and directional signing placed in various types of tapers.

Turn Lane Closure

The closure of a right or left turn lane for work operations. Signing in the TTC zone shall provide adequate warning to the motorists and provide an alternative turning maneuver. Layouts from the various roadway types should be reviewed for the best alternate depending upon roadway intersection design, traffic control (stop, yield, signals, etc.), speed limit, and volume.

Two-Lane, Two-Way Road

A roadway consisting of two opposing lanes of undivided traffic.

Two-Way Continuous Left Turn Lane

That part of the roadway that has a continuous two-way, left turn lane located between the opposing lanes of traffic. This design variation may be found on either two-lane, two-way roads or multi-lane roads.

Two Way Taper

The taper used on a two-lane, two-way road 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 typically 50 feet in length and contains 5 equally spaced channelizing devices.

Undivided Road

A roadway where opposing traffic lanes have no physical separation barriers except pavement markings (where required).

Urban Street

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

Volume

The number of vehicles passing a given point on the roadway or the Average Daily Traffic (ADT).

Work Space

That part of the TTC zone closed to traffic and set aside for workers, equipment, and materials. The space requirements for a specific TTC zone will determine the type of TTC layout that is appropriate for the project. The layout will specify the appropriate sign locations, flagger stations, and tapers depending on the type of work space.

Work Zone

An area of a roadway where road user conditions are changed because of a work space by the use of TTC devices, flaggers, uniformed law enforcement officers, or other authorized personnel.

Work Zone Speed Limits

A regulatory speed limit in a Temporary Traffic Control zone. The two types, Workers Present and 24/7 Construction, each require proper documentation to approve and install. Under certain conditions a workers present speed limit is required. Contact the road authority. See "Speed Limits in Work Zones Guidelines" for details: http://www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf.

Temporary Traffic Control General Guidelines

Individual Responsibilities

Before beginning work, you should familiarize yourself with this manual, the definitions, principles, and the following General Responsibilities. Qualified individuals who have adequate training in Temporary Traffic Control and have a basic understanding of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) should supervise the selection, placement, and maintenance of traffic control devices in Temporary Traffic Control (TTC) zones.

General Responsibilities

Except where otherwise specified, any public or private agency performing work within the right-of-way of streets or highways open to public travel shall be responsible for:

- Supplying, installing, and maintaining all necessary traffic control devices outlined in this manual and as stipulated by the road authority to protect the work space and safely direct traffic around the TTC zone.
- Supplying their own flagger(s) when required.
- Informing occupants of abutting properties, either orally or by written notice, of parking prohibitions or access limitations.
- Notifying the road authority when existing traffic signs need to be removed or relocated or when any regulatory sign must be installed for construction or maintenance work.
- Replacing or reimbursing the road authority for any damage to or loss of existing traffic signs or devices.
- Keeping all traffic control devices clean and in proper position to ensure optimum effectiveness.
- Removing traffic control equipment when it is no longer required or appropriate.
- Keeping proper records of traffic control that contain starting and ending times, location, names of personnel, traffic controls used, etc. The method of record keeping may vary from a log entry to a complete Temporary Traffic Control Plan (TTCP).
- Performing and documenting routine day and night inspections of the TTC zone.

Permission to Work Within the Right-of-Way

Prior to starting work, permission shall be obtained from the road authority. The road authority may limit the hours of work or have other requirements such as detours, parking restrictions, etc. Peak traffic periods vary by hour or 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.

Any work requiring traffic control to extend across a railroad right-of-way requires coordination with the railroad authority.

Selecting an Appropriate Temporary Traffic Control Layout

This Field Manual, Part 6K of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD), has been organized such that field personnel are able to determine the proper Temporary Traffic Control layout(s) for the work zone they need. The layouts are divided primarily by the type of roadway and type of work space. The roadway designations are:

1. Low Volume Rural/Residential,
2. Two-Lane, Two-Way Roads (low, intermediate, and high volumes),
3. Roads with Two-Way Continuous Left Turn Lanes,
4. Multi-Lane Undivided Roads, and
5. Multi-Lane Divided Roads.

After determining the type of roadway upon which the work space will be located, the type of work space needs to be determined. The work space is the area within the right-of-way that will be closed from normal usage. It includes all the area needed by support equipment, materials, workers, and vehicles. It may require the closing of a roadway lane(s), the shoulder(s) of the road, or turn lane(s) within an intersection. The work space may even be completely off the roadway shoulder such as on side-slopes or along sidewalks. The layouts are listed by the typical work space areas. Continuity for existing road users (vehicles, pedestrians, and/or bicyclists) needs to be provided by the temporary traffic control.

Within some layouts, there are TTC options that may be omitted based upon several factors. These may include: duration of the operation, volume of the road, speed limit on the road, and departmental (or company) policy. TTC supervisors should be fully aware of the variations in the layouts due to the various factors, and when and how the layouts may be modified. See Figure 6K-1, Checklist for Establishing a TTC Zone (page 6K-p).

All distances shown on the layouts and charts are approximate. In general, all chart distances vary based upon the posted speed limit. Adjustments to these distances should be made based on traffic entry points and decision sight distance.

Several layouts may need to be combined together for one project. For example, work in or near an intersection may require a layout for a lane closure, a layout for work in the intersection, and a layout for sidewalk detours or bypasses.

In some situations, a TTC layout usually required for a longer duration may be needed due to the nature of the work or the traffic. For example, patching a pothole on a high-volume, high-speed freeway may require less than 15 minutes of time (mobile operation) but a stationary lane closure may be needed because of the high volumes of traffic.

Additional layouts have been placed in this manual for unique operations and special signing conditions. These layouts may have special restrictions and guidelines contained within their notes.

Enhancement of Temporary Traffic Control Layouts

To improve safety, typical layouts contained in this manual may need to be modified to fit more complex roadway conditions or operations. When conditions are more complex, modifications may incorporate devices and practices from the following list:

1. Additional Personnel
   a. Spotters
   b. Law Enforcement
   c. Multiple Flaggers
2. Additional Devices:
   a. More signs or enhanced signs (using LEDs, flags, beacons, etc.)
   b. Flashing Arrow Board(s)
   c. More channelizing devices at close spacing
   d. Temporary raised pavement markers
   e. High-level warning devices
   f. Portable Changeable Message Sign(s) (PCMS)
   g. Portable traffic signals
   h. Protection Vehicles
   i. Temporary rumble strips
   j. More delineation
3. Upgrading of Devices
   a. A complete set of standard pavement markings in high hazard areas
   b. Brighter and/or wider pavement markings
   c. Larger and/or brighter signs
   d. More visible channelizing devices with greater conspicuity
4. Lateral Buffer Space or Closing an Additional Lane
5. Closing Shoulders with Shoulder Tapers and/or Protection Vehicles
6. Increased Distances
   a. Longer advance warning area
   b. Longer tapers
7. Lighting
   a. Temporary roadway lighting
   b. Steady burn lights used with channelizing devices
   c. Sequential lighting
   d. Flashing lights for isolated hazards
   e. Illuminated signs
   f. Work space lighting
8. Work zone speed limits
   a. See Workers Present Speed Limit (Layouts 83a & b)
   b. Contact the road authority.
   c. See "*Speed Limits in Work Zones Guidelines"* for details: http://www.dot.state.mn.us/speed/pdf/wzspeedlimitguideline.pdf

Installing the Temporary Traffic Control Zone

Traffic control devices shall be installed in the order that drivers will see them, starting with the sign or device that is furthest from the work space. If traffic in both directions will be affected, such as work in the center lane(s), the devices may be placed in both directions at the same time. When one direction of traffic will be directed into the opposing lanes of traffic, all traffic controls for the opposing traffic should be installed first.

A minimum lane width of 10 feet should be provided at all times. Anything less than 10 feet shall be approved by the road authority. After the Temporary Traffic Control (TTC) zone is in place, it should be inspected by driving through the zone. Motorists' actions and reactions should be noted and any problems encountered should be quickly corrected. Any modifications to the Temporary Traffic Control plan or standard layouts and the reasons for the modifications should be documented.

During the life of a TTC zone, maintenance of devices is frequently needed. On short term operations, vehicles may knock over cones which then need to be placed upright. Problems encountered should be corrected immediately and documented.

Inspecting the Temporary Traffic Control Zone

To provide acceptable levels of operations and to maintain safety, routine day and night inspections of the TTC zone should be performed and documented by knowledgeable personnel. See Figure 6K-2, SAMPLE PROJECT INSPECTION CHECKLIST (page 6K-q) for an example inspection sheet.

Removing the Temporary Traffic Control Zone

Traffic control devices should be removed as soon as the work is completed and they are no longer needed. Devices should be removed in the opposite order from which they were installed, especially devices in the termination, activity, and transition areas. Devices in the advance warning area may be removed in the order they were installed. Alternatively, a Mobile Lane Closure may be used to remove the TTC devices in the order that they were installed.

Crossing Live Lanes of Traffic

Personnel may cross live traffic lanes only if it is safe to do so utilizing a walking pace taking into consideration roadway geometry, traffic volume, and other appropriate factors.

Roadside Safety

Attention should be given to the maintenance of roadside safety during the life of the TTC zone by applying the following principles:

- To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical. See Table 6K-1, Recommended Clear Zones (page 6K-c).

- Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.

In urban areas with curbs, wide clear zones are typically much more difficult to achieve; in these areas, a minimum **lateral offset to obstruction** of 1.5 feet should be provided behind the curb face.

When work is not active, hazards or fixed objects should not be left or placed within the clear zone distance from Table 6K-1 (page 6K-c) or the lateral offset to obstruction of 1.5 feet, depending on the road environment. If not practical to remove hazards or fixed objects, they should be protected with temporary barrier. If not practical to provide temporary barrier, hazards or fixed objects should be delineated with Type B channelizing devices.

Marking Hazards

Damaged infrastructure (such as washouts, damaged guardrail, impacted end treatments and light poles) should be repaired as soon as possible (based on agency priorities); however, until the repair occurs, these hazards should be marked with either a Type I/Type II barricade with a Type A low intensity flashing warning light or a retroreflectorized drum. Cones may be used for short term emergency situations.

Certain construction operations may leave structures (manhole covers, drainage structures, etc.) exposed above the grade or dropped below the grade in the traffic space of the activity area. These should be made apparent so that drivers, bicyclists, and pedestrians are able to avoid them or slow down to minimize the hazard.

Checklist for Establishing a Temporary Traffic Control Zone

- ❑ **Obtain permission from all affected road authority(ies).**
- ❑ **Determine the type of roadway.**
- ❑ **Determine the type of road users (vehicles, pedestrians, bicyclists).**
- ❑ **Determine the type of work space.**
- ❑ **Determine the duration of work.**
- ❑ **Select hours of work to avoid peak periods.**
- ❑ **Select the appropriate layout(s) using:**

  Type of roadway, type of work, duration, traffic volume, speed, and impact on pedestrian and bicycle travel (see the appropriate **Index Chart** at the start of each section). **Review all NOTES on Layout(s)**.
- ❑ **Determine any modifications to typical layout(s) (see Enhancement of TTC Layouts on page 6K-m).**
- ❑ **Check Decision Sight Distance(s) (D).**
- ❑ **If possible, maintain access to intersections, parking areas, driveways (public and private), and mass transit.**
- ❑ **Coordinate with mass transit if needed.**
- ❑ **Allow for buffer space free of obstructions.**
- ❑ **Contact the road authority if the work zone interferes with normal signal operation in the area.**
- ❑ **Check the condition and orientation of devices (see Quality Standards, pages 6K-93 through 6K-108).**
- ❑ **Install devices beginning with the first device the driver will see.**
- ❑ **Conduct a drive through to check for problems, modify as needed.**
- ❑ **Document Temporary Traffic Control zone problems and major modifications to the layouts.**
- ❑ **Observe traffic to see if the TTC is working correctly.**
- ❑ **Remove, turn, or cover the devices as soon as work is suspended or completed.**

Figure 6K-1

SAMPLE

PROJECT INSPECTION CHECKLIST

PROJECT - _____

ITEM		YES	NO	HOW MANY?
1.	**Are any devices missing?**	❑	❑	_____
	Do any devices need repair?	❑	❑	_____
	Were all replaced or repaired?	❑	❑	_____
2.	**Are any lights (flashers, etc.) not functioning?**	❑	❑	_____
	Were they all replaced or repaired?	❑	❑	_____
3.	**Are any devices improperly placed?**	❑	❑	_____
	Were all positions corrected?	❑	❑	_____
4.	**Do any devices need cleaning?**	❑	❑	_____
	Were all devices cleaned?	❑	❑	_____
ADDITIONAL COMMENTS ON THE BACK OF THIS FORM?		❑	❑	_____

The above check was completed by _____
(name/title)

on _____ at _____ ❑ a.m. ❑ p.m.
(date) (time)

Figure 6K-2

Temporary Traffic Control Devices

Crashworthy Testing Compliance

With the exception of Trailer Mounted Devices described below, Temporary Traffic Control 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 Temporary Traffic Control 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)."

Trailer Mounted Devices

When required, trailer mounted devices, such as Arrow Boards and Portable Changeable Message Signs shall be installed per Layout 7. When not in use, the devices should not be stored on the shoulder.

High Visibility Clothing

All workers who are exposed to traffic, work vehicles, or construction equipment within the TTC zone shall wear high-visibility safety apparel meeting ANSI/ISEA 107-2004 (or ANSI/ISEA 107-2010) Performance Class 2 or 3 requirements. ANSI/ISEA 107-2015 Type R, Performance Class 2 or 3 is also acceptable. Clothing shall have an attached original label indicating the Performance Class. When working in an area that does not require the use of a hard hat for head protection, a high visibility hat should be worn.

Flashing Warning Lights

Flashing warning lights may be used to supplement road, ramp, and sidewalk closure signing, and other warning signs and/or barricades to attract the road user's attention.

Vehicle Warning Lights

All vehicles shall have approved operating vehicle warning lights when decelerating to enter a TTC zone and again when a vehicle leaves the TTC zone and enters the traveled traffic lane. All vehicles within a mobile TTC operation or working within 15 feet of an open traffic lane should have approved vehicle warning lights. Vehicle warning lights shall be visible for 360 degrees around the vehicle at a minimum height of 3 1/2 feet and a radius of 60 feet or greater.

Optional Devices

Some signs and devices on the TTC layouts are shown as optional or have factors that may make them optional. Some advance warning signs and/or channelizing devices may be omitted for low speed roads and/or if the duration will be less than 1 hour. Read the associated notes on each layout for options. The ONE LANE ROAD AHEAD sign is an example of a sign that is only required for higher speeds. The BE PREPARED TO STOP sign 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.

Channelizing Devices

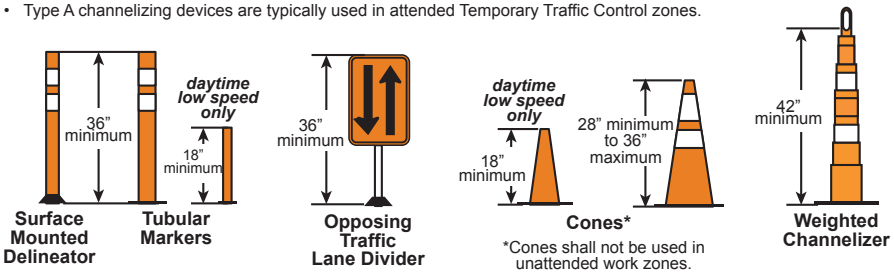
The function of channelizing devices is to delineate a desired vehicle path, mark specific hazards on or near the roadway, separate opposing traffic flows, and partially or totally close the roadway. See Figure 6K-7, Longitudinal Drop-off Guidelines (pages 6K-aj through 6K-al) for the use of channelizing devices adjacent to shoulder edge drop-offs or uneven lanes.

Channelizing devices include cones, drums, barricades, temporary raised islands, and various kinds of markers. The devices are broken into two type classifications (Type A and Type B) based upon the nighttime visibility of the device. Visibility is determined based upon the total retroreflective area of the device. Devices with less than 270 square inches are classified as Type A channelizing devices and devices with more than 270 square inches of retroreflective area are Type B channelizing devices.

Type A channelizing devices may be used in attended TTC zones and Type B channelizing devices shall be used if the TTC zone will be left unattended or be in place longer than 12 hours. Where a Type B channelizing device, such as a drum, causes an isolated sight restriction, or is too wide for a space, a 42-inch tall weighted channelizer may be substituted. This substitution may be used in unattended overnight conditions as approved by the road authority. When used, the spacing of the weighted channelizers should be reduced by up to 50 percent. Figure 6K-3 shows a breakdown of devices by Channelizer Type (drawn to approximate scale). See the MN MUTCD, Part 6F for additional details on application restrictions.

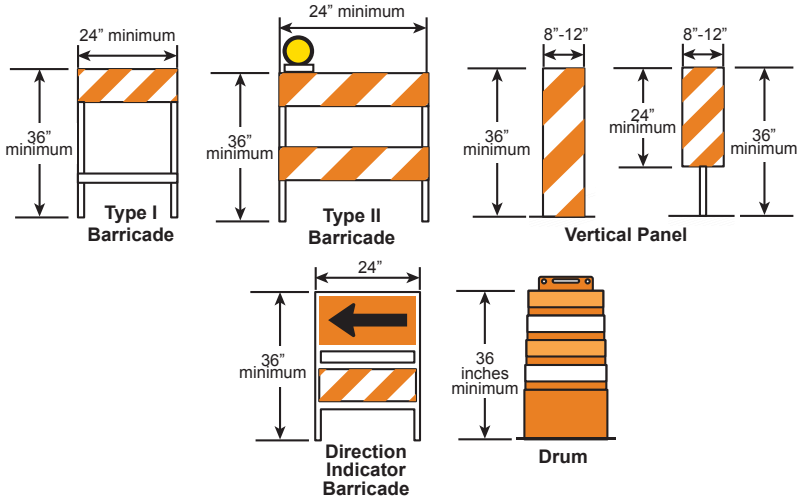
TYPE A CHANNELIZERS

- Type A channelizing devices are typically used in attended Temporary Traffic Control zones.



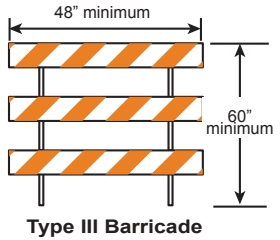
TYPE B CHANNELIZERS

- Channelizers used on high speed roadways shall have a minimum of 270 square inches of retroreflective area facing road users.
- Orange diagonals shall slope down toward the traffic side.
- Type B channelizing devices shall be used if the Temporary Traffic Control zone will be installed for more than 12 hours or if it is left unattended. Weighted channelizers may be used in lieu of a Type B channelizer with the permission of the road authority.
- Type A Flashing Warning Lights may be used - place on the side with traffic.



TYPE C CHANNELIZER

- Orange diagonals shall slope down toward the traffic side.
- Signs mounted on Type III barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.
- Type A Flashing Warning Lights may be used - place on the side with traffic.



Types of Channelizing Devices
Figure 6K-3

Work Zone Signing

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. See Figure 6K-11, TTC Distance Charts (page 6K-ap or back cover) for the Advance Warning Sign Spacing distance (**A).** When special emphasis is needed, signs may be placed on both the left and right sides of a two-way roadway. Signs, although ordinarily mounted on posts for long term operations, 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. Any portable sign or barricade placed in a pedestrian walkway that could be a hazard to a visually impaired pedestrian should have a detectable edge to guide the pedestrian around the hazard.

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 approximately perpendicular to the roadway and vertically plumb in accordance with Quality Standards (pages 6K-93 through 6K-108). The bottom of signs mounted on barricades or temporary supports shall be no less than 1 foot above the traveled 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. Supplemental advisory plaques shall be placed directly below or on the lower side of the warning sign nearest traffic.

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 Temporary Traffic Control zone. For high-speed streets and rural highways, the maximum distance from the last sign to a point where the driver detects the activity area shall not exceed 1 mile. In urban areas, the number of intersections shall be considered and this distance reduced accordingly.

All advance warning signs shall be at least 48 x 48 inches in size when used on high speed roadways. Warning signs used on low speed roadways shall be at least 36 x 36 inches in size. **Smaller signs may be used as approved by the road authority** where larger signs become an additional hazard to motorists and pedestrians.

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

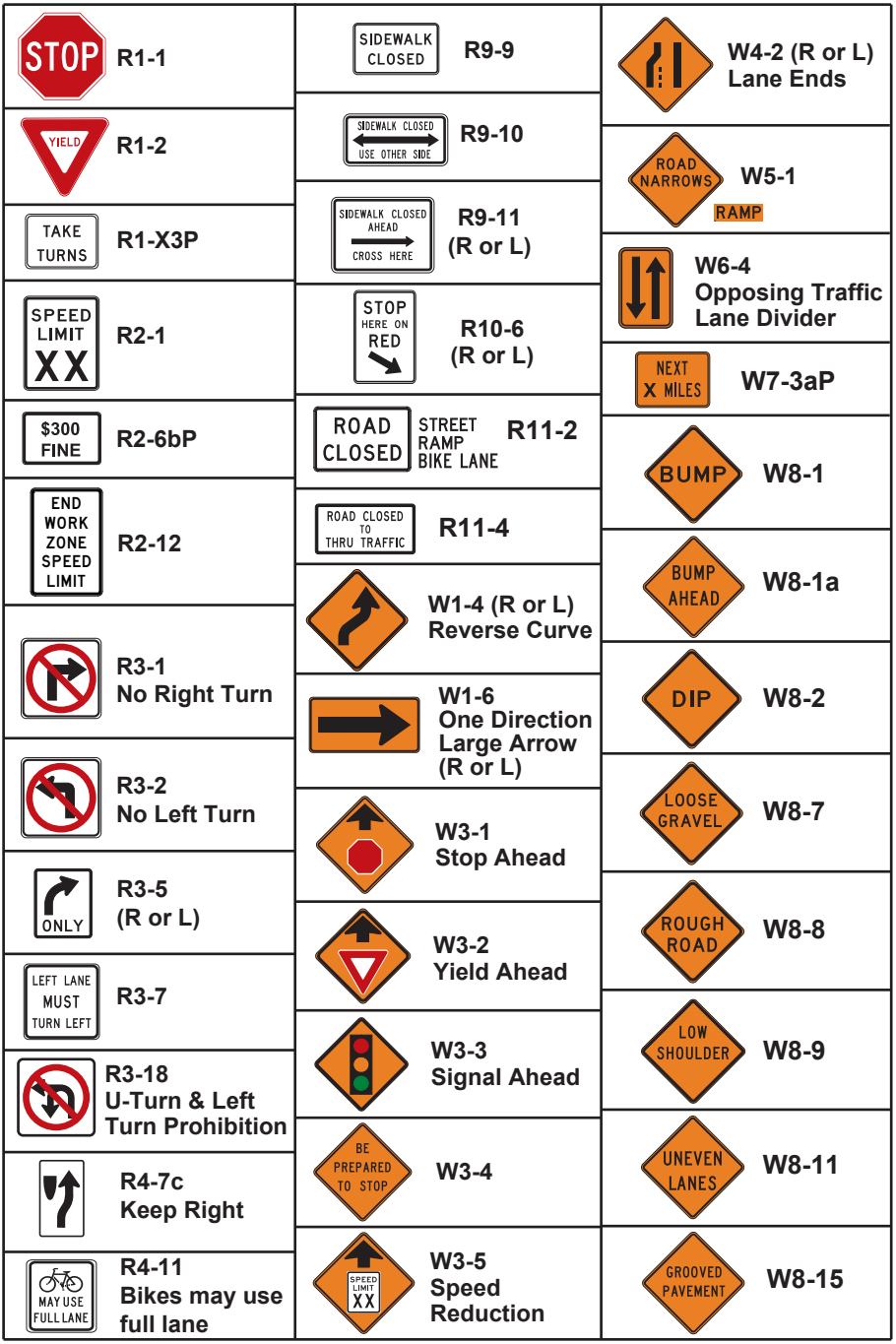
All signs used at night shall be retroreflective with a material that has a smooth sealed outer surface that shows the same shape and color both day and night. Non-retroreflective mesh signs shall not be used at any time. Retroreflectorized

roll-up signs may be used for daytime and for nighttime only when workers are present to monitor the signs.

On multi-lane divided roadways, where the median shoulder is narrow (less than 6 feet), the 48 x 48 inch advance warning signs, as shown on the TTC layouts, may not fit on the left side of the roadway. Where this situation occurs, one of the following options may be used:

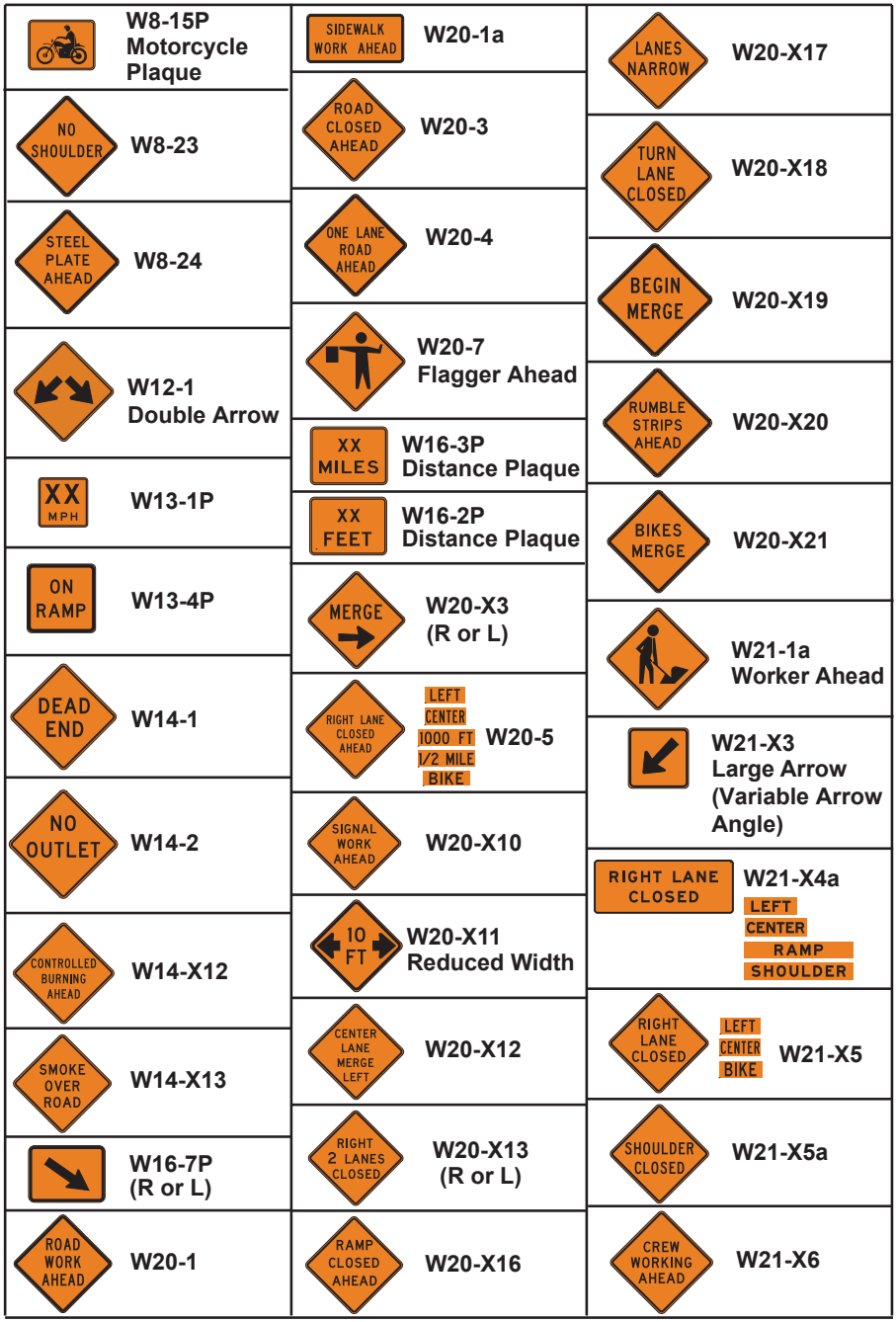
1. Reduce the left side signs sizes, or
2. Eliminate the left side signing, use an additional RIGHT LANE CLOSED (or LEFT as appropriate) sign on the right side, and require the use of an arrow board on the shoulder at the beginning of the lane closure taper.

All advance warning signs shall be removed, covered, or turned to face away from traffic when they are no longer required or appropriate.



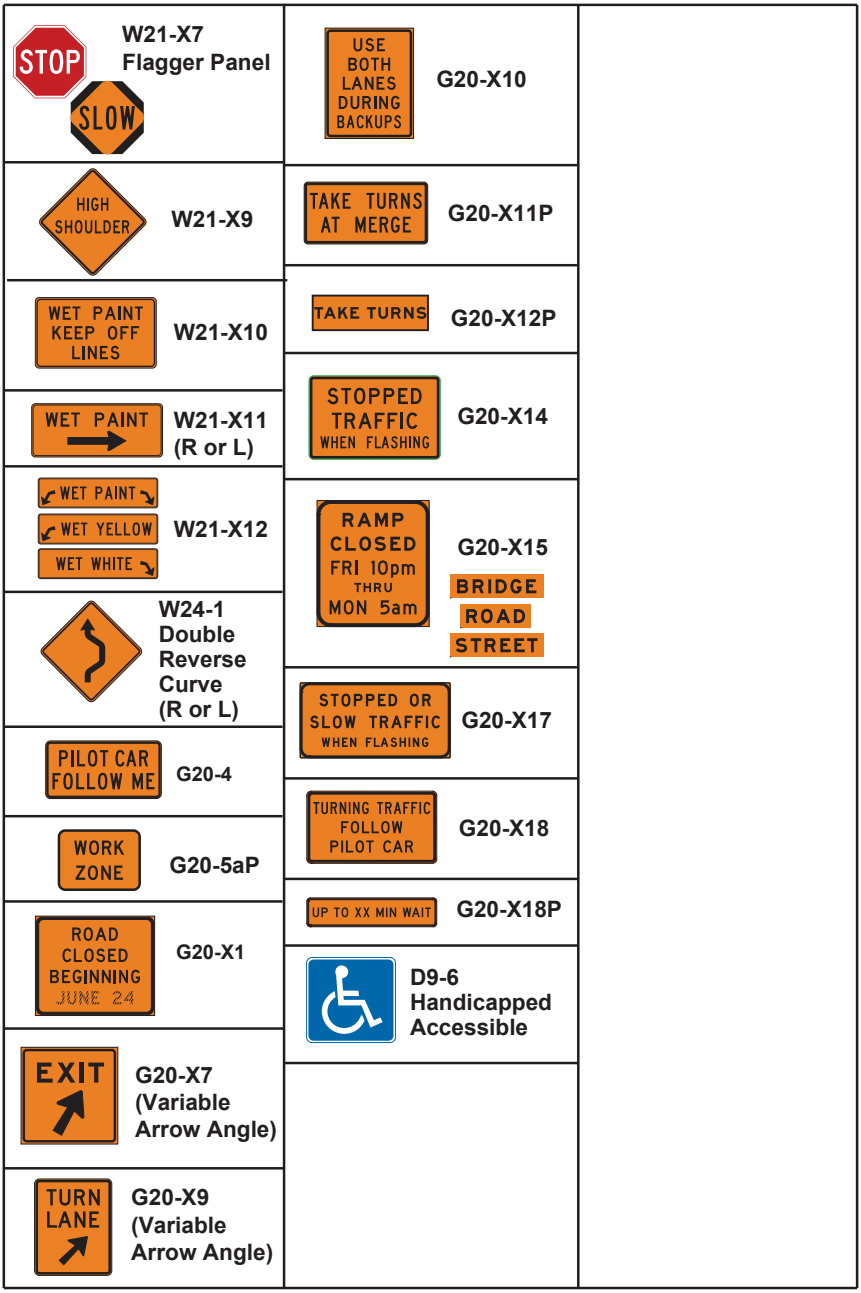
For additional signs and information on typical sizes and usage, see the Minnesota Manual on Uniform Traffic Control Devices.

Sign Codes Quick Reference
Figure 6K-4



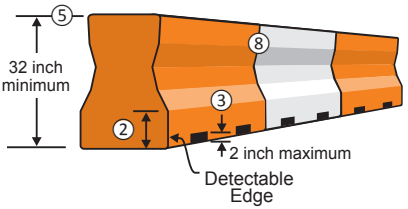
For additional signs and information on typical sizes and usage, see the Minnesota Manual on Uniform Traffic Control Devices.

Sign Codes Quick Reference
Figure 6K-4

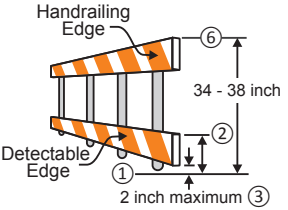


For additional signs and information on typical sizes and usage, see the Minnesota Manual on Uniform Traffic Control Devices.

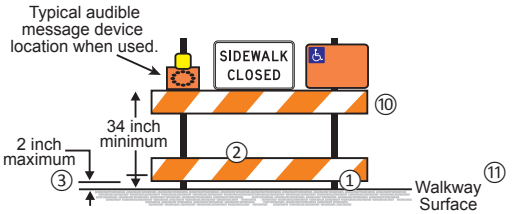
Sign Codes Quick Reference
Figure 6K-4



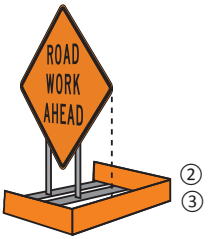
Pedestrian Channelizer
using a Temporary Barrier



Pedestrian Channelizer



Sidewalk Barricade



Detectable Edge
for Portable Sign Stand

NOTES:

① To prevent any tripping hazard to pedestrians, ballast shall be located behind or internal to the device. Any support on the front of the device shall not extend into the 48 inch minimum walkway clear space and shall have 0.5 inch maximum height above the walkway surface with approved beveling (see Note #9 on page 6K-aa for beveling details).

② Detectable edges for long canes shall be continuous and 6 inches minimum above the walkway surface and have color or markings contrasting with the walkway surface. The detectable edge around a portable sign stand should be placed in the walkway area in which the sign poses a hazard to a visually impaired pedestrian.

③ Devices shall not block water drainage from the walkway. A gap height or opening from the walkway surface up to 2 inch maximum height is allowed for drainage purposes.

4. Railings or other objects may protrude a maximum of 4 inches into the walkway clear space when located 27 inches minimum above the walkway surface.

⑤ Longitudinal channelizing devices for pedestrians shall be 32 inches high or greater.

⑥ When hand guidance is required, the top rail or top surface shall be:
- In vertical plane perpendicular to the walkway above the detectable edge,
- Continuous at a height of 34 to 38 inches above the walkway surface, and
- Supported with minimal interference to the pedestrian's hands or fingers.

7. All devices shall be free of sharp or rough edges and fasteners (bolts) shall be rounded to prevent harm to hands, arms, or clothing.

⑧ All devices used to channelize pedestrian flow should interlock such that gaps do not allow pedestrians to stray from the channelized path.

9. Any pedestrian devices used to provide positive protection (traffic or hazard) for pedestrians or workers shall meet crashworthy requirements appropriate for the barriers' application.

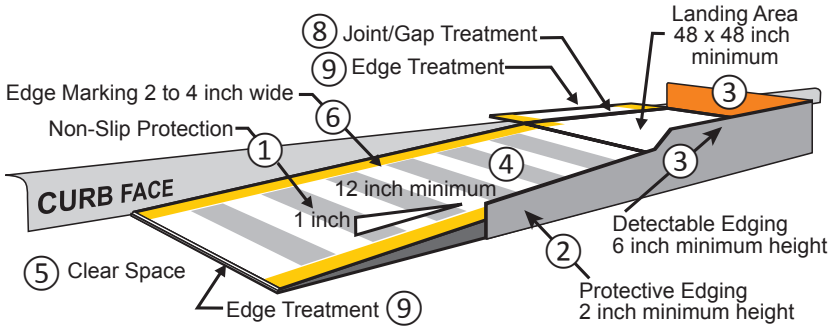
⑩ Barricades shall be used to close the entire width of the walkway surface.

⑪ A walkway surface shall be firm, stable, and slip resistant.

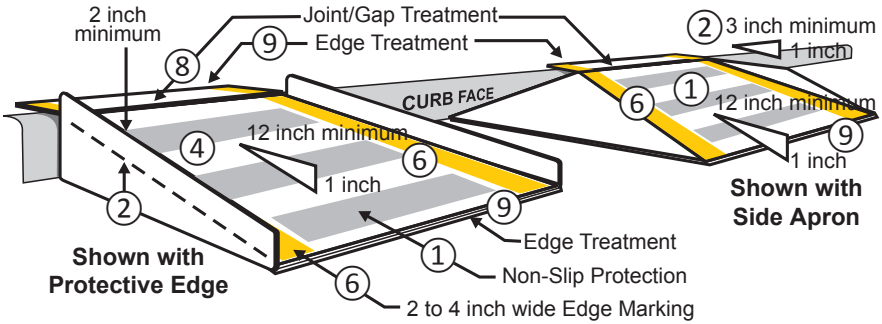
Refer to the MnDOT website Pedestrian Accommodations Through Work Zones for more information (http://www.dot.state.mn.us/trafficeng/workzone/apr.html).

Typical TPAR Devices
Figure 6K-5

Temporary Curb Ramp - Parallel to Curb



Temporary Curb Ramp - Perpendicular to Curb



NOTES:

① Curb ramps shall be 48 inches minimum width with a firm, stable, and non-slip surface.

② Protective edging with a 2 inch minimum height shall be installed when the curb ramp or landing platform has a vertical drop of 6 inches or greater or has a side apron slope steeper than 1:3 (33%). Protective edging should be considered when curb ramps or landing platforms have a vertical drop of 3 inches or more.

③ Detectable edging with 6 inches minimum height and contrasting color shall be installed on all curb ramp landings where the walkway changes direction (turns).

④ Curb ramps and landings should have a 1:50 (2%) max cross-slope.

⑤ Clear space of 48 x 48 inches minimum shall be provided above and below the curb ramp.

⑥ The curb ramp walkway edge shall be marked with a contrasting color 2 to 4 inch wide marking. The marking is optional where color contrasting edging is used.

7. Water flow in the gutter system shall have minimal restriction.

⑧ Lateral joints or gaps between surfaces shall be less than 0.5 inches in width.

⑨ Changes between surface heights should not exceed 0.5 inches. Lateral edges should be vertical up to 0.25 inches high, and beveled at 1:2 between 0.25 inches and 0.5 inches in height.

Refer to the MnDOT website Pedestrian Accommodations Through Work Zones for more information (http://www.dot.state.mn.us/trafficeng/workzone/apr.html).

Typical TPAR Devices
Figure 6K-5

Portable Changeable Message Signs (PCMS)

The primary purpose of Portable Changeable Message Signs (PCMS) is to advise the driver of unexpected traffic and routing situations.

General Guidelines

- 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 panel, and shall be used solely as an arrow board.
- Performance specifications can be found in the current version of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD), Part 6, Section 6F.
- A PCMS installed on the shoulder of a road shall be accompanied with Type B channelizing devices (see Layout 7).

Messages

- Each display should contain a single thought. The message should consist of no more than 2 displays on high speed roadways and no more than 3 displays on low speed roadways.
- The entire message should be readable twice at the posted speed limit. See Table 6K-2 (page 6K-ac) for additional requirements.
- An accurate description of the work location or the incident location is critical.
- The PCMS shall have readable up-to-date information. Any delay message should accurately reflect the traffic delay time.
- The PCMS message shall use days of the week not calendar dates unless the PCMS is placed 7 days or greater in advance.
- The use of abbreviations is discouraged. The entire word should be spelled out whenever space permits.
- If abbreviations are used, they should be easily understood (see Table 6K-3: Abbreviations Allowable on PCMS(s), pages 6K-ad through 6K-ag and Table 6K-4: Unacceptable PCMS Abbreviations, page 6K-ah).
- Displays shall not scroll horizontally or vertically across the face of the sign.
- If multiple PCMSs are used, make sure the messages do not conflict.

For more information on the use of PCMSs, see the CMS Manual of Practice at: http://dotapp7.dot.state.mn.us/projectPages/pages/projectDetails.jsf;jsessionid=t3PoW79ootelQ8QF9YwBytyc.9773acc1-da1d-30bb-b6a7-70c38c81c330?id=4590&type=CONTRACT.

Requirements

Specifications for use of a PCMS are in the following table.

Table 6K-2: Specifications for use of a PCMS

Requirements	Type A	Type B	Type C
Line(s) of Message	1 Line	2 Lines	3 Lines
Typical Mounting	Vehicle Mounted	Vehicle or Trailer Mounted	Trailer Mounted
Allowed Usage	Emergency and Incident Management	Advance Warning	Advance Warning and Advance Notice
Legibility Distance Requirements	Legible at 350 feet	Legible at 750 feet	Legible at 900 feet
Minimum Character Height	10 inches	≤ 40 mph* = 14 inches ≥ 45 mph* = 18 inches	18 inches
Maximum Number of Displays	1	≤ 40 mph* = 3 ≥ 45 mph* = 2	≤ 40 mph* = 3 ≥ 45 mph* = 2
Message Cycle	Constant	At least 2 seconds per display	At least 2 seconds per display
Minimum Sign Height to Bottom of Sign Panel	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)
Minimum PCMS Spacing	500 feet	1000 feet	1000 feet

** Posted speed limit prior to work starting.*

The width-to-height ratio of the sign characters should be between 0.7 and 1.0. The stroke width-to-height ratio should be 0.2.

Table 6K-3: Abbreviations Allowable on PCMS(s)

Emergency Word Message	Standard Abbreviation	Typical Prompt Word that Precedes the Abbreviation	Typical Prompt Word that Follows the Abbreviation
Access	ACCS	PARKING, STADIUM	ROAD
Afternoon/Evening	PM	---	---
Ahead	AHD	FOG	---
Alternate	ALT	---	ROUTE, ACCESS
Avenue	AVE, AV	---	---
Bicycle	BIKE	---	---
Blocked	BLKD	LANE, ROAD	---
Boulevard	BLVD*	---	---
Bridge	BR	(NAME)*	---
Cannot	CANT	---	---
Center	CNTR	---	LANE
Center (as part of a place name)	CTR	---	---
Chemical	CHEM	---	SPILL
Circle	CIR**	---	---
Closed	CLSD, CLOSD	---	---
Condition	COND	TRAFFIC	---
Congested	CONG	TRAFFIC	---
Construction	CONST	---	AHEAD
County Road Numbered Route	CR	---	ROUTE DESIGNATION*
Court	CT**	---	---
Crossing (other than highway-rail)	X-ING	---	---
Do Not	DONT	---	---
Downtown	DWNTN	---	TRAFFIC
Drive	DR**	---	---
East	E	---	---
Eastbound	E, E-BND, EB	---	---
Emergency	EMER	---	---
Entrance, Enter	ENT	---	---
Exit	EX	NEXT	---
Express	EXP	---	LANE

Table 6K-3: Abbreviations Allowable on PCMS(s), cont.

Emergency Word Message	Standard Abbreviation	Typical Prompt Word that Precedes the Abbreviation	Typical Prompt Word that Follows the Abbreviation
Expressway	EXPRS, EXPWY**	---	---
Feet	FT	---	---
Freeway	FRWY, FWY**	---	---
Friday	FRI	---	---
Frontage	FRNTG	---	ROAD
Hazardous	HAZ	---	DRIVING
Hazardous Material	HAZMAT	---	---
High Occupancy Vehicle	HOV	---	---
Highway	HWY	---	---
Highway-Rail Grade Crossing	RR XING	---	---
Hospital	HOSP	---	---
Hour(s)	HR, HRS	---	---
Information	INFO	---	---
International	INTL	---	---
Interstate Numbered Route	I	---	ROUTE DESIGNATION*
Junction/Intersection	JCT	---	---
Lane	LN, LA	RIGHT, LEFT, CENTER	---
Left	LFT, LF, L	---	---
Local	LOC	---	TRAFFIC
Lower	LWR	---	LEVEL
Maintenance	MAINT	---	---
Major	MAJ	---	CRASH
Maximum	MAX	---	---
Mile(s)	MIL	---	---
Miles Per Hour	MPH	---	---
Minnesota Numbered Route	MN		ROUTE DESIGNATION*
Minimum	MIN	---	---
Minor	MNR	---	CRASH

Table 6K-3: Abbreviations Allowable on PCMS(s), cont.

Emergency Word Message	Standard Abbreviation	Typical Prompt Word that Precedes the Abbreviation	Typical Prompt Word that Follows the Abbreviation
Minute(s)	MIN	---	---
Monday	MON	---	---
Morning/Late Night	AM	---	---
Mount	MT	---	---
Mountain	MTN	---	---
National	NATL	---	---
Normal	NORM	---	---
North	N	---	---
Northbound	N, N-BND, NB	---	---
Oversized	OVRSZ	---	LOAD
Parking	PKING	---	---
Parkway	PKWY**	---	---
Pavement	PVMT	WET, GROOVED	ENDS
Pedestrian	PED	---	---
Place	PL**	---	---
Pounds	LBS	---	---
Prepare	PREP	---	TO STOP
Right	RT, R	KEEP, NEXT	---
Road	RD**	---	---
Roadwork	RDWK	---	AHEAD (DISTANCE)
Route	RT, RTE	BEST, ALTERNATE	---
Saint	ST	---	---
Saturday	SAT	---	---
Service	SERV	---	---
Shoulder	SHLDR	---	---
Signal	SIGNL	---	OUT
Slippery	SLIP	---	---
South	S	---	---
Southbound	S, S-BND, SB	---	---
Speed	SPD	---	---
Stadium	STDM	NAME OF STADIUM	PARKING, NEXT EXIT

Table 6K-3: Abbreviations Allowable on PCMS(s), cont.

Emergency Word Message	Standard Abbreviation	Typical Prompt Word that Precedes the Abbreviation	Typical Prompt Word that Follows the Abbreviation
Street	ST**	---	---
Sunday	SUN	---	---
Sweeper	SWEEP	---	AHEAD
Temporary	TEMP	---	---
Terrace	TER**	---	---
Thursday	THUR	---	---
Tons of Weight	T	---	---
Traffic	TRAF	---	---
Trail	TR**	---	---
Tuesday	TUE	---	---
Two-Way Intersection	2-WAY	---	---
Two-Wheeled Vehicles	CYCLES	---	---
Upper	UPR	---	LEVEL
US Numbered Route	US	---	ROUTE DESIGNATION*
Vehicle(s)	VEH, VEHS	---	---
Warning	WARN	---	---
Wednesday	WED	---	---
West	W	---	---
Westbound	W, W-BND,WB	---	---
Will Not	WONT	---	---

NOTES:
* A space and no dash shall be placed between the abbreviation and the number of the route.

** This abbreviation shall not be used for any application other than the name of a roadway.

Table 6K-4: Unacceptable PCMS 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

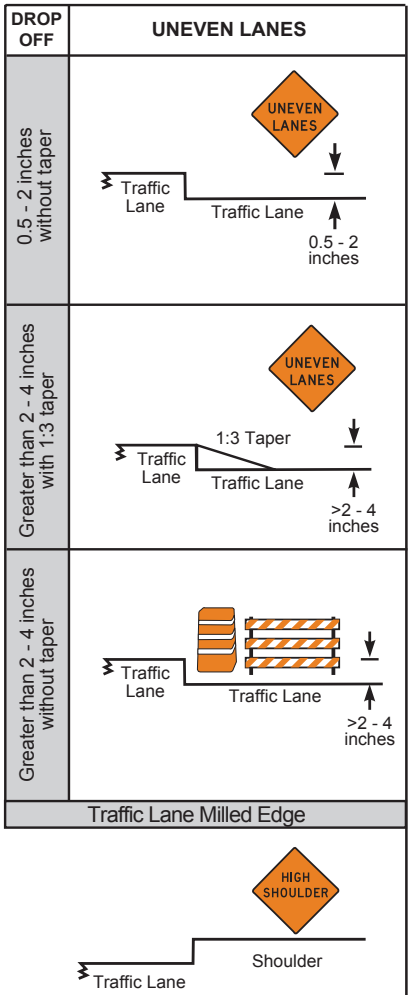
Operating Mode	Panel Display (Element layout for Type C panel shown.)
1. At least one of the following three modes shall be provided:	(Right arrow is shown, left arrow is similar)
Flashing Arrow	 Move/Merge Right
Sequential Arrow	 Move/Merge Right
Sequential Chevron	 Move/Merge Right
2. The following mode shall be provided:	
Flashing Double Arrow	 Move/Merge Right or Left
3. At least one of the following three modes shall be provided:	
Flashing Four Corners	
Flashing Bar	
Alternating Flashing Diamonds	 Caution

Panel Type	Minimum Size (Inches)	Minimum Legibility Distance (miles)	Minimum Number of Elements	Recommended Usage
A	48 x 24	0.50	12	Low Speed Streets
B	60 x 30	0.75	13	Anything not covered in A or C
C	96 x 48	1.00	15	Freeways and Expressways

Arrow Stick 

Arrow Sticks may supplement other TTC devices, but shall not be used in place of arrow boards.

Advance Warning Arrow Board Specification
Figure 6K-6



Note: Milled edges greater than 2 inches require tapers and/or deliniation as detailed for edge drop-offs in addition to the HIGH SHOULDERS signs.

These guidelines are intended to increase traffic safety using traffic control devices, safety related appurtenances, and construction techniques for uneven lanes, milled edges, and edge drop-offs that occur in work zones. The best way to increase traffic safety is to make every attempt to minimize exposure to these hazards. Only when uneven lanes, milled edges, and edge drop-offs are deemed necessary, shall the appropriate portion(s) of these guidelines be applied to enhance traffic safety.

No traffic control treatments are needed if edgelines are installed and shoulder widths and cross section slopes are the same as existing adjacent roadway sections.

Drop-offs of 0.5 to 4 inches, at least 8 feet from the edge of traffic carrying lanes, do not require any traffic control treatments.

Drop-offs of greater than 4 to 12 inches adjacent to traffic carrying lanes are permitted without tapers or temporary barriers for:

A. Projects within an urban area when the speed limit is 30 mph or less, or
B. Short term (3 calendar days or less) repair less than 50 feet in length when the speed limit is greater than 30 mph.

Weather permitting, milling and paving operations shall be required to complete the full width of the section under construction at the end of each work period. At no time shall there be more than one uneven lane condition between the traffic carrying lanes which include auxiliary lanes, turn lanes, and ramp access or egress areas.

Tapered slopes shall be adequately compacted to provide a firm driving surface.

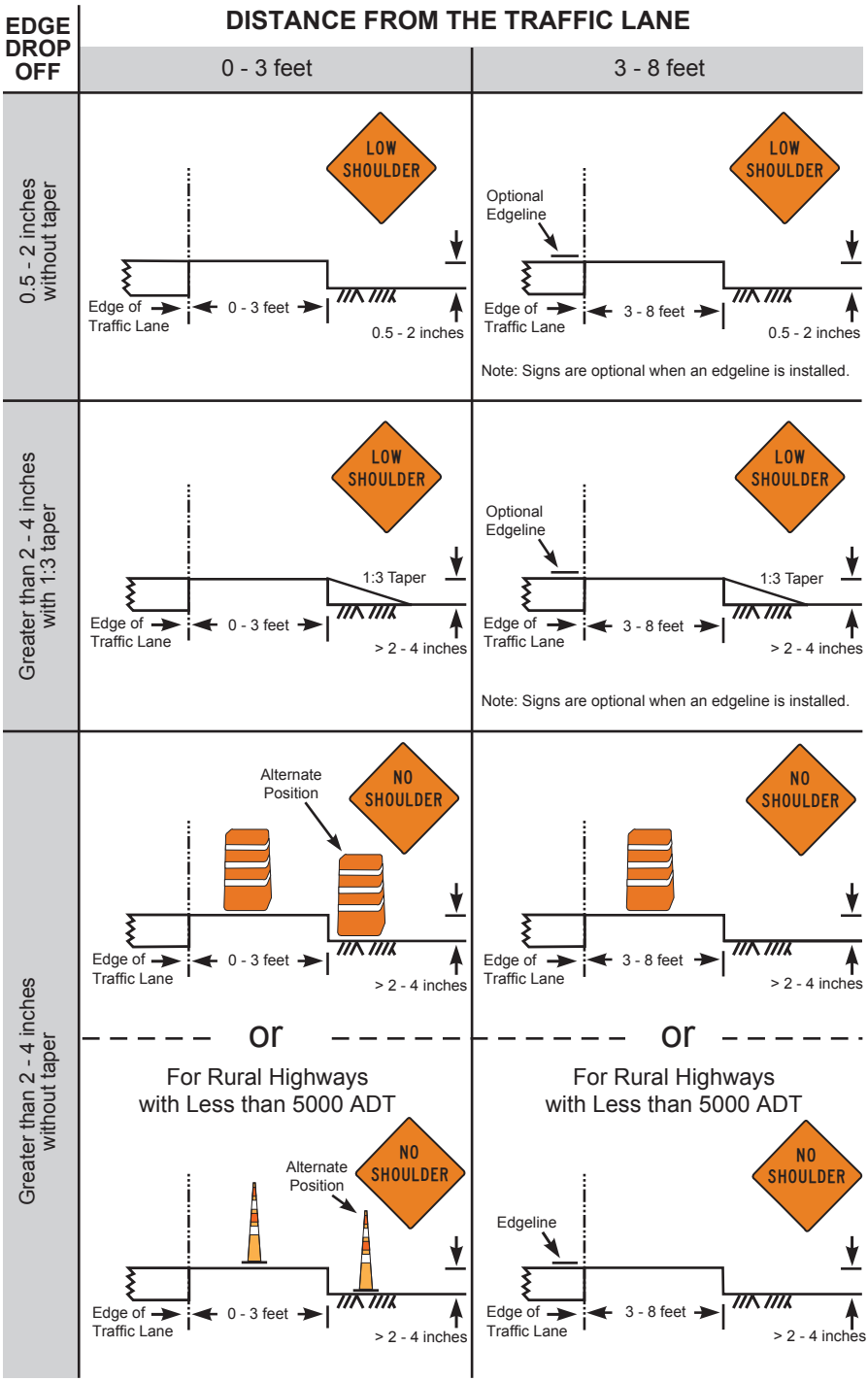
Appropriate uneven lane warning signs or shoulder warning signs shall be repeated after each intersection.

Where space is limited or there is a sight restriction, weighted channelizers may be used in place of drums to delineate longitudinal drop-offs.

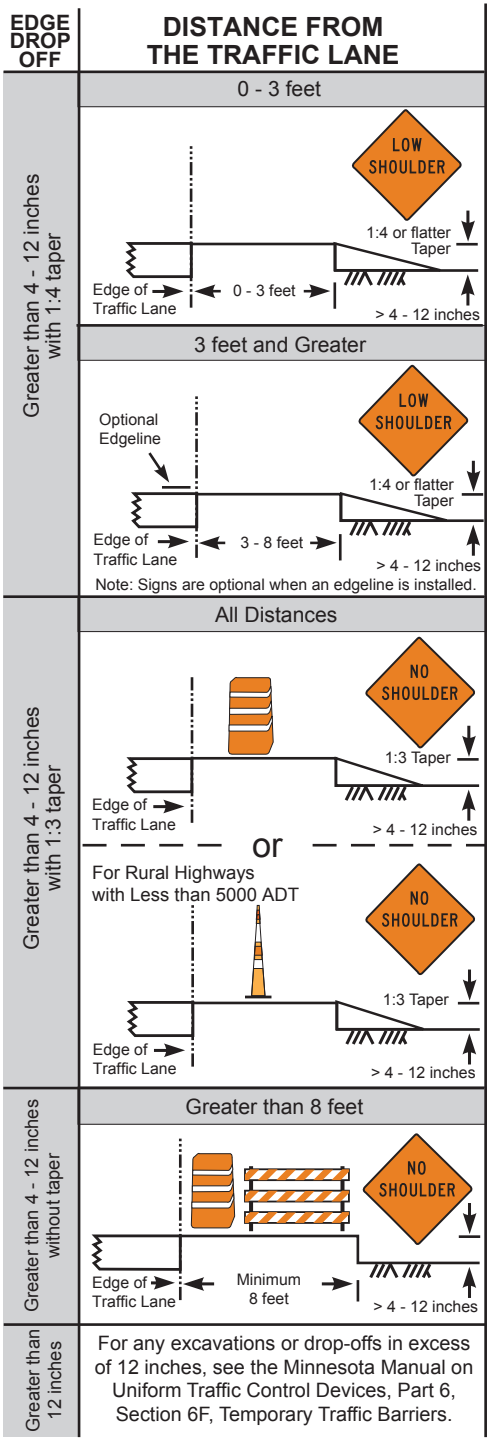
Maximum spacing of traffic control devices shall be determined based on the posted speed limit and using the following table.

Traffic Control Device	Maximum Spacing of Devices
Sign	low speed = 1/4 mile high speed = 1 mile
Drum	2G
Weighted Channelizer or Tubular Marker	G
Type III Barricade	20G

Longitudinal Drop-off Guidelines
Figure 6K-7



Longitudinal Drop-off Guidelines, cont.
Figure 6K-7



These guidelines are intended to increase traffic safety using traffic control devices, safety related appurtenances, and construction techniques for uneven lanes, milled edges, and edge drop-offs that occur in work zones. The best way to increase traffic safety is to make every attempt to minimize exposure to these hazards. Only when uneven lanes, milled edges, and edge drop-offs are deemed necessary, shall the appropriate portion(s) of these guidelines be applied to enhance traffic safety.

No traffic control treatments are needed if edgelines are installed and shoulder widths and cross section slopes are the same as existing adjacent roadway sections.

Drop-offs of 0.5 to 4 inches, at least 8 feet from the edge of traffic carrying lanes do not require any traffic control treatments.

Drop-offs of greater than 4 to 12 inches adjacent to traffic carrying lanes are permitted without tapers or temporary barriers for:

A. Projects within an urban area when the speed limit is 30 mph or less, or
B. Short term (3 calendar days or less) repair, less than 50 feet in length when the speed limit is greater than 30 mph.

Weather permitting, milling and paving operations shall be required to complete the full width of the section under construction at the end of each work period. At no time shall there be more than one uneven lane condition between the traffic carrying lanes which include auxiliary lanes, turn lanes, and ramp access or egress areas.

Tapered slopes shall be adequately compacted to provide a firm driving surface.

Appropriate uneven lane warning signs or shoulder warning signs shall be repeated after each intersection.

Where space is limited or there is a sight restriction, weighted channelizers may be used in place of drums to delineate longitudinal drop-offs.

Maximum spacing of traffic control devices shall be determined based on the posted speed limit and using the following table:

Traffic Control Device	Maximum Spacing of Devices
Sign	low speed = 1/4 mile high speed = 1 mile
Drum	2G
Weighted Channelizer or Tubular Marker	G
Type III Barricade	20G

Longitudinal Drop-off Guidelines, cont.
Figure 6K-7

Flagger or Operator of Automated Flagging Assistance Device

Automated Flagging Assistance Device (AFAD)

Flashing Arrow Board (FAB)

Portable Changeable Message Sign (PCMS)

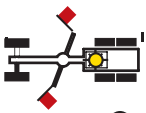
Portable Equipment - Includes testing devices, detection, surveying, etc.

Portable Traffic Signal

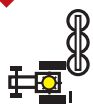
360-Degree Yellow Flashing Vehicle Light(s)

Work Vehicle

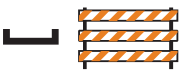
Work Vehicle with Crash Attenuator (Truck or Trailer Mounted)



Motor Grader



Mower



Type III Barricade

Traffic Control Sign

Type A Flashing Warning Light

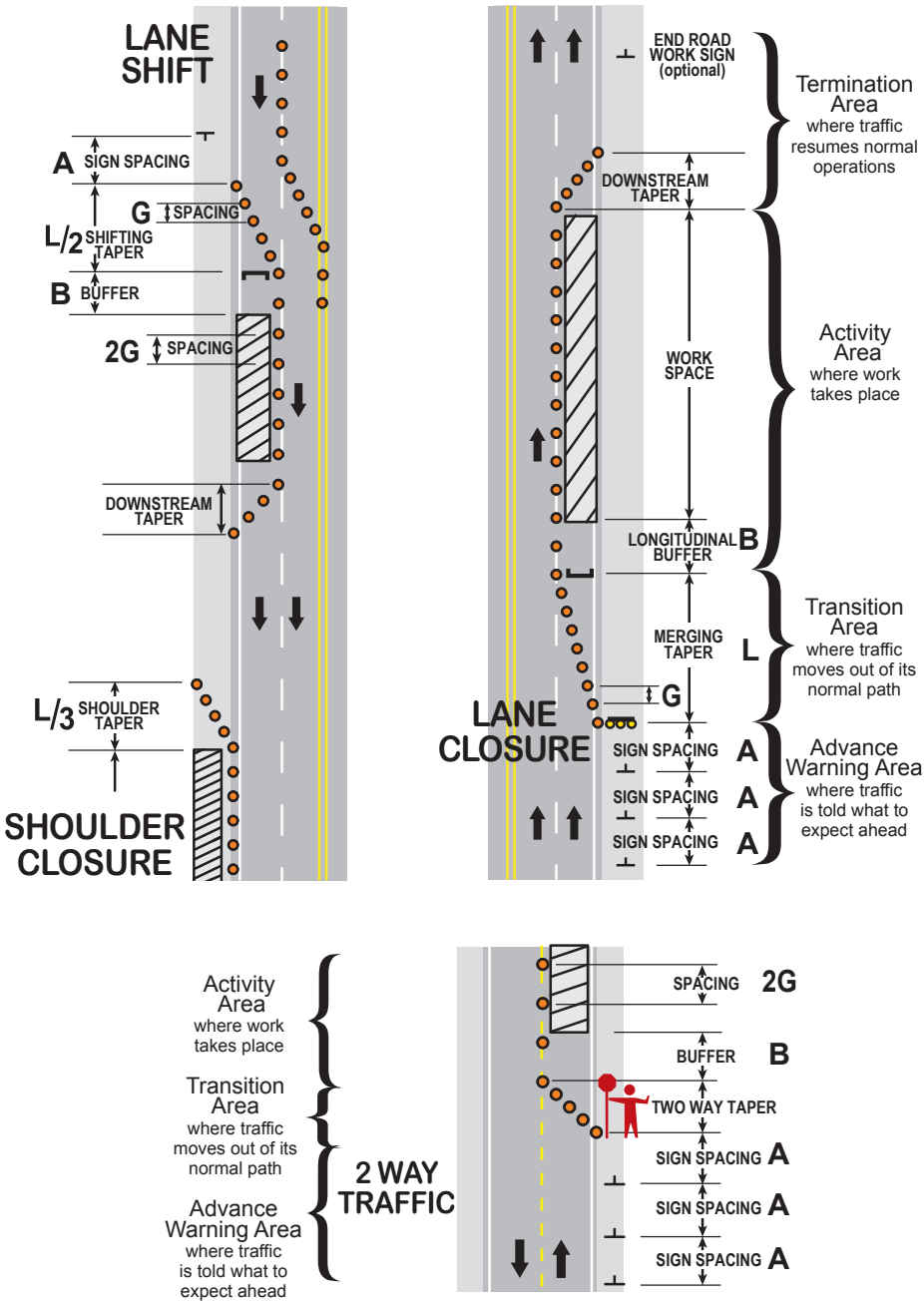
Channelizing Device

Direction of Traffic

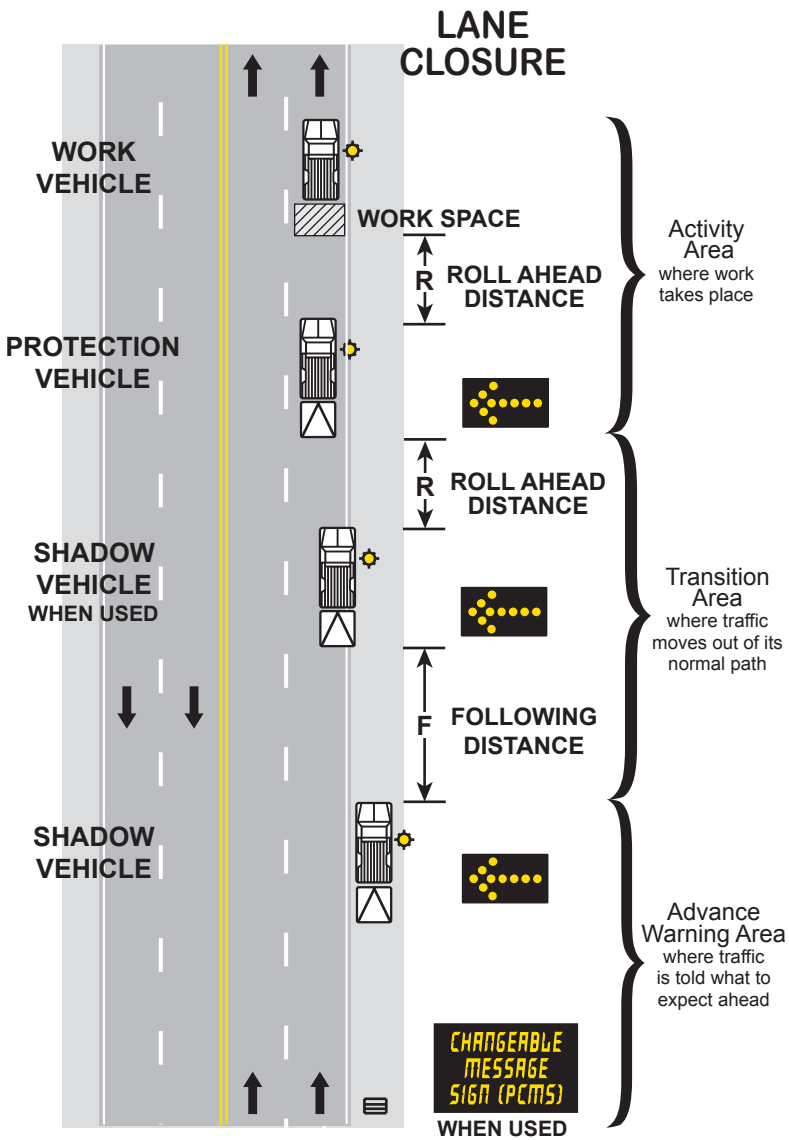
See Note (i.e. See Note 6)

Work Space

Symbols Used in Typical Layouts
Figure 6K-8



Components of a Stationary Temporary Traffic Control Zone
Figure 6K-9



Components of a Mobile Temporary Traffic Control Zone
Figure 6K-10

Temporary Traffic Control Distance Charts

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing **(A)** feet	Decision Sight Distance **(D)** feet	Taper Length (*12 ft lane*) **(L)** feet	Shifting Taper (*12 ft lane*) **(L/2)** feet	Typical Shoulder Taper **(L/3)** feet	Buffer Space **(B)** feet
0-30	**G = 25 ft.**	100	550	200	100	75	200
35-40		325	700	325	175	125	305
45-50	**G = 50 ft.**	600	900	600	300	200	425
55		750	1200	700	350	250	500
60-65		1000	1400	800	400	275	650
70-75		1200	1600	900	450	300	820

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Following Distance **(F)** feet	**Roll Ahead Distance Charts**			
			Recommended Spacing for Vehicles Weighing 9,900 to 22,000 lbs GVW **(R)** feet		Recommended Spacing for Vehicles Weighing Greater than 22,000 lbs GVW **(R)** feet	
			Stationary Operation	**Moving Operation 15 MPH max**	**Stationary Operation**	**Moving Operation 15 MPH max**
0-30	**G = 25 ft.**	100 - 550	100	100	75	100
35-40		325 - 700	100	100	75	100
45-50	**G = 50 ft.**	600 - 900	125	175	100	150
55		750 - 1200	125	175	100	150
60-65		1000 - 1400	175	225	150	175
70-75		1200 - 1600	175	225	150	175

Shadow and Protection Vehicle wheels should be pointed straight ahead.

Temporary Traffic Control Distance Charts
Figure 6K-11

Low Volume Roads: Rural and Urban

A Rural Highway with less than 400 ADT, and an Urban Residential Street with less than 400 ADT and speeds of 30 mph or less.

Low Volume

**Drawings Not To Scale*

LOW VOLUME ROADS: RURAL AND URBAN				
Low Volume Less than 400 ADT	**MOBILE 15 Minutes or Less**	**SHORT DURATION 1 Hour or Less**	**SHORT TERM 12 Hours or Less**	**INTERMEDIATE TERM 3 Days or Less**
Work Vehicle Parked On Shoulder	6		8	
Work on Shoulder	9		8	
Work off Shoulder	8			
Work off Roadway	10			
Shoulder or Parking Lane Closure	8			
Partial Shoulder Closure for Trailer Mounted Devices	7			
Lane Closure	11			
Uncontrolled	4			
One Flagger Control	4*			
2 Flagger Control	16*			
Moving Work Spaces	17 *			
Near Intersection	20*, 21*			
Near Railroad Xing	22*			
Pilot Car Operation	18*			
Flagging Crossroads and Blind Curves	19*			
Automated Flagger Assistance Device (AFAD)	24*			
Portable Signal Control	25			
STOP Sign Control	14			
Flagging Station Enhancements	23			
Turn Lane Closures	33, 34			
Lane Shift	29			
Work on Centerline	1 (30 mph or less only)			
Work in Center of Road	2			
Work in Intersection	3 (30 mph or less only)			
Temporary Road Closure (15 minute intervals)	31			
Temporary Road Closure	32			
Road Closure - Special Events	5			
Sidewalk Closure	88, 89			
Gravel Road Maintenance	30			

* This layout may be used for nighttime operations only if the flagging stations are occupied and illuminated with auxiliary lighting such as floodlights or balloon lighting except in emergency situations.

Layout Selection Matrix by Maintenance Activity

The following are examples of situations where layouts may be used. Layouts may be used for other operations.

URBAN

	MAINTENANCE ACTIVITY	WORK DURATION MOBILE 15 Minutes or Less	SHORT DURATION 1 Hour or Less	SHORT TERM 12 Hours or Less
On Road	Asphalt Pavement Patching	11	4*	4*
	Concrete Pavement Patching			4*
	Pothole Patching	11	4*	
	Crack Filling		4*	4*, 16*
	Crack Sealing - Route and Seal			4*, 16*
	Surface Treatment			4*, 16*
	Sweeping - Residential	11		
	Utility Repair - Centerline	1	1	1, 2
	Utility Repair - Center of Intersection	3	3	3
	Road Closure (e.g. water main break)	31	31	31, 32
	Road Closure (for Special Event)	5	5	5
	Utility Maintenance (partial road closure)			4*
Roadside	Mowing	10		
	Tree/Brush Removal	10, 11	4*	4*
	Debris Removal - Routine (e.g. litter pickup)	8, 9	8, 9	
	Debris Removal - Large Item (e.g. couch, roadkill)	11		
	Utility Repair - Shoulder	8, 9	8, 9	8
	Sign Repair	8, 9, 11	8, 9	
	Snow Cleanup	8, 9, 11	8, 9	

* This layout may be used for nighttime operations only if the flagging stations are occupied and illuminated with auxiliary lighting such as floodlights or balloon lighting except in emergency situations.

Layout Selection Matrix by Maintenance Activity

The following are examples of situations where layouts may be used. Layouts may be used for other operations.

RURAL

	MAINTENANCE ACTIVITY	WORK DURATION MOBILE 15 Minutes or Less	SHORT DURATION 1 Hour or Less	SHORT TERM 12 Hours or Less
On Road	Asphalt Pavement Patching	11	4*	4*
	Concrete Pavement Patching			4*
	Temporary Pothole Patching	11	4*	
	Crack Filling		4*	16*
	Crack Sealing - Route and Seal			16*
	Surface Treatment			16*
	Grading a Gravel Road	30		
	Road Closure (e.g. water main break)	31	31	31, 32
	Culvert Maintenance (partial road closure)			4*
	Shouldering Shoulder Disking/Blading	10, 11		
Roadside	Mowing	10		
	Tree/Brush Removal	10, 11	4*	4*
	Debris Removal - Routine (e.g. litter pickup)	11	8	
	Debris Removal - Large Item (e.g. couch, roadkill)	11		
	Utility Repair - Shoulder	8	8	8
	Sign Repair	11	8	
	Snow Cleanup	11		
	Driveway Culvert Maintenance	8	8	8
	Ditch Maintenance (Partial Road Closure)			8

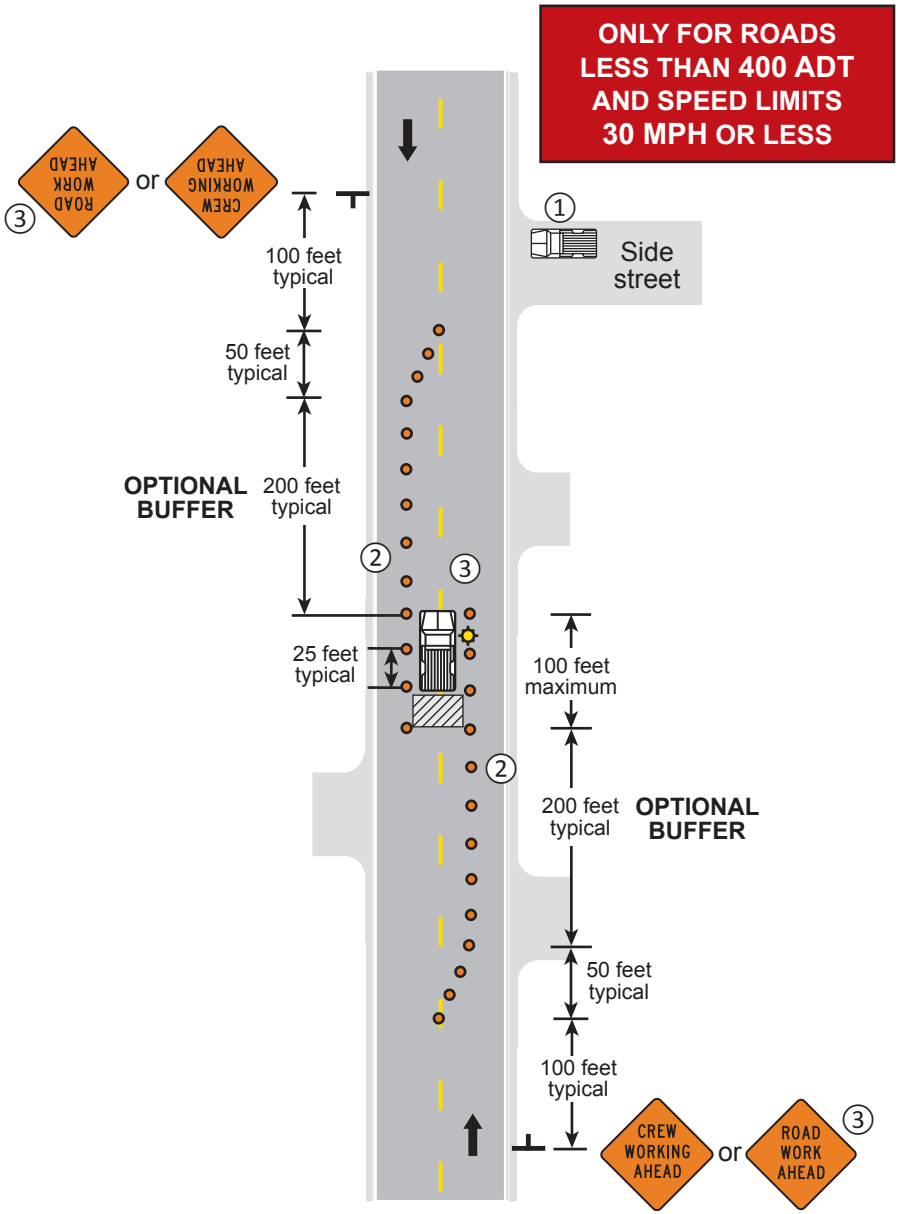
* This layout may be used for nighttime operations only if the flagging stations are occupied and illuminated with auxiliary lighting such as floodlights or balloon lighting except in emergency situations.

NOTES:

① Additional Work Vehicle shall be parked off of the roadway. Do not obstruct the shoulder in the coned areas.

② A minimum of 10 feet of drivable surface outside of the channelizers should be maintained on all sides. Anything less than 10 feet shall be approved by the road authority.

③ Channelizers and ROAD WORK AHEAD signs are optional at 15 minutes or less.



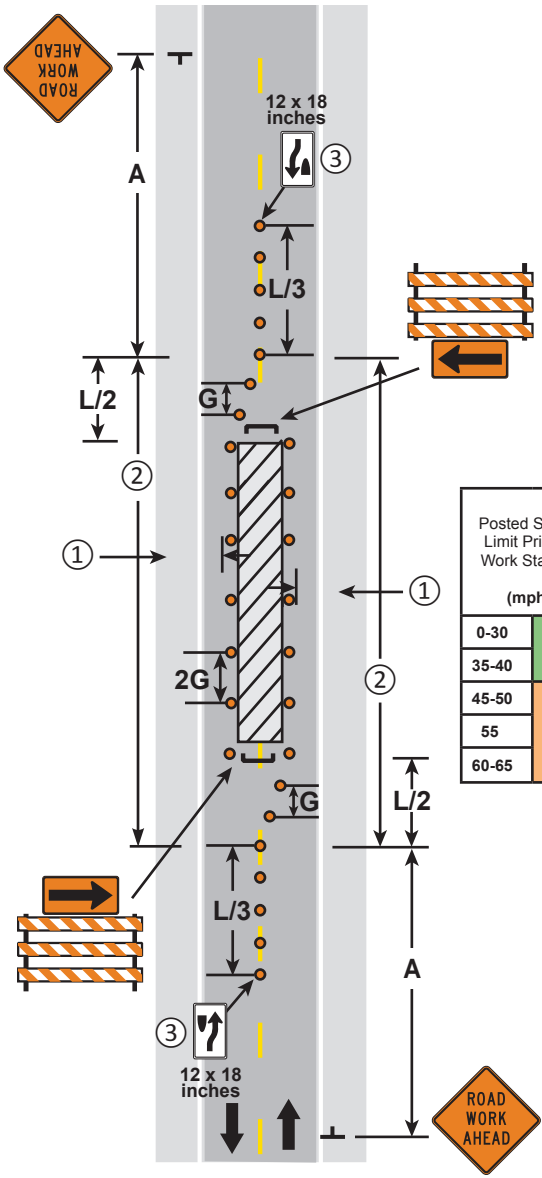
WORK ON CENTERLINE

12 HOURS or LESS **LAYOUT 1**

NOTES:

1. Minimum drivable surface outside of the channelizing devices shall be 10 feet.
2. Parking and stopping should be prohibited along the work area and tapers.
3. Keep Right sign may be omitted if posted speed limit is 40 mph or less.

ONLY FOR ROADS LESS THAN 400 ADT



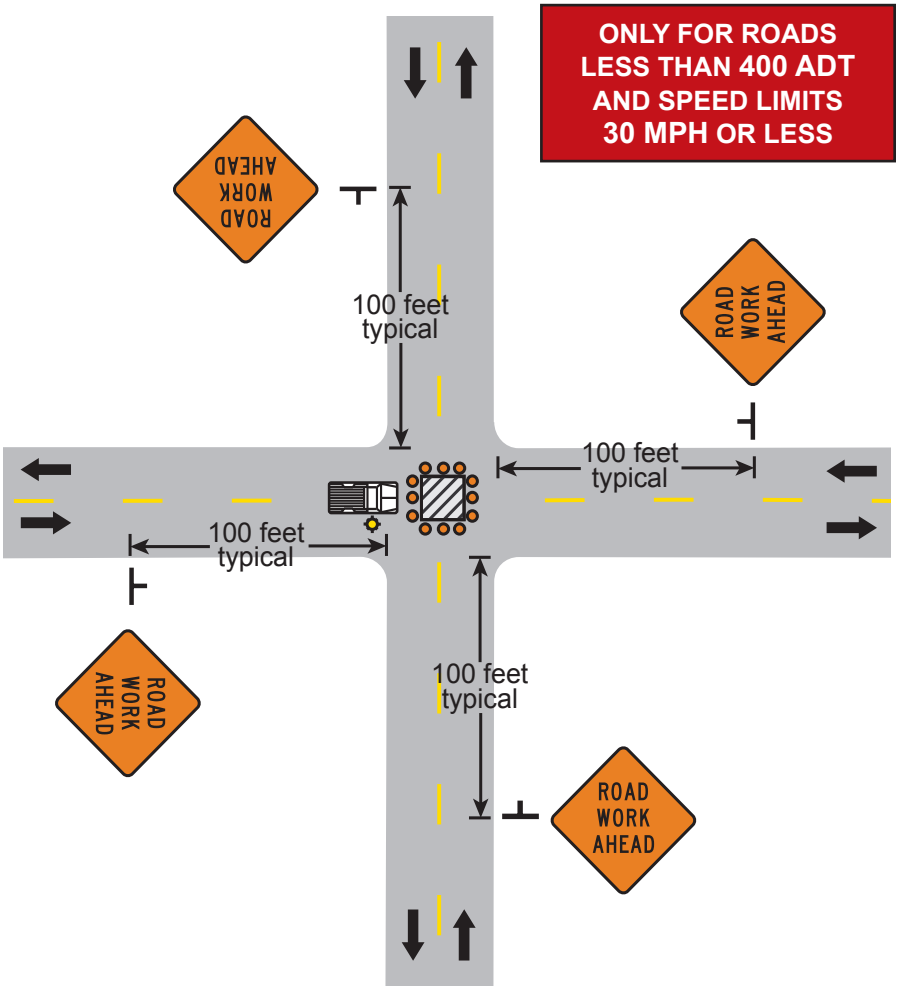
Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Shifting Taper *(12 ft lane)* (L/2) feet	Typical Shoulder Taper *(12 ft lane)* (L/3) feet
0-30	G = 25 ft.	100	100	75
35-40		325	175	125
45-50	G = 50 ft	600	425	900
55		750	350	250
60-65		1000	400	275

WORK SPACE IN CENTER OF ROAD
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 2**

NOTES:

1. A minimum of 10 feet of drivable surface outside of the channelizers shall be maintained such that traffic can self-regulate.



CLOSURE IN CENTER OF INTERSECTION

3 DAYS or LESS **LAYOUT 3**

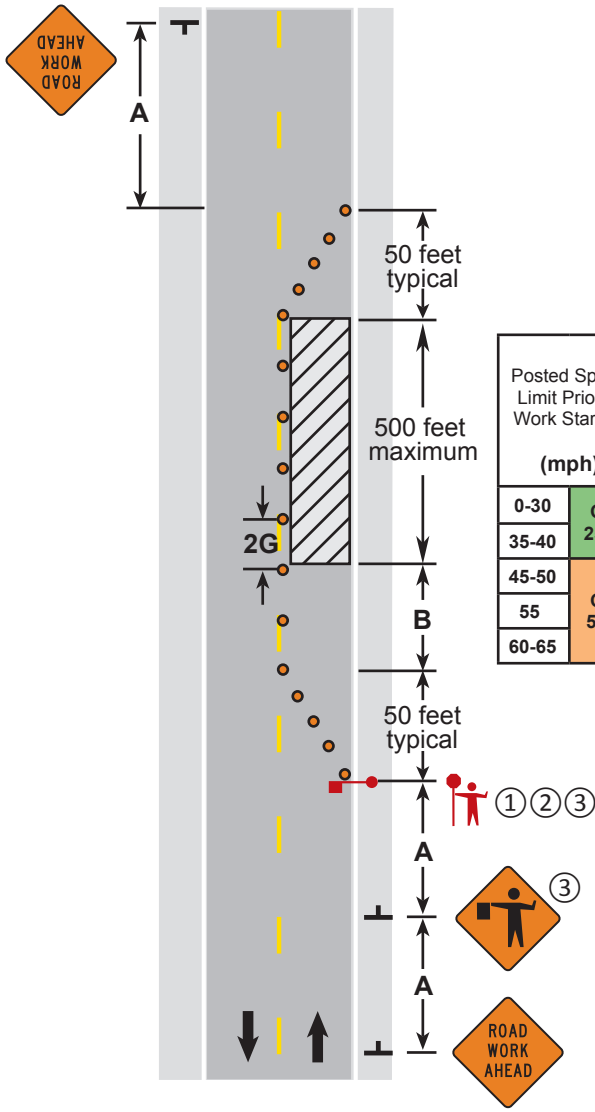
NOTES:

① The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**).

② If the flagger's ability to see oncoming motorists beyond the work space is less than the Decision Sight Distance (**D**), two flaggers shall be used - See Layout 16.

③ The Flagger and Flagger Ahead sign may be omitted if the operation is during daylight hours, 12 hours or less, and traffic is able to self-regulate.

4. If the work space must be left unattended at night use Layout 14.



ONLY FOR ROADS LESS THAN 400 ADT

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Buffer Space (B) feet	Decision Sight Distance (D) feet
0-30	G = 25 ft.	100	200	550
35-40		325	305	700
45-50	G = 50 ft	600	425	900
55		750	500	1200
60-65		1000	650	1400

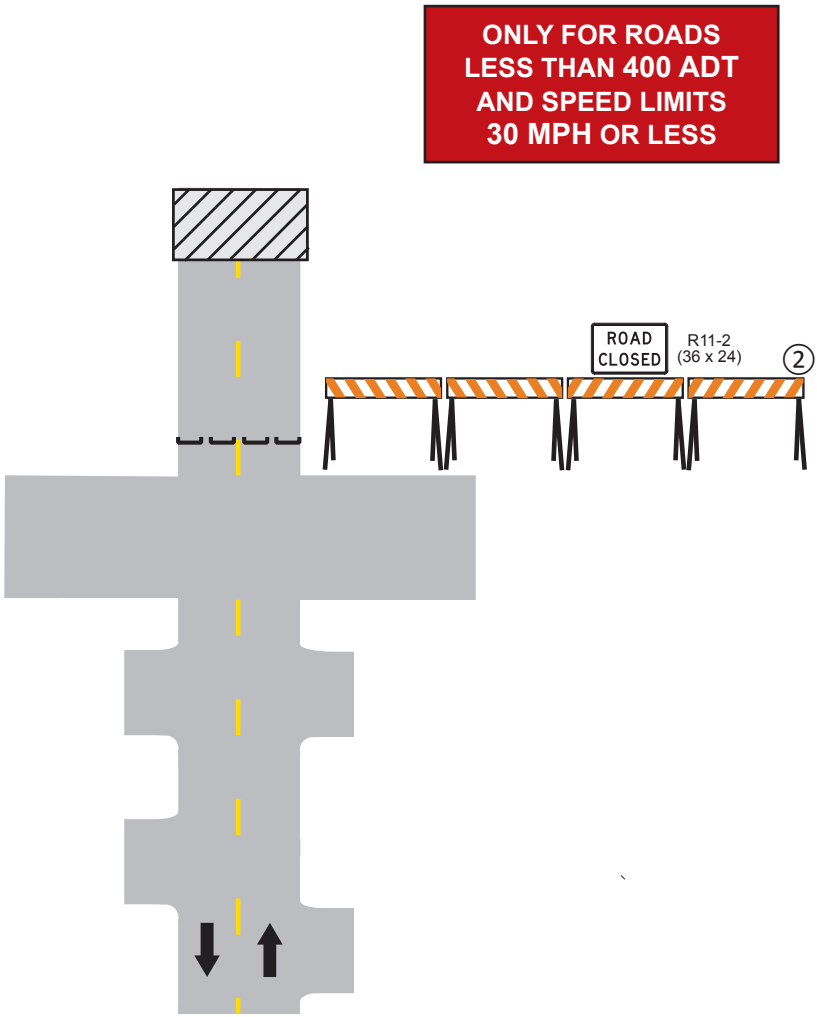
LANE CLOSURE, ONE FLAGGER
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 4**

NOTES:

1. The road authority shall be contacted prior to closure and may provide requirements related to detours and/or additional temporary traffic control.

(2) Install Type I barricades at the last driveway or intersection beyond which there is no public access. Barricades shall span the entire roadway including traversable shoulders. All signs and barricades used at night shall be retroreflective.



ROAD CLOSURE
SPECIAL EVENTS

12 HOURS or LESS **LAYOUT 5**

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Two-Lane, Two-Way Roads

A road consisting of two opposing lanes of undivided traffic.

Two-Lane Two-Way

**Drawings Not To Scale*

TWO-LANE, TWO-WAY ROADS

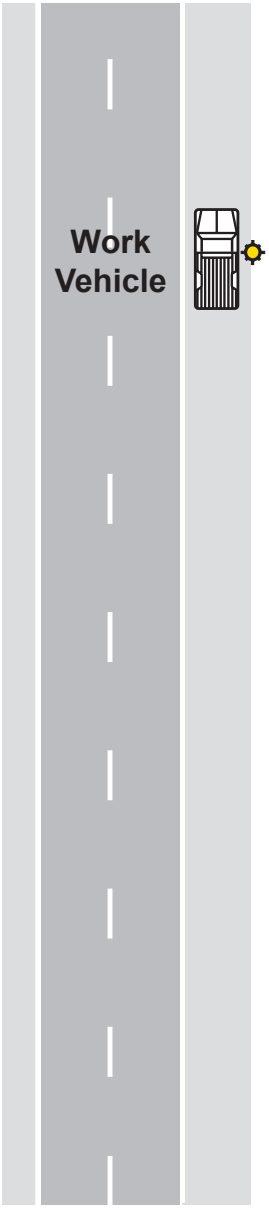
Intermediate Volume Up to 1500 ADT	MOBILE 15 Minutes or Less	SHORT DURATION 1 Hour or Less	SHORT TERM 12 Hours or Less	INTERMEDIATE TERM 3 Days or Less
Lane Closure	11			
Flagger Control	26*		15*	
STOP Sign Control	14			
Work in Center of Road	27*			
All ADTs	**MOBILE 15 Minutes or Less**	**SHORT DURATION 1 Hour or Less**	**SHORT TERM 12 Hours or Less**	**INTERMEDIATE TERM 3 Days or Less**
Work Vehicle Parked on Shoulder	6		8	
Work on Shoulder	9		8	
Work off Shoulder	8			
Work off Roadway	10			
Shoulder or Parking Lane Closure	8			
Partial Shoulder Closure for Trailer Mounted Devices	7			
Lane Closure	12, 13*			
2 Flagger Control	16*			
Moving Work Spaces	17*			
Near Intersection	20*, 21*			
Near Railroad Xing	22*			
Pilot Car Operation	18*			
Flagging Crossroads and Blind Curves	19*			
Automated Flagger Assistance Device (AFAD)	24*			
Portable Signal Control	25			
Flagging Station Enhancements	23			
Work in Center of Road	28*			
Lane Shift	29			
Turn Lane Closures	33, 34			
Temporary Road Closure (15 minute intervals)	31*			
Temporary Road Closure	32			
Sidewalk Closure	88, 89			
Bike Lane Closure	87			
Gravel Road Maintenance	30			
Crossroad and Confirmation Signing	35			

See Low Volume Roads section for ADTs less than 400.

* This layout may be used for nighttime operations only if the flagging stations are occupied and illuminated with portable lights.

NOTES:

1. The Work Vehicle should be pulled over as far off the roadway as possible, and shall display and operate a 360-degree flashing beacon.



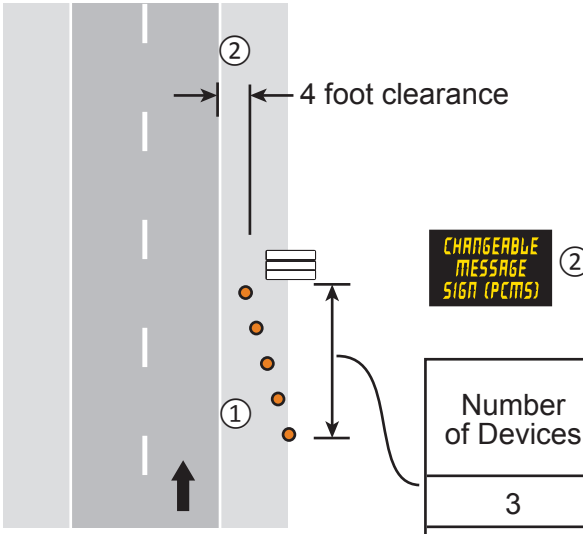
WORK VEHICLE PARKED ON SHOULDER

1 HOUR or LESS **LAYOUT 6**

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 Trailer mounted traffic control devices should be placed at least 4 feet from the traveled lane. If a 4 foot clearance cannot be met, then the taper length shall be doubled.



Number of Devices	Taper Length (feet)	Speed Limit (mph)
3	50	≤ 40
5	100	≥ 45

PARTIAL SHOULDER CLOSURE

Trailer Mounted Devices on Shoulder

3 DAYS or LESS **LAYOUT 7**

NOTES:

① The ROAD WORK AHEAD sign may be omitted for short term daylight operations if a vehicle is displaying and operating a 360-degree flashing beacon and:

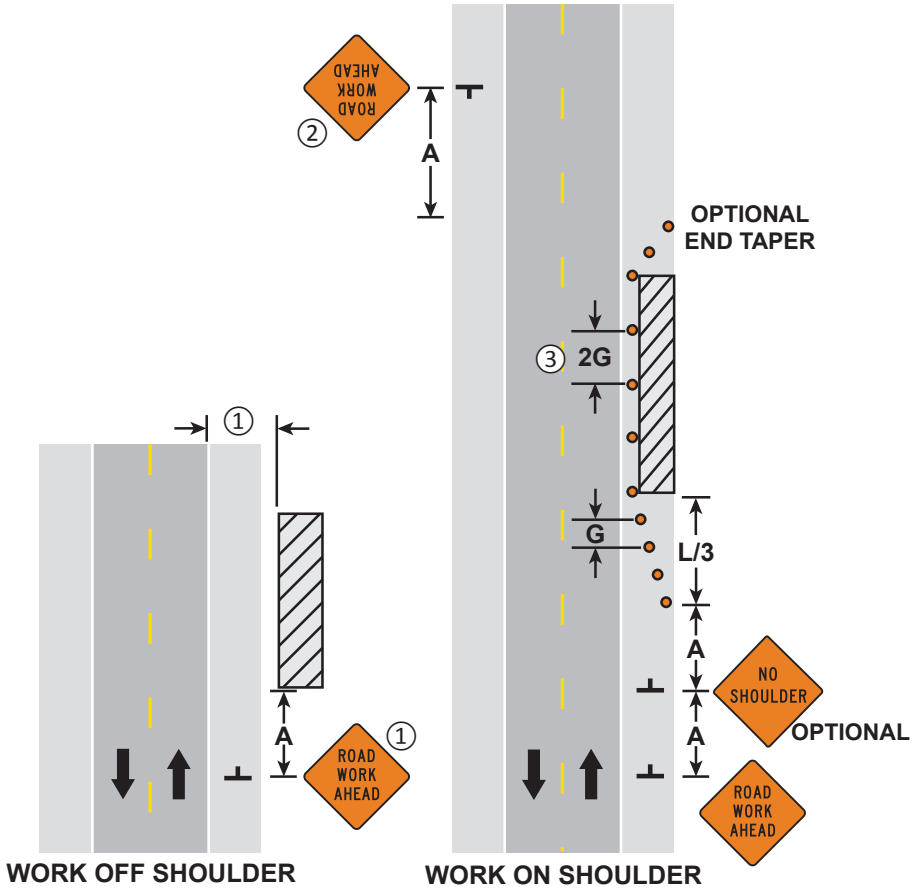
a. The distance from curb face to the work space is at least 2 feet, or

b. The distance from the edge of the roadway to the work space is at least 15 feet.

② This ROAD WORK AHEAD sign shall be installed on two-lane, two-way roads if traffic control devices are installed for a work space in the opposite shoulder.

③ If this layout is used to close a parking lane that is normally open to vehicle travel during the time of day the closure will be in effect, the lane shall be considered a traveled lane and not a parking lane. Layout 42 shall be used to provide traffic control for the lane closure.

4. If this layout is used to close a parking lane, channelizer spacing may be reduced from 2G to G in high volume areas.



SHOULDER AND PARKING LANE CLOSURE

Work On or Near Shoulder

3 DAYS or LESS **LAYOUT 8**

NOTES:

① Any Shadow Vehicle or Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

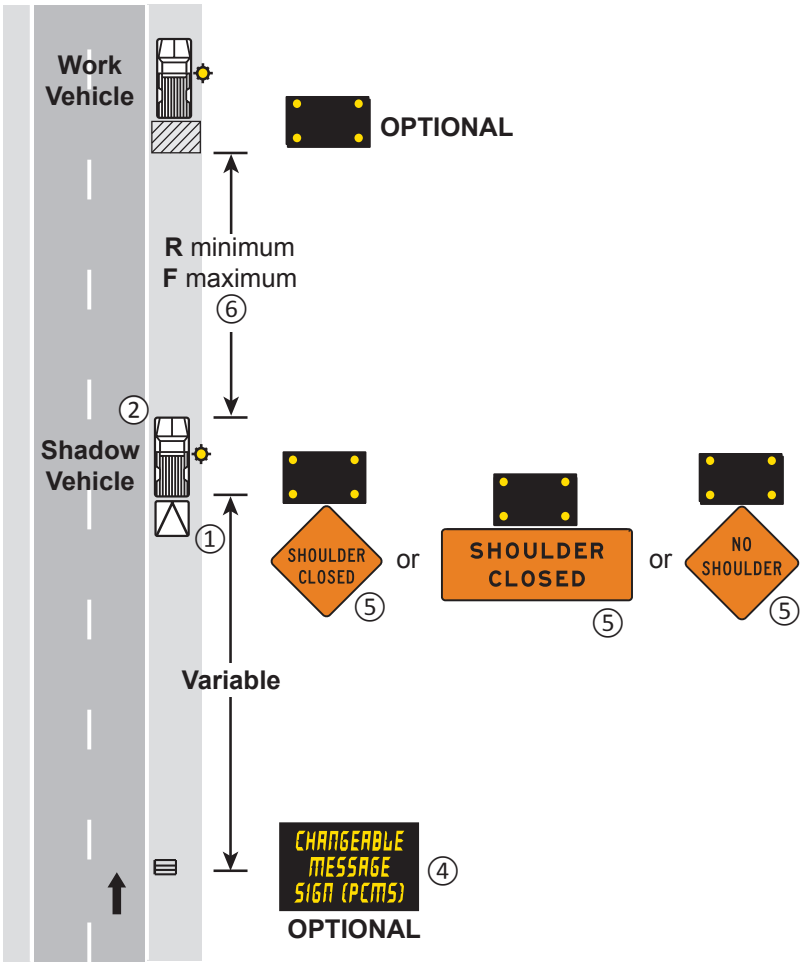
② The Shadow Vehicle or Protection Vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.

3. Any vehicle not displaying a Flashing Arrow Board shall display high-intensity rotating, flashing, oscillating, or strobe lights.

④ The PCMS shall be used for nighttime operations.

⑤ When the PCMS is used, the SHOULDER CLOSED or NO SHOULDER sign becomes optional.

⑥ The distance between the work area and the Shadow Vehicle should be adjusted between **R** and **F** based on traffic volume and sight distance.



SHOULDER CLOSURE
Mobile and Short Duration

1 HOUR or LESS **LAYOUT 9**

NOTES:

① A Shadow Vehicle should be used on roadways where Decision Sight Distance (**D**) is frequently restricted and the equipment consistently encroaches within 3 feet of the traffic lane. The Shadow Vehicle may be omitted on roadways with speeds limits of 40 mph or less.

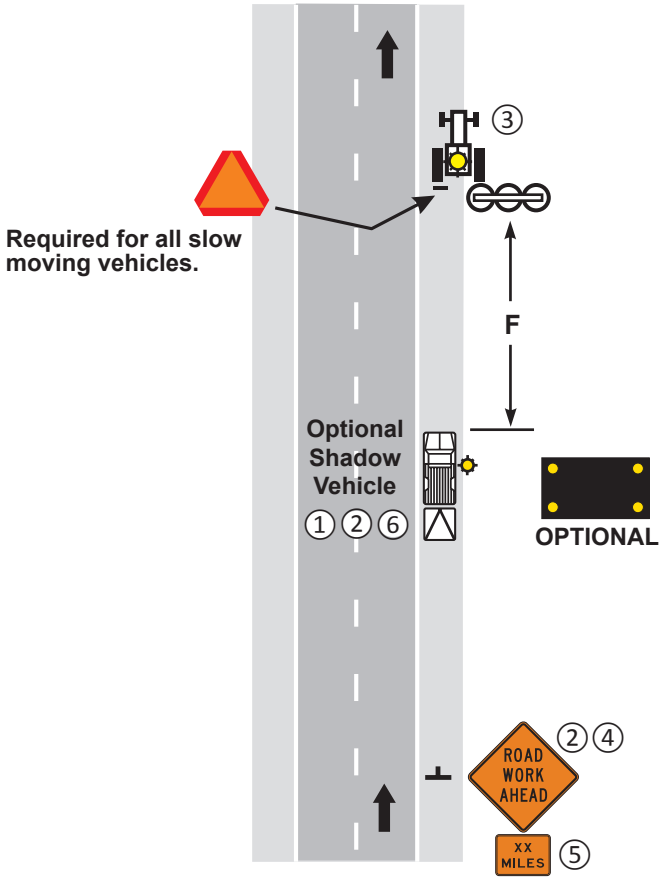
② On roadways of less than 400 ADT the Shadow Vehicle and ROAD WORK AHEAD sign may be omitted.

③ The vehicle should be as far off the roadway as possible, and shall display and operate a 360-degree flashing beacon.

④ The ROAD WORK AHEAD sign may be omitted when there is an adequate approach Decision Sight Distance (**D**) to the equipment along the majority of the route.

⑤ When advance warning signs are used, the signs should be no more than 3 miles from the equipment. The location of the signs should be determined by the sources of traffic, such as major cross roads. If the distance is 1 mile or greater, a XX MILES distance plaque should be used and placed directly below or on the lower side of the warning sign nearest traffic.

⑥ The Shadow Vehicle should be equipped with a TMA if it encroaches into the traffic lane.



WORK OFF ROADWAY

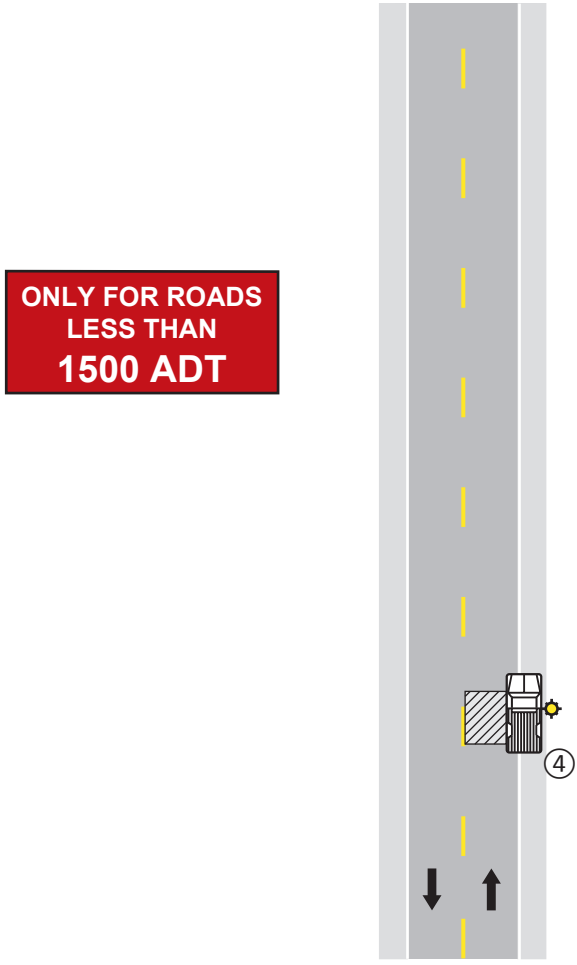
Mobile Operations Having Little or No Interference with Traffic

15 MINUTES or LESS **LAYOUT 10**

NOTES:

1. If the approach sight distance is restricted, a spotter should be used.
2. If the visibility is poor or the operation does not move at least the Decision Sight Distance (**D**) every 15 minutes, the appropriate stationary layout should be used.
3. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.

④ The slow moving or stopped Work Vehicle should keep the traffic lane as wide as possible by using the shoulder space whenever possible.



LANE CLOSURE
TWO-LANE, TWO-WAY ROAD

15 MINUTES or LESS **LAYOUT 11**

NOTES:

1. Use Layout 13 under any of the following conditions:
   - If the work space is not visible for at least the Decision Sight Distance (**D**),
   - The motorists cannot see beyond the work space, or
   - Traffic volumes do not allow passage.

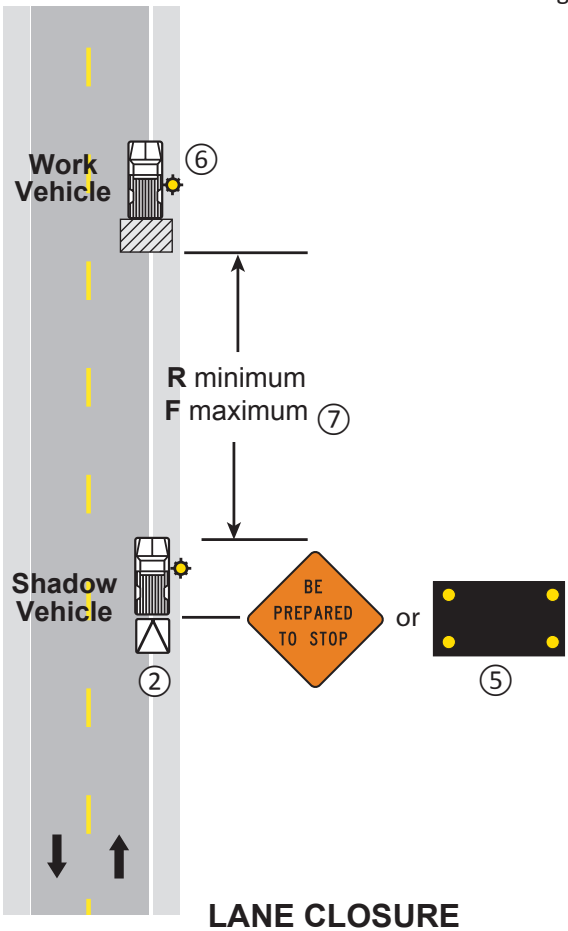
② Any Shadow Vehicle or Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

3. If the work space does not move at least the Decision Sight Distance (**D**) every 15 minutes, the appropriate stationary layout should be used.
4. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.

⑤ For nighttime operations, the Flashing Arrow Board shall be used.

⑥ The slow moving or stopped Work Vehicle and Shadow Vehicle should keep the traffic lane as wide as possible by using the shoulder space whenever practical.

⑦ The distance between the work area and the Shadow Vehicle should be adjusted between **R** and **F** based on traffic volume and sight distance.

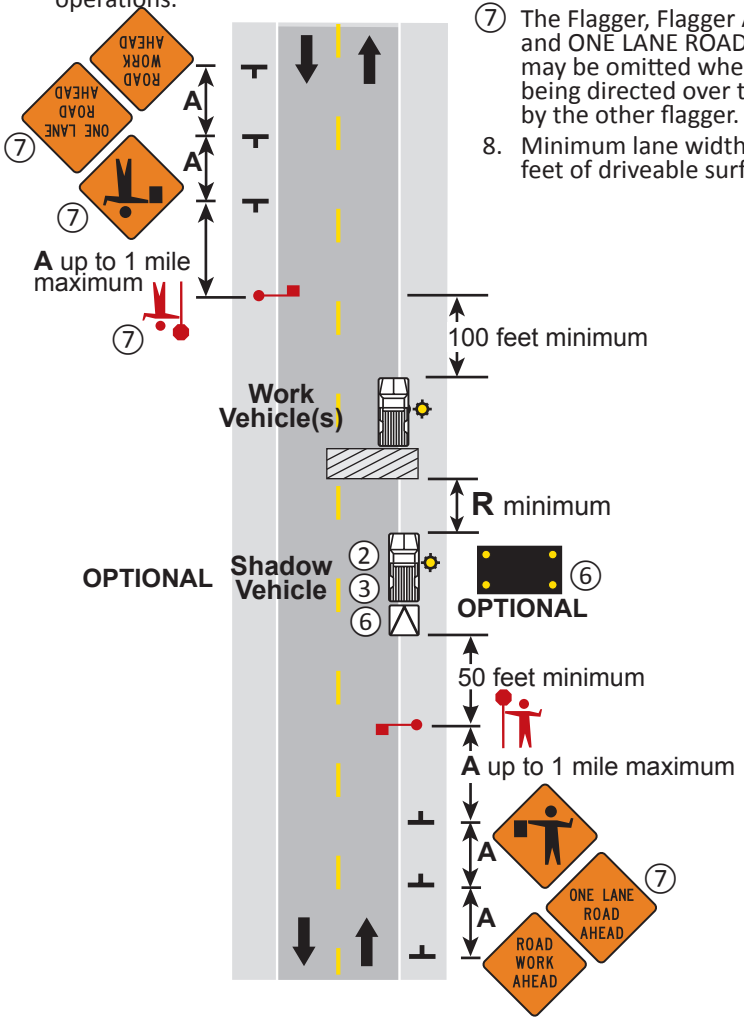


LANE CLOSURE
With Random Work Areas
TWO-LANE, TWO-WAY ROAD

15 MINUTES or LESS **LAYOUT 12**

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 Shadow Vehicle or Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.
3. The slow moving or stopped Work Vehicle(s) and Shadow Vehicle should keep the traffic lane as wide as possible by using the shoulder space whenever practical.
4. If the work area does not move at least the Decision Sight Distance (**D**) 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. The Shadow Vehicle with Flashing Arrow Board shall be used during nighttime operations.
7. The Flagger, Flagger Ahead sign, and ONE LANE ROAD AHEAD sign may be omitted when traffic is not being directed over the center line by the other flagger.
8. Minimum lane widths shall be 10 feet of driveable surface.

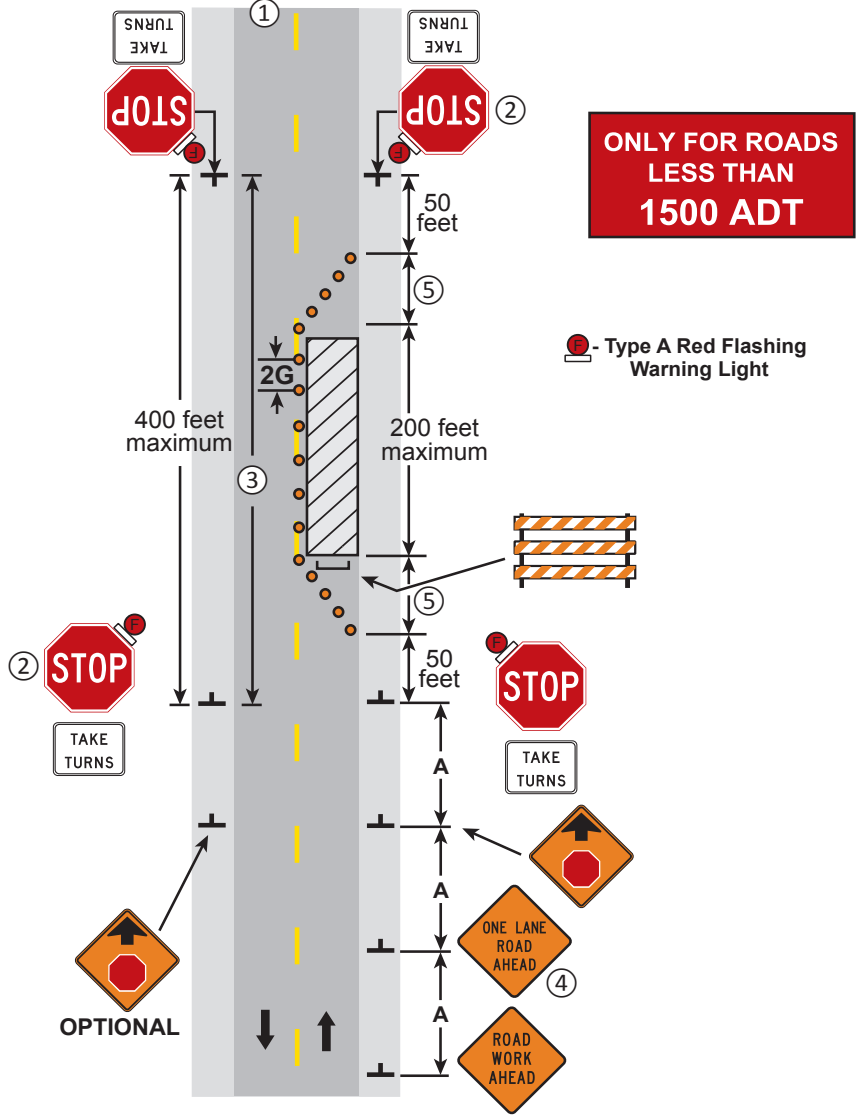


LANE CLOSURE
With a Moving Work Area
TWO-LANE, TWO-WAY ROAD

15 MINUTES or LESS **LAYOUT 13**

NOTES:

1. Approach signs are the same in both directions.
2. STOP signs shall be 48 x 48 inches. The left-side STOP sign may be 30 x 30 inches.
3. If adequate sight distance is not available to recognize a stopped vehicle or traffic volume restricts vehicles from taking turns through the open lane, use Layout 16 or 25.
4. The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
5. The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.



LANE CLOSURE WITH STOP SIGNS
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 14**

NOTES:

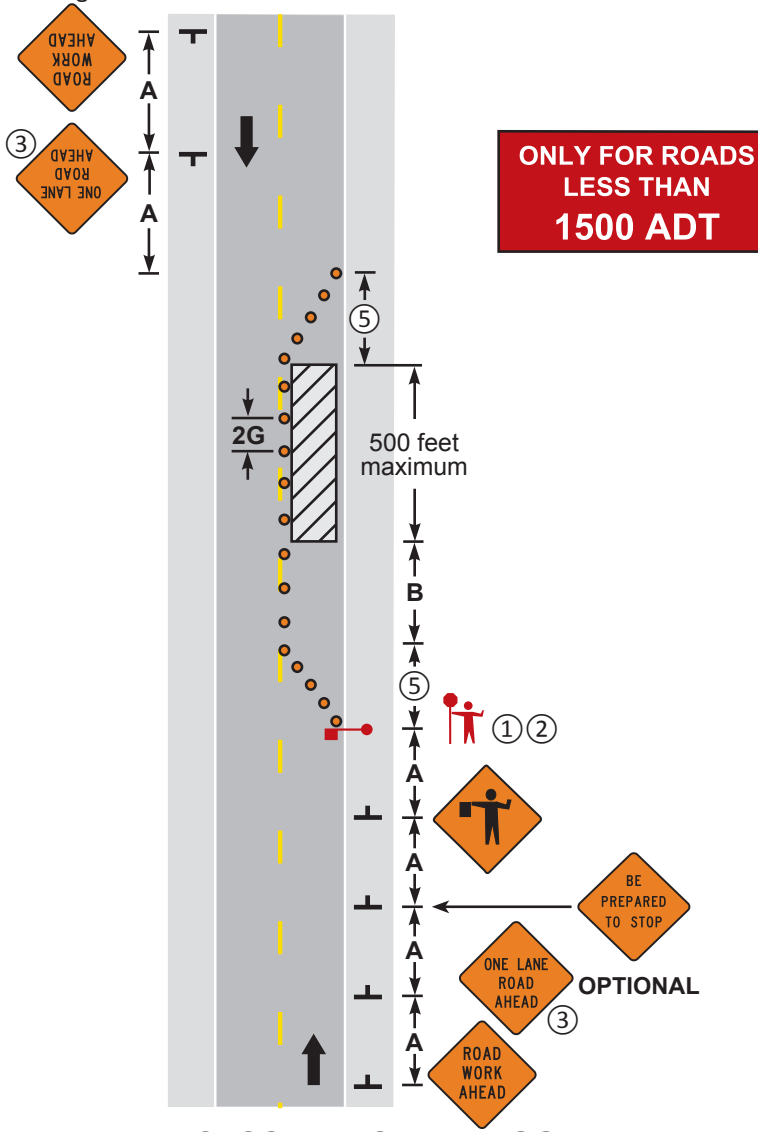
① The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**).

② If the flagger's ability to see oncoming motorists beyond the work space is less than the Decision Sight Distance (**D**), two flaggers shall be used - See Layout 16.

③ The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

4. If the work space must be left unattended at night use Layout 14.

⑤ The two-way taper should be 50 feet in length and using 5 equally spaced channelizing devices.



LANE CLOSURE, ONE FLAGGER
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 15**

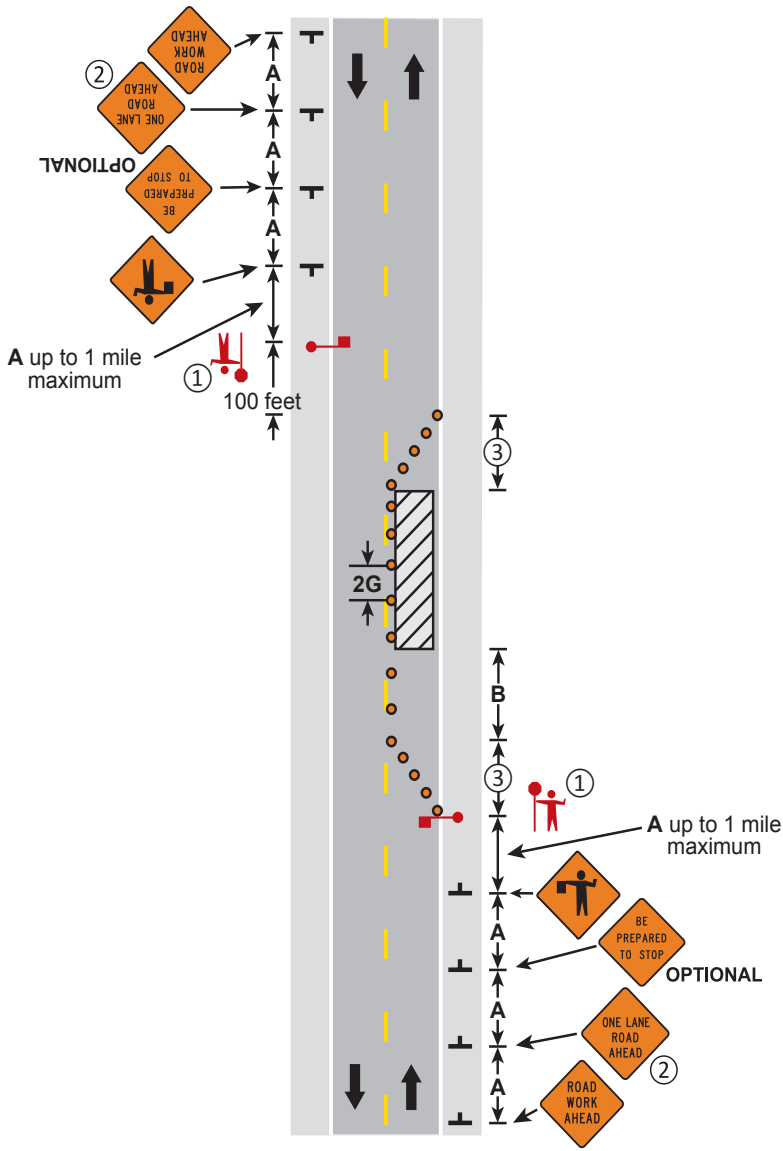
NOTES:

① The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**).

② The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

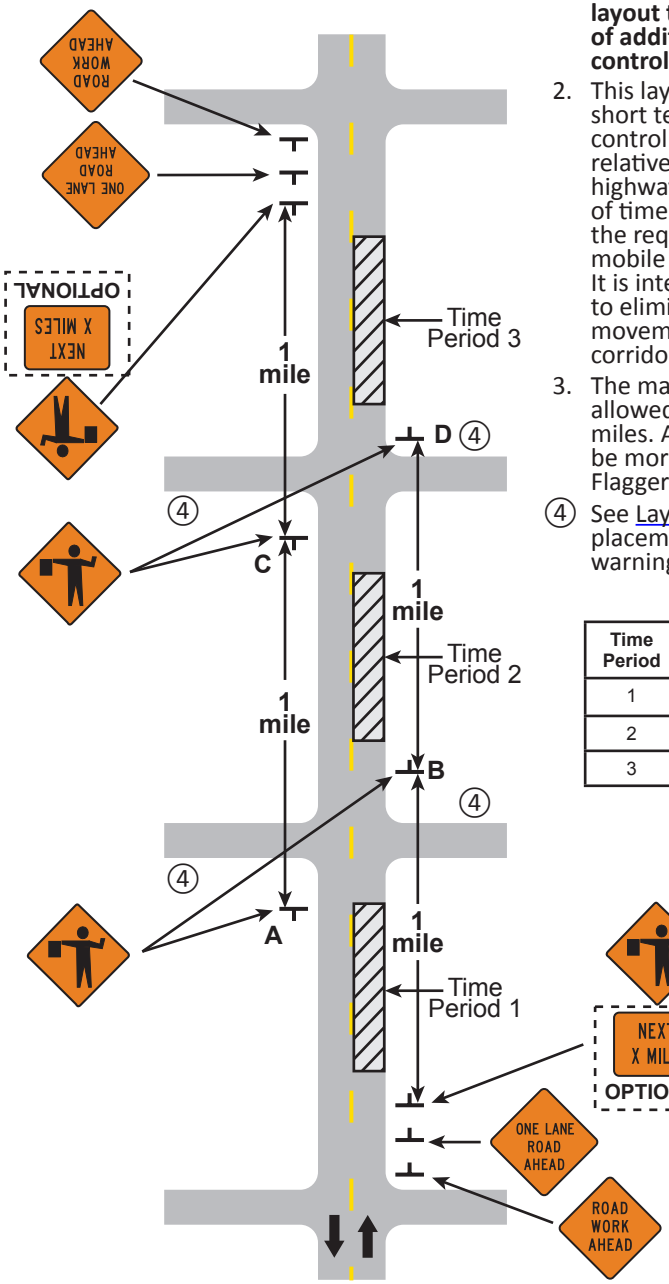
③ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.

4. If anticipating operational problems, the use of a Pilot Car (see Layout 18) may improve operations and safety.



LANE CLOSURE, TWO FLAGGERS
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 16**



NOTES:

1. **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 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 allowed for this layout is 3 miles. At no time will there be more than 1 mile between Flagger Ahead signs.

④ See Layout 35 for required placement of advance warning signs on crossroads.

Time Period	Signs Displayed	Signs Not Displayed
1	C & A	B & D
2	C & B	A & D
3	B & D	A & C

MOVING WORK SPACES

12 HOURS or LESS **LAYOUT 17**

NOTES:

① The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**).

② The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

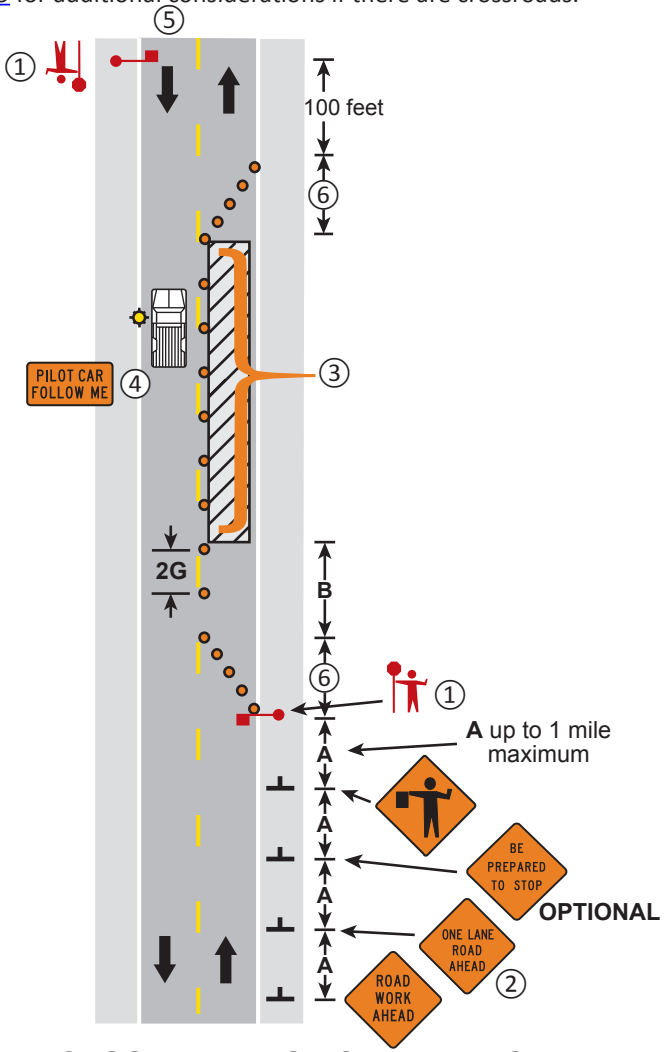
③ Channelizing devices along the edge of the work space may be omitted unless traffic is traveling next to longitudinal drop-offs that are greater than 4 inches.

④ Pilot Cars should lead traffic through the work zone at a safe speed. See the Flagging Handbook for additional guidance.

⑤ Advance warning signs are the same for both directions approaching the work area.

⑥ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.

7. See Layout 19 for additional considerations if there are crossroads.



LANE CLOSURE, PILOT CAR METHOD
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 18**

NOTES:

① See Layout 16 for advance signing and flagger setup. Approach signs are the same in both directions.

② When a flagger is positioned at an intersection, they:

- Shall have 2-way communications with the Pilot Car,
- Should use hand signals with a flag or flashlight with red glow cone to control traffic movements rather than the typical STOP/SLOW paddle in order to avoid displaying the SLOW paddle to the opposite approach, and
- May need additional flaggers to direct traffic when the crossroad consistently has multiple vehicles per direction waiting each Pilot Car cycle.

③ 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:

- Shall be located to clearly see traffic from both directions,
- Shall not be positioned in the open traffic lane,
- Shall have 2-way communications with the Pilot Car,
- Shall have a flagger paddle; and
- Should have a means to warn an errant driver such as an air horn.

4. Consider distributing brochures to local businesses and residents detailing Pilot Car operations.

⑤ PILOT CAR FOLLOW ME sign shall be mounted on the Pilot Car.

⑥ Channelizers shall be placed near intersections and flagging stations.

⑦ Layout 18 indicates which channelizers are optional with Pilot Car operations.

FLAGGING CROSSROADS AND BLIND CURVES
PILOT CAR OPERATIONS
LAYOUT 19a

3 DAYS or LESS **LAYOUT 19a & b**

FLAGGING CROSSROADS AND BLIND CURVES

PILOT CAR OPERATIONS

3 DAYS or LESS **LAYOUT 19b** **LAYOUT 19a & b**

6K-19b

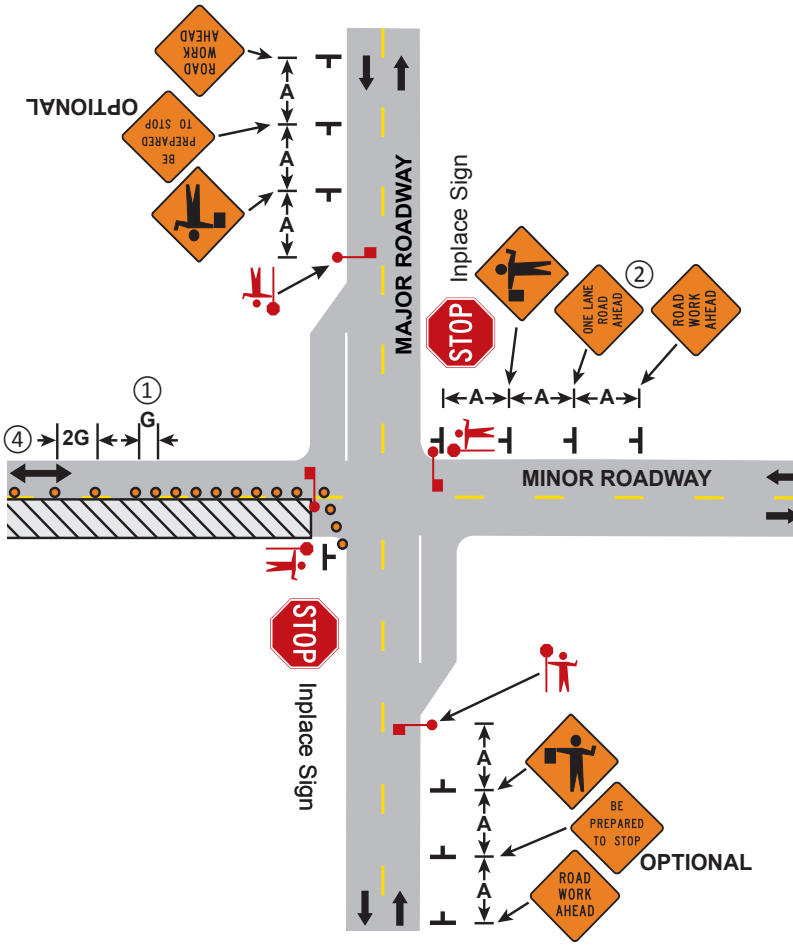
NOTES:

① The spacing between devices should be reduced to **G** or less when the work space is within 300 feet of the intersection. This will help keep motorists from entering into the work space near the intersection.

② The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

3. When the traffic volume of the minor roadway exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
   a. Control 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 work space has left the area near the intersection.

④ For other temporary traffic control devices in advance of the work space, see Layouts 4, 15, or 16.



LANE CLOSURE ON MINOR ROAD

Before Intersection of Major Road
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 20**

NOTES:

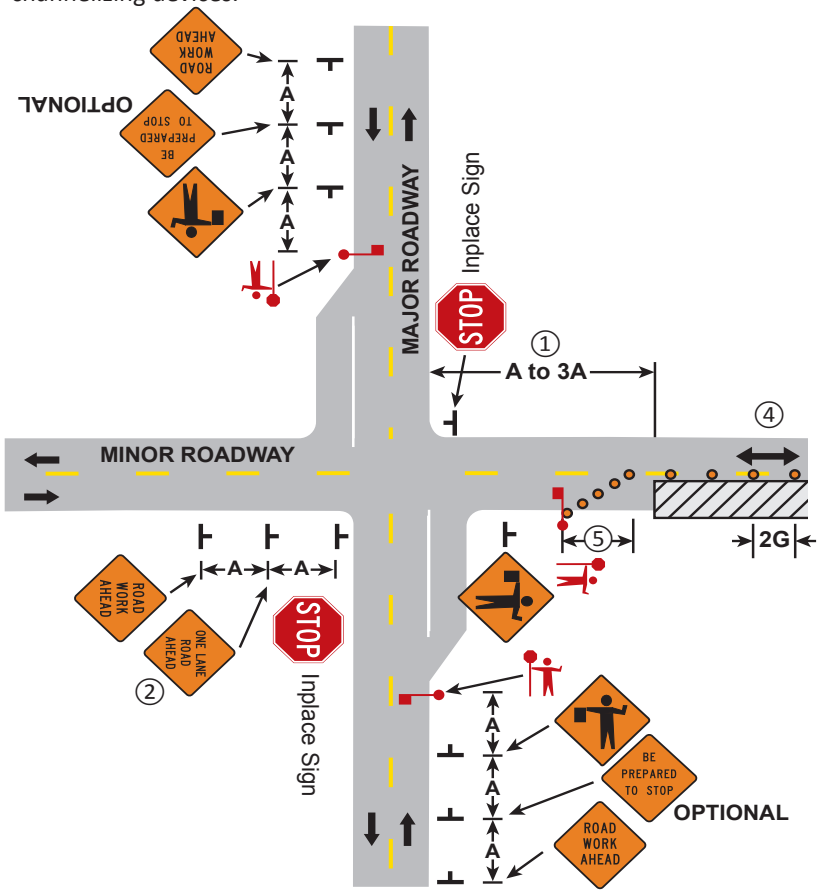
① When the work space is located between **A** and **3A** beyond a controlled intersection, the normal sign and buffer spacing in the approach area may be reduced during daylight operations. The Flagger Ahead sign should be centered between the flagger station and the intersection.

② The ONE LANE ROAD AHEAD sign may be omitted when the posted speed is 40 mph or less.

3. When the traffic volume of the minor roadway exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
   a. Control 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 work space has left the area near the intersection.

④ For other temporary traffic control devices in advance of the work space, see Layouts 4, 15, or 16.

⑤ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.



LANE CLOSURE ON MINOR ROAD
Beyond Intersection of Major Road
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 21**

NOTES:

1. Users of this layout shall coordinate with the railroad.
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 crossing to prevent vehicles from stopping within the railroad crossing even if automatic warning devices are in place.

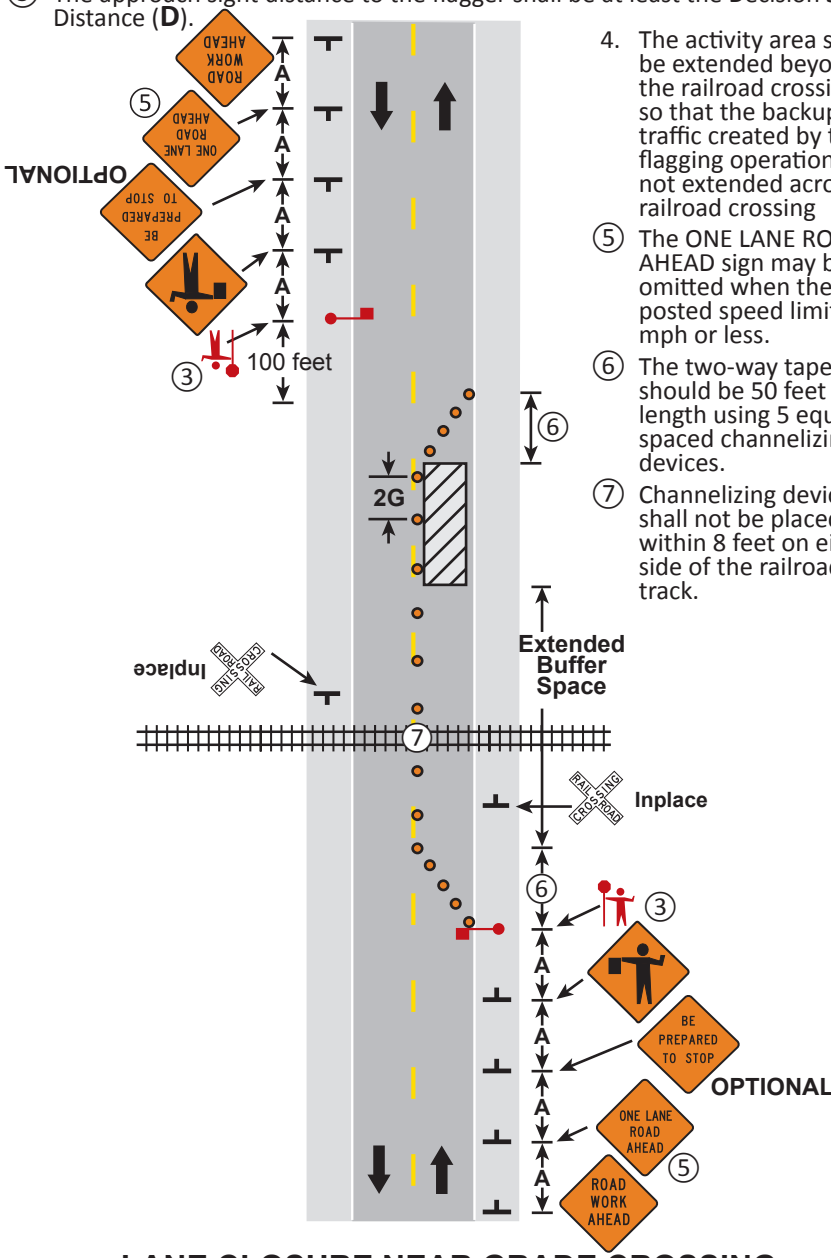
③ The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**).

4. The activity area should be extended beyond the railroad crossing so that the backup of traffic created by the flagging operation will not extended across the railroad crossing

⑤ The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

⑥ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.

⑦ Channelizing devices shall not be placed within 8 feet on either side of the railroad track.



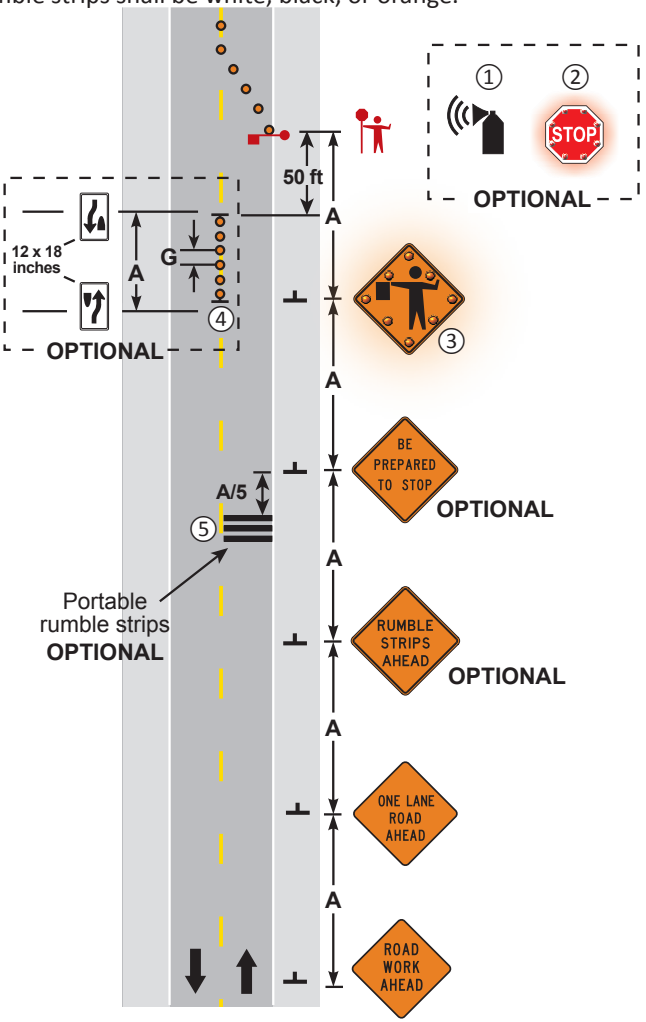
LANE CLOSURE NEAR GRADE CROSSING
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 22**

NOTES:

1. The flagger may be equipped with an airhorn.
2. The STOP/SLOW paddle may be enhanced with flashing conspicuity lights on the signs.
3. The Flagger Ahead sign may be enhanced with flashing conspicuity lights on it.
4. Keep Right signs and Type A channelizing devices such as weighted channelizers, cones, tubular markers, or centerline delineators are optional.
5. The portable rumble strips array should consist of 3 strips placed perpendicular to the direction of travel. Spacing of rumble strips should be from center of rumble to center of rumble and based on the posted speed limit:
   - 40 mph or less = 10 feet spacing
   - 45 to 55 mph = 15 feet spacing
   - 60 mph or greater = 20 feet spacing

   The rumble strips shall be white, black, or orange.



FLAGGING STATION OPTIONS
TWO-LANE, TWO-WAY ROAD

3 DAYS or LESS **LAYOUT 23**

NOTES:

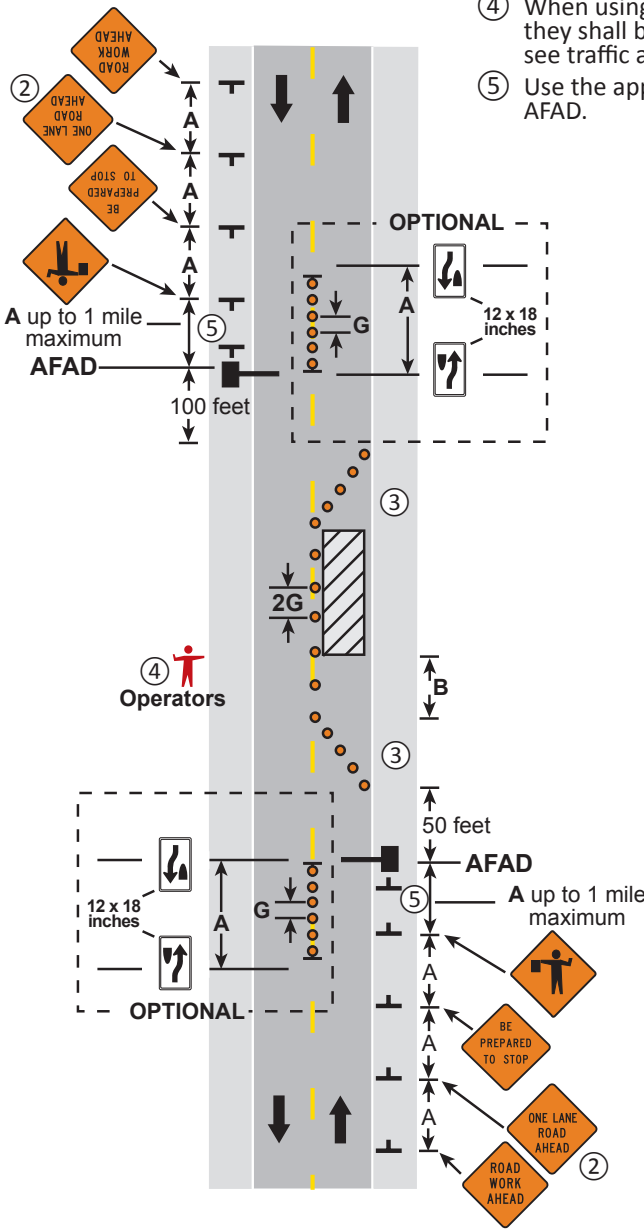
1. The approach sight distance to the Automated Flagging Assistance Device (AFAD) shall be at least the Decision Sight Distance (**D**).

② The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.

③ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.

④ When using a single operator, they shall be located so they can see traffic at both AFAD locations.

⑤ Use the appropriate sign on the AFAD.



LANE CLOSURE, AUTOMATED FLAGGERS
TWO-LANE, TWO-WAY ROAD

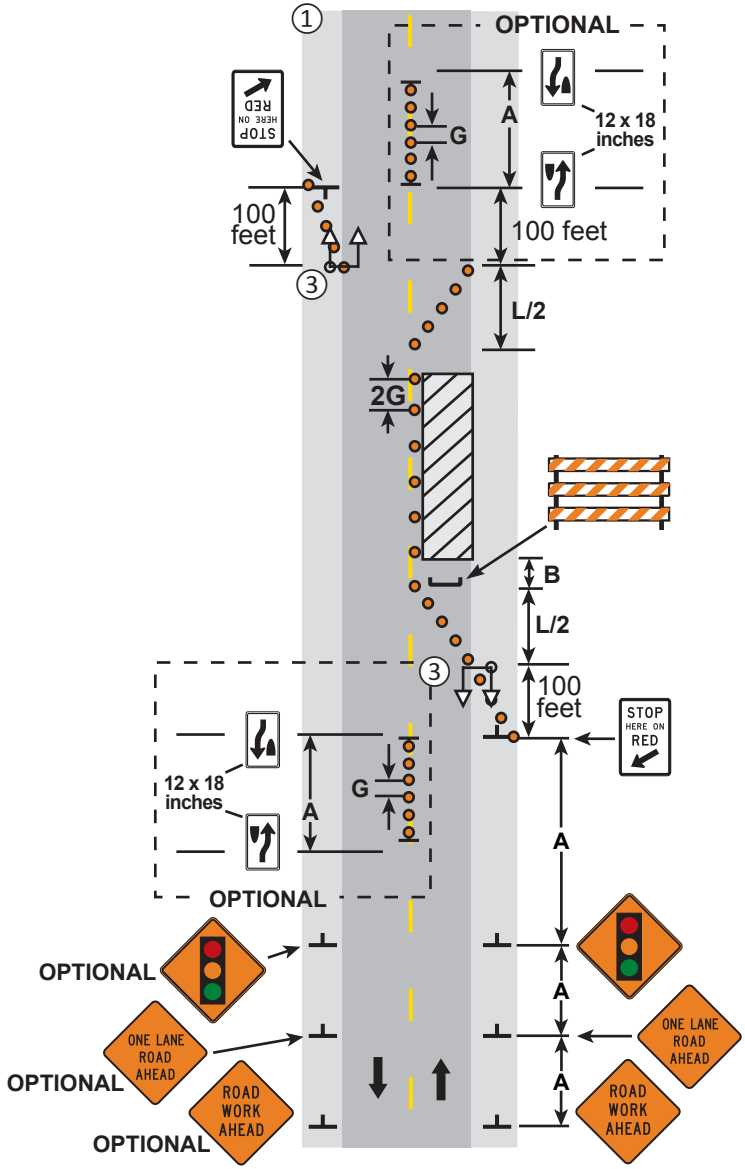
3 DAYS or LESS **LAYOUT 24**

NOTES:

① Approach signs are the same in both directions.

2. Signal timing and signal head locations shall be established by qualified personnel and approved by the road authority.

③ Two signal heads shall be installed per approach. The first shall be installed on the right shoulder. The second signal head may be installed on either the left shoulder or mounted overhead on the same structure as the first signal head.



LANE CLOSURE WITH PORTABLE SIGNALS
TWO-LANE, TWO-WAY ROAD

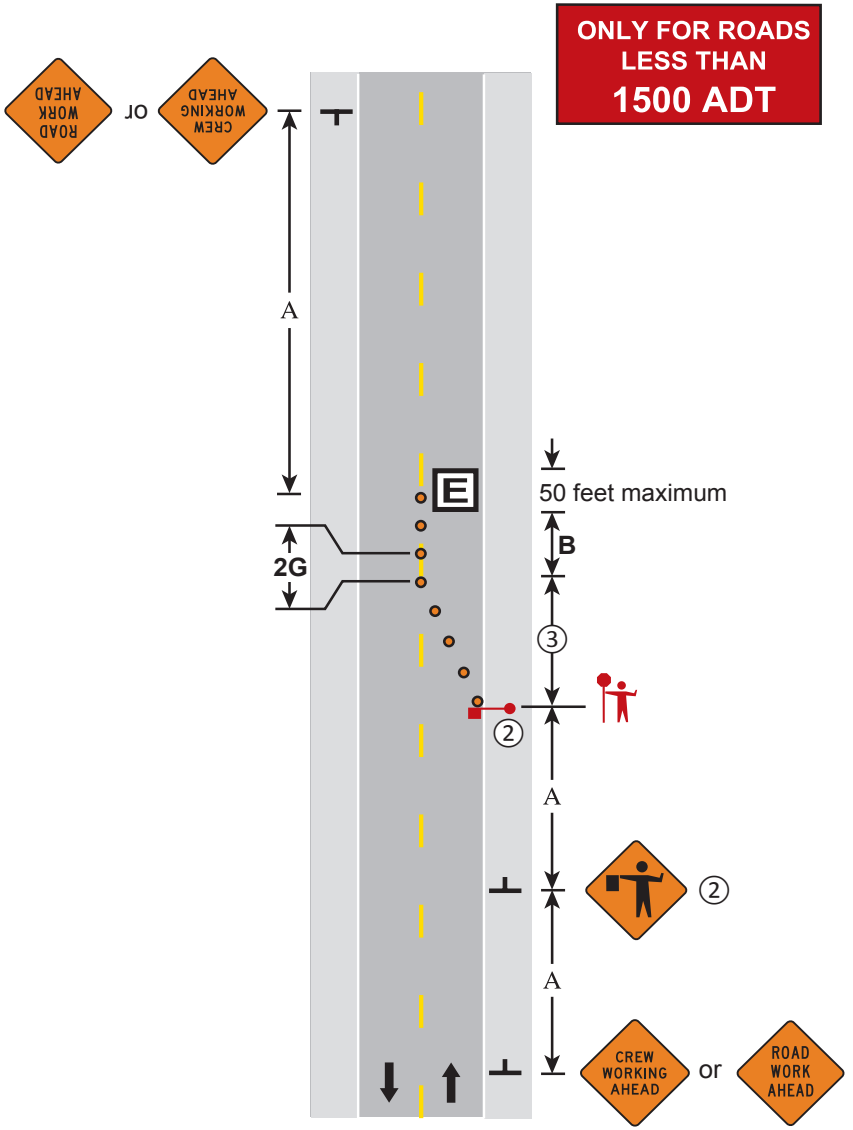
3 DAYS or LESS **LAYOUT 25**

NOTES:

1. The Work Vehicles shall not be parked on the shoulder opposite of the coned area.

② The Flagger and Flagger Ahead sign may be omitted when traffic volumes do not restrict the ability of traffic to regulate itself through the length of the work space.

③ The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.



EQUIPMENT IN TRAFFIC LANE
TWO-LANE, TWO-WAY ROAD

1 HOUR or LESS **LAYOUT 26**

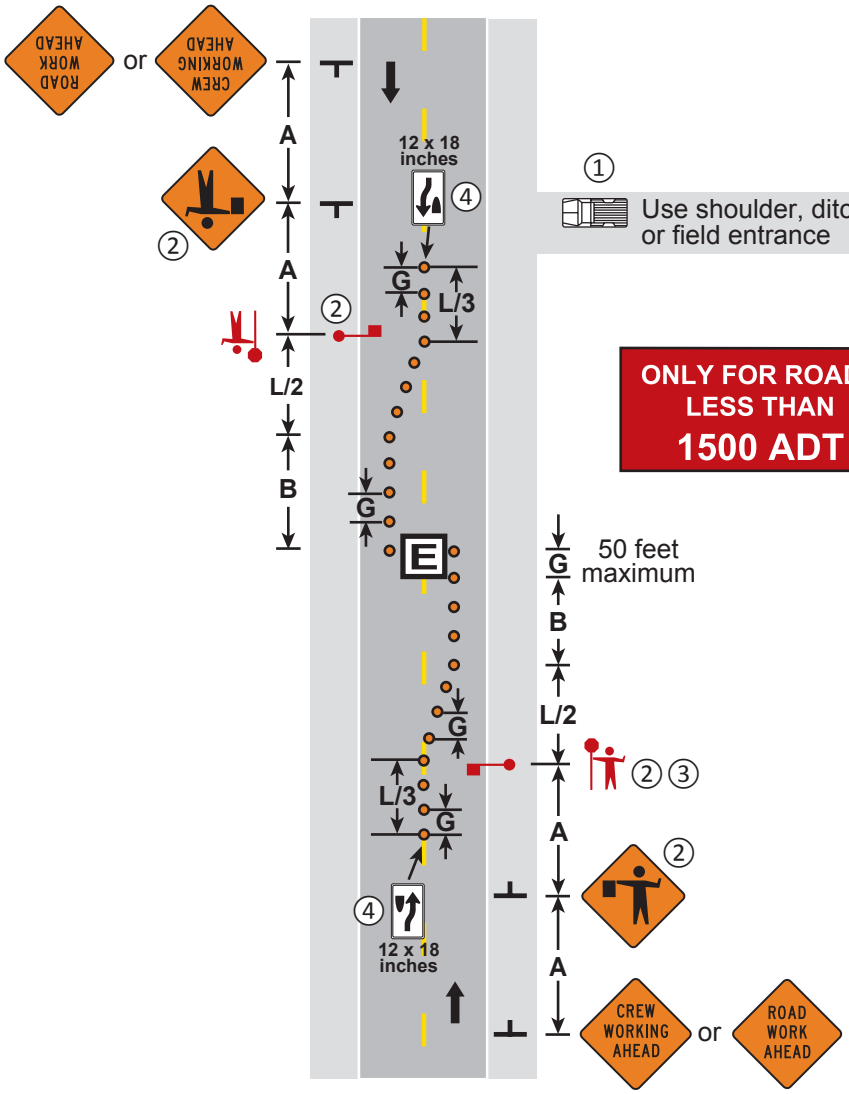
NOTES:

① The Work Vehicle shall be parked off of the roadway. Do not obstruct the shoulder in the coned areas.

② The Flaggers and the Flagger Ahead signs may be omitted if the posted speed limit is 40 mph or less and there is at least 10 feet of driveable surface outside of the channelizing devices.

③ The flagger shall be visible for at least the Decision Sight Distance (**D**).

④ The Keep Right sign may be omitted if the posted speed limit is 40 mph or less.



EQUIPMENT ON CENTERLINE
TWO-LANE, TWO-WAY ROAD

1 HOUR or LESS **LAYOUT 27**

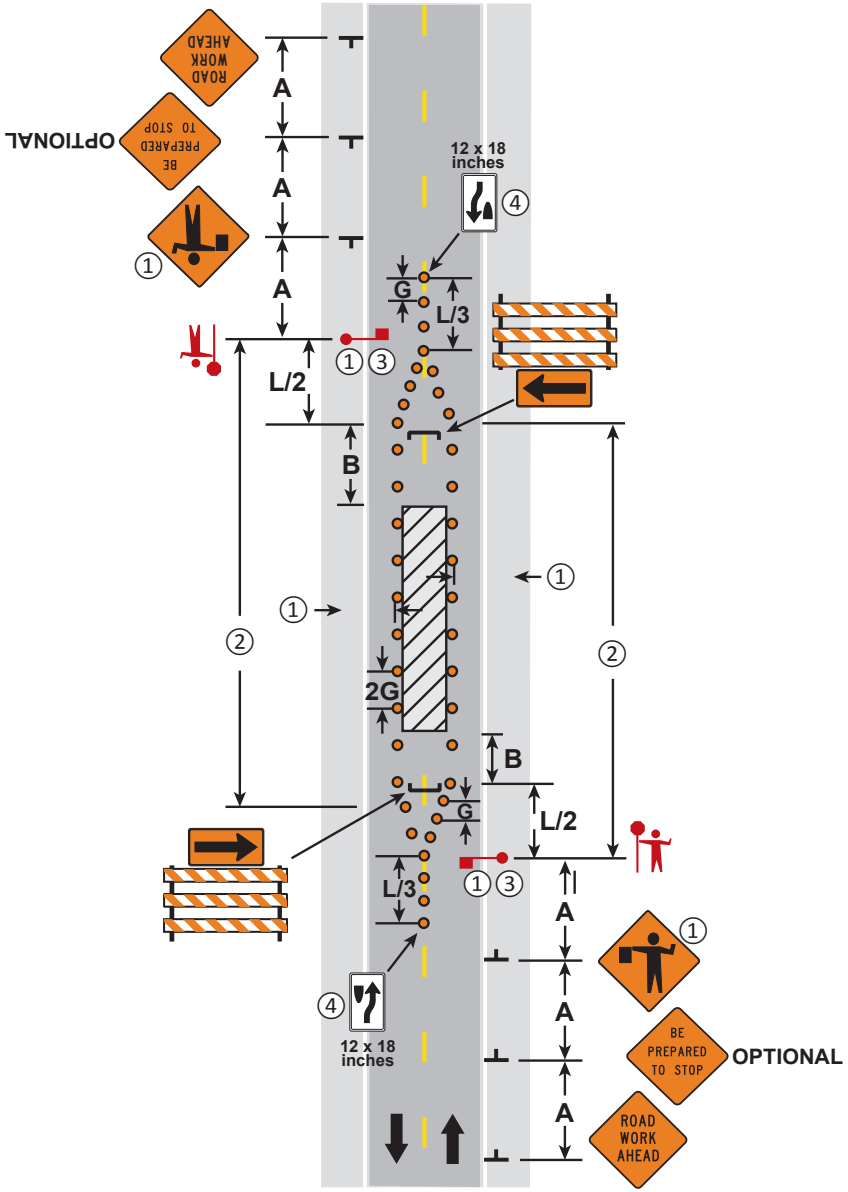
NOTES:

① The Flaggers and the Flagger Ahead signs may be omitted if the posted speed limit is 40 mph or less and there is at least 10 feet of driveable surface outside of the channelizing devices.

② Parking and stopping should be prohibited along the work area and tapers.

③ The flagger shall be visible for at least the Decision Sight Distance (**D**).

④ The Keep Right sign may be omitted if the posted speed limit is 40 mph or less.

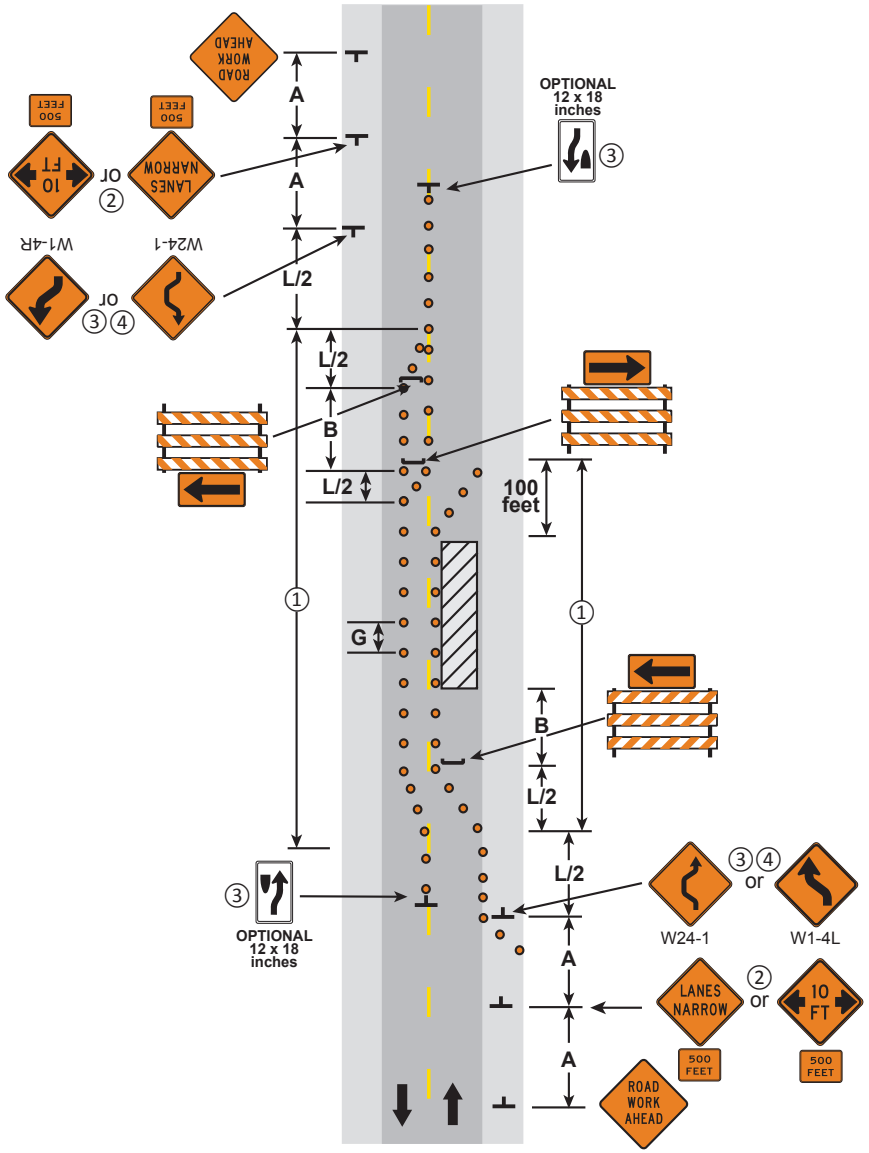


WORK SPACE IN CENTER OF ROAD
TWO-LANE, TWO-WAY ROAD

12 HOURS or LESS **LAYOUT 28**

NOTES:

1. Parking and stopping should be prohibited along the work area and tapers.
2. Minimum lane widths shall be 10 feet of driveable surface. When temporary lane widths are less than existing lane widths a LANES NARROW sign or a Narrow Lane (width shown) sign with advisory plaque placed directly below or on the lower side of the warning sign nearest traffic should be used.
3. The Double Reverse Curve, Reverse Curve, and/or Keep Right signs may be omitted when the posted speed limit is 40 mph or less.
4. If tangent length of activity area is 600 feet or less, use the Double Reverse Curve sign.



WORK SPACE OCCUPIES ONE HALF OF ROAD
TWO-LANE, TWO-WAY ROAD

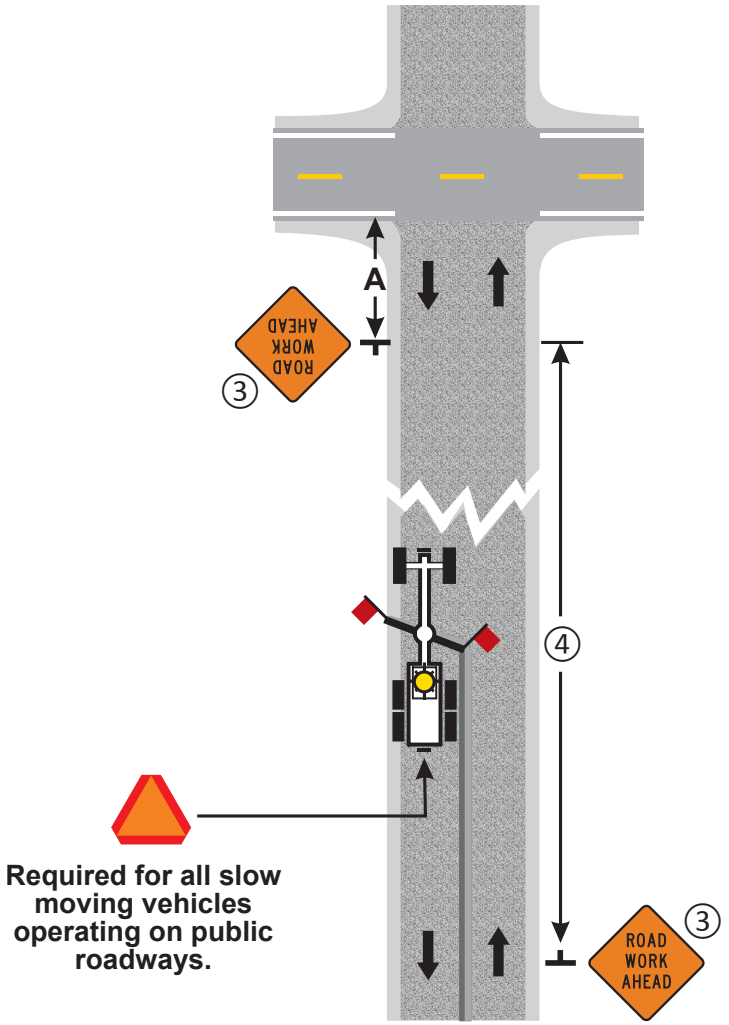
3 DAYS or LESS **LAYOUT 29**

NOTES:

1. Motor Graders shall be equipped with operating vehicle warning lights visible for 360 degrees around the vehicle at a minimum height of 3 1/2 feet and a radius of 60 feet or greater.
2. Motor Grader blade end(s) may be marked with red or orange flags to provide additional warning and make the equipment more visible to passing vehicles.

③ The ROAD WORK AHEAD signs may be omitted when there is an adequate approach Decision Sight Distance (**D**) to the Motor Grader along the majority of the route.

④ When advance warning signs are used, the signs should be no more than 3 miles from the Work Vehicle. The location of the signs should be determined by the sources of traffic, such as major cross roads.



GRAVEL ROAD MAINTENANCE

Grading Operations

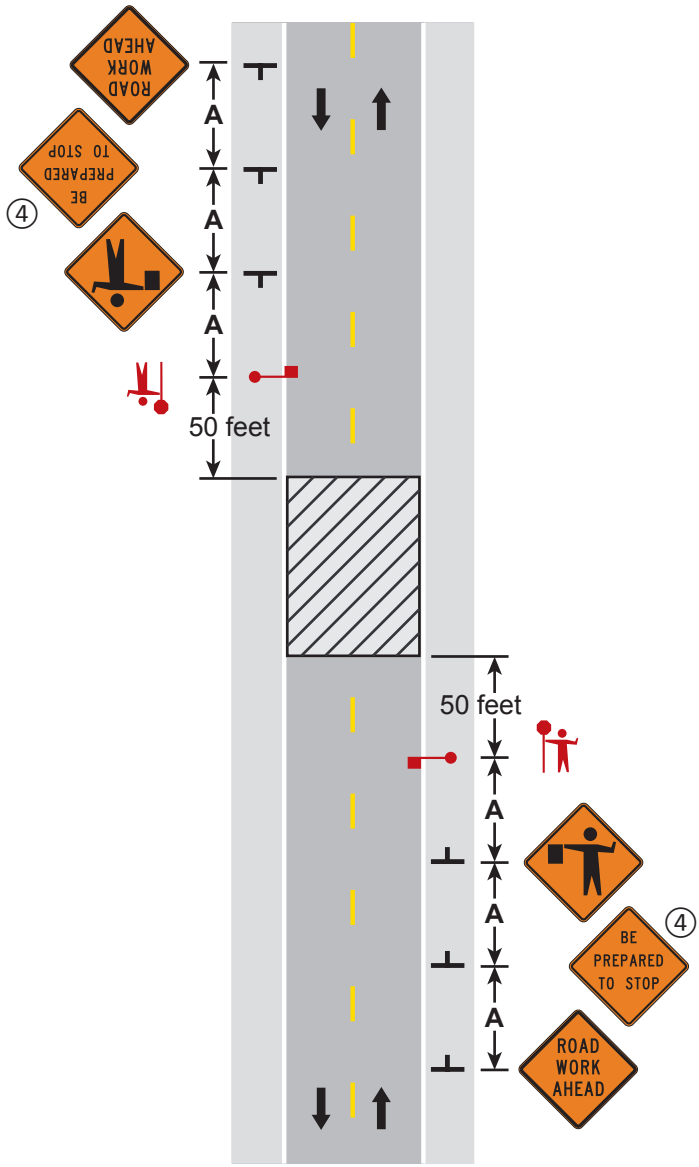
TWO-LANE, TWO-WAY ROAD

12 HOURS or LESS **LAYOUT 30**

NOTES:

1. Road authority shall be contacted prior to closure.
2. If the volume is less than 400 ADT, traffic control devices may be substituted with law enforcement.
3. Traffic should not be stopped for intervals of greater than 15 minutes.

④ The BE PREPARED TO STOP sign may be omitted when the posted speed limit is 40 mph or less.

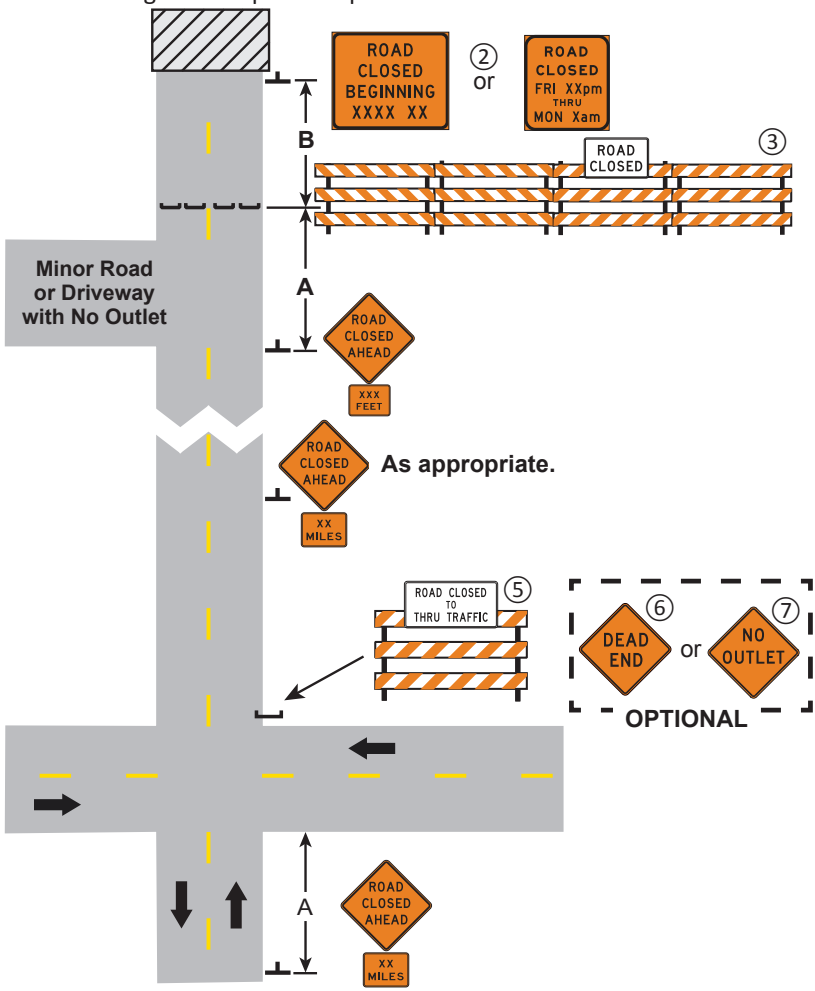


TEMPORARY ROAD CLOSURE
TWO-LANE, TWO-WAY ROAD

12 HOURS or LESS **LAYOUT 31**

NOTES:

1. The road authority shall be contacted prior to closure. The road authority may provide requirements related to sign placement, detours, emergency services, etc.
2. A Road Closure Notice sign should be installed in advance (timewise) as required by the road authority.
3. Install Type III barricade at the last driveway or intersection beyond which there is no public access. Barricade shall span the entire roadway including traversable shoulders.
4. Road user safety and usability must be maintained up to the full closure.
5. ROAD CLOSED TO THRU TRAFFIC barricade assembly may be placed on the center line; stripes on barricade shall slope downward toward the appropriate traffic direction (for both directions of the roadway).
6. DEAD END sign shall be used only when there is a dead end and there are no alternate through routes past this point.
7. NO OUTLET sign shall be used only when there are no outlets and there are no alternate through routes past this point.



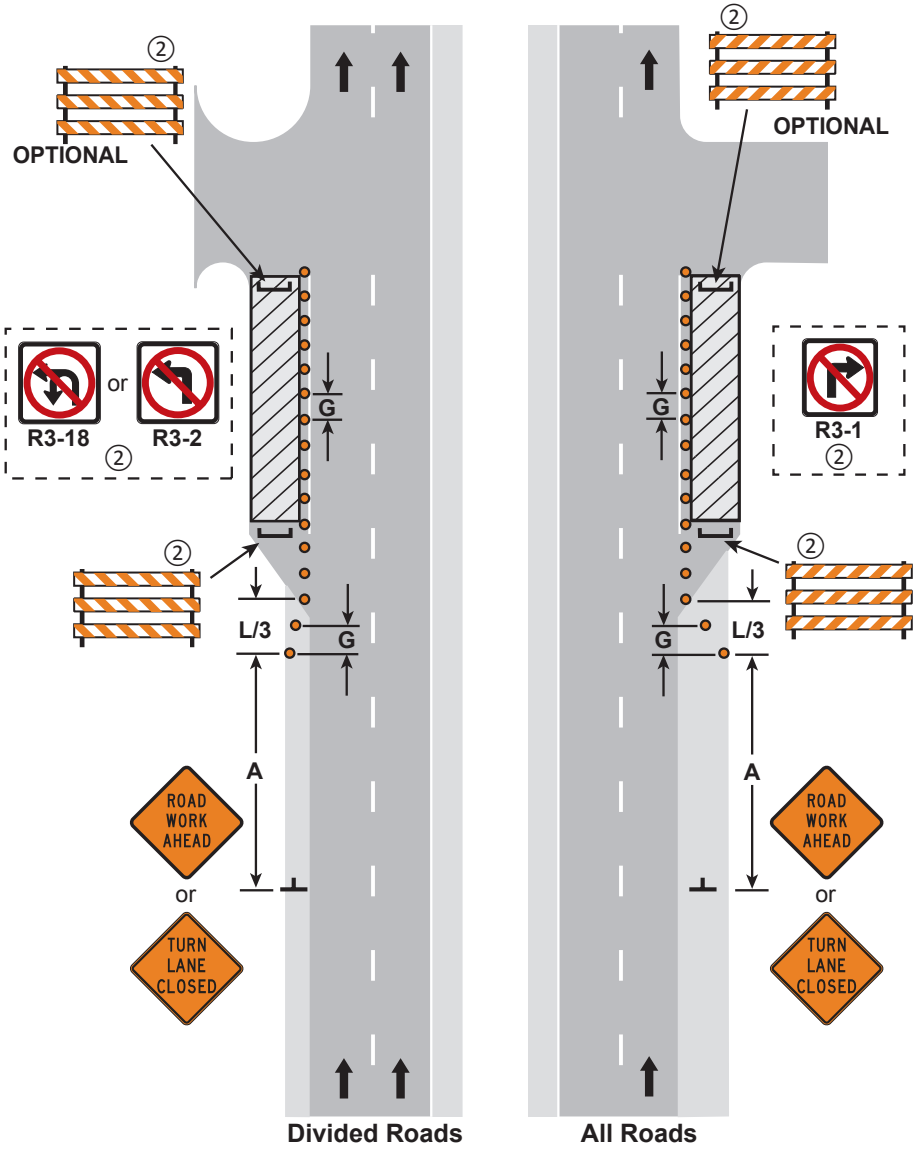
ROAD CLOSURE

3 DAYS or LESS **LAYOUT 32**

NOTES:

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

② Optional R3-1, R3-2, or R3-18 signs may be placed on sign stand or top of barricades on side closest to traffic. Signs are required if turns are prohibited.



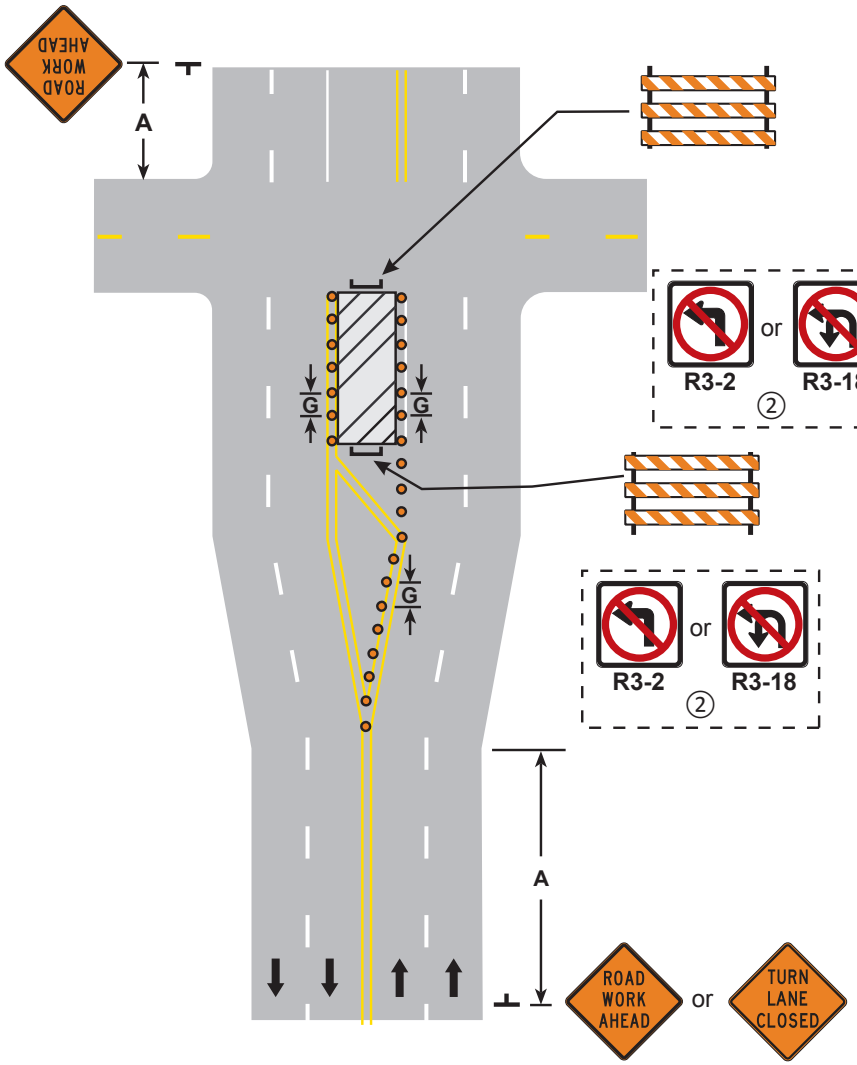
TURN LANE CLOSURES

3 DAYS or LESS **LAYOUT 33**

NOTES:

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

② Optional R3-2 or R3-18 signs may be placed on sign stand or top of barricades on side closest to traffic. Signs are required if turns are prohibited.



LEFT TURN LANE CLOSURE
TWO-LANE, TWO-WAY or MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 34**

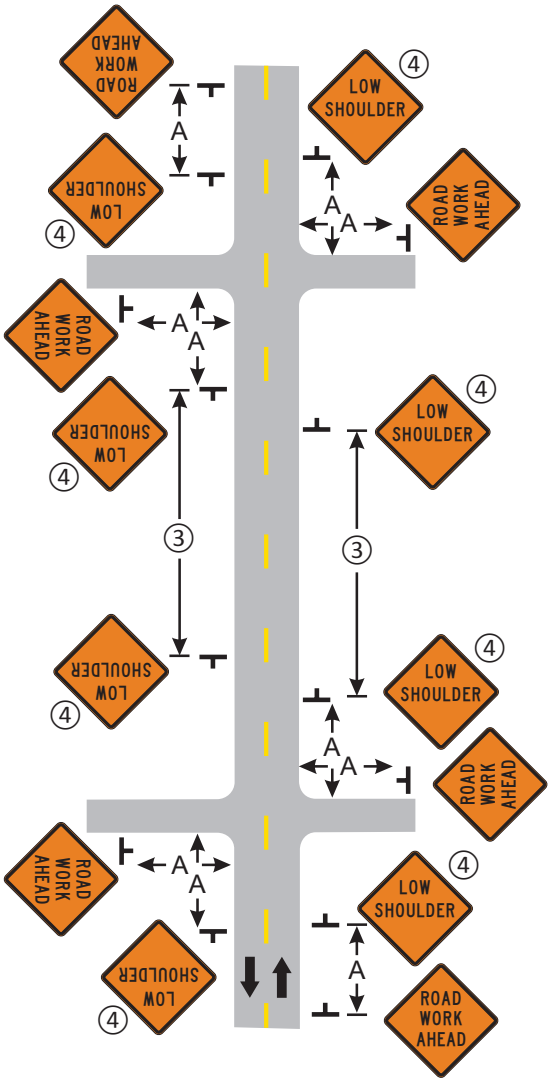
NOTES:

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 work space (such as re-surfacing operations, area of paving, etc).

③ Confirmation signing for a continuous condition should be placed after every intersection and approximately 1 mile spacing for speeds 45 mph or greater, or 1/4 mile spacing for speeds 40 mph or less.

④ Use the appropriate advance warning sign for the roadway condition, i.e. GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD. An advisory Motorcycle plaque may be placed directly below or on the lower side of the warning sign nearest traffic if the warning is directed primarily to motorcyclists.

5. Consider delineating raised structures (manhole covers, etc.)



CROSSROAD & CONFIRMATION SIGNING

Traffic Control Zone

3 DAYS or LESS **LAYOUT 35**

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Two-Way, Continuous Left Turn Lane

A roadway with a center lane between opposing lanes of traffic that allows traffic from either direction to make left turns off the roadway.

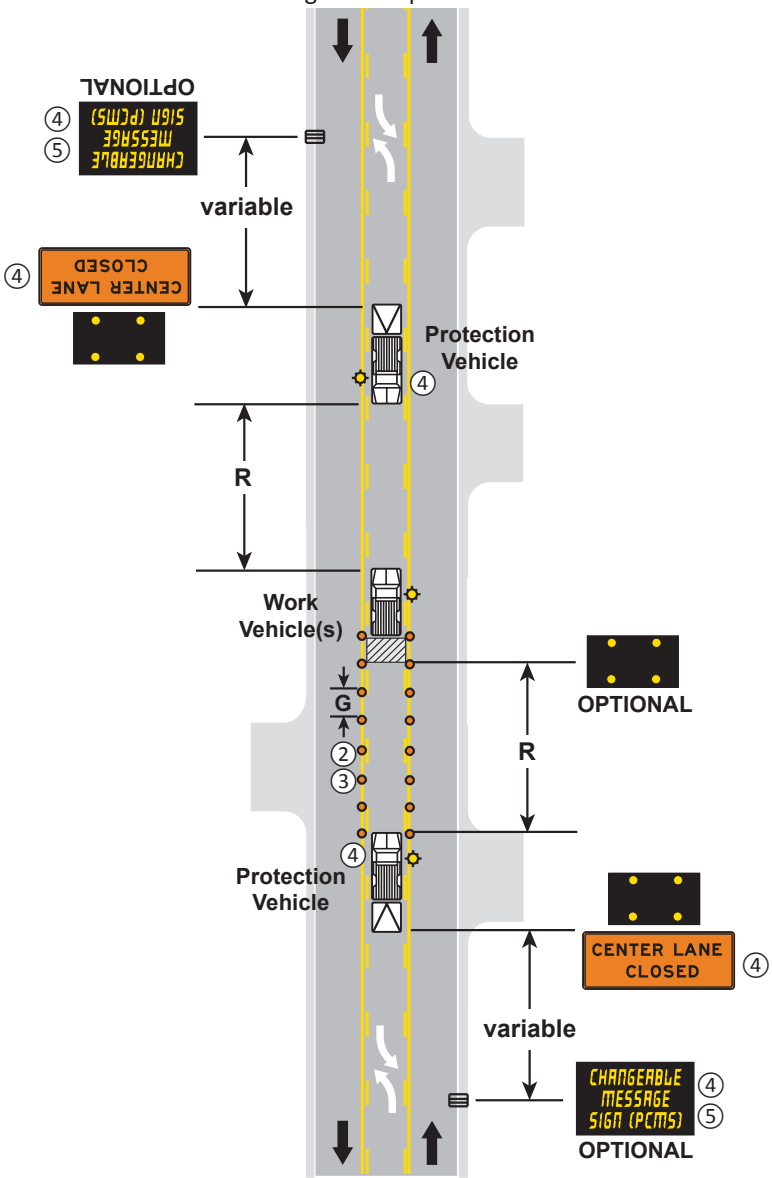
**Drawings Not To Scale*

TWO-WAY, CONTINUOUS LEFT TURN LANE

Lane Closures	MOBILE 15 Minutes or Less	SHORT DURATION 1 Hour or Less	SHORT TERM 12 Hours or Less	INTERMEDIATE TERM 3 Days or Less
Two-Way, Continuous Turn Lane	36		37	
Through Lane Closure (3 Lane Section)	38			
Right Lane Closure (5 Lane Section)	41		42	
Left Lane Closure (5 Lane Section)	41		39	
Double Lane Closure (5 Lane Section)	40			

NOTES:

1. Protection Vehicles operating totally or partially in a traffic lane should be equipped with a TMA.
2. Channelizers may be omitted if the operation moves at least the Decision Sight Distance (**D**) every 15 minutes (mobile operation).
3. Reduce channelizing device spacing as needed to prevent turns.
4. If PCMSs are not used, Protection Vehicles shall have CENTER LANE CLOSED signs.
5. The PCMS shall be used for nighttime operations.



MOBILE/SHORT DURATION LANE CLOSURE
TWO-WAY CONTINUOUS LEFT TURN LANE

1 HOUR or LESS **LAYOUT 36**

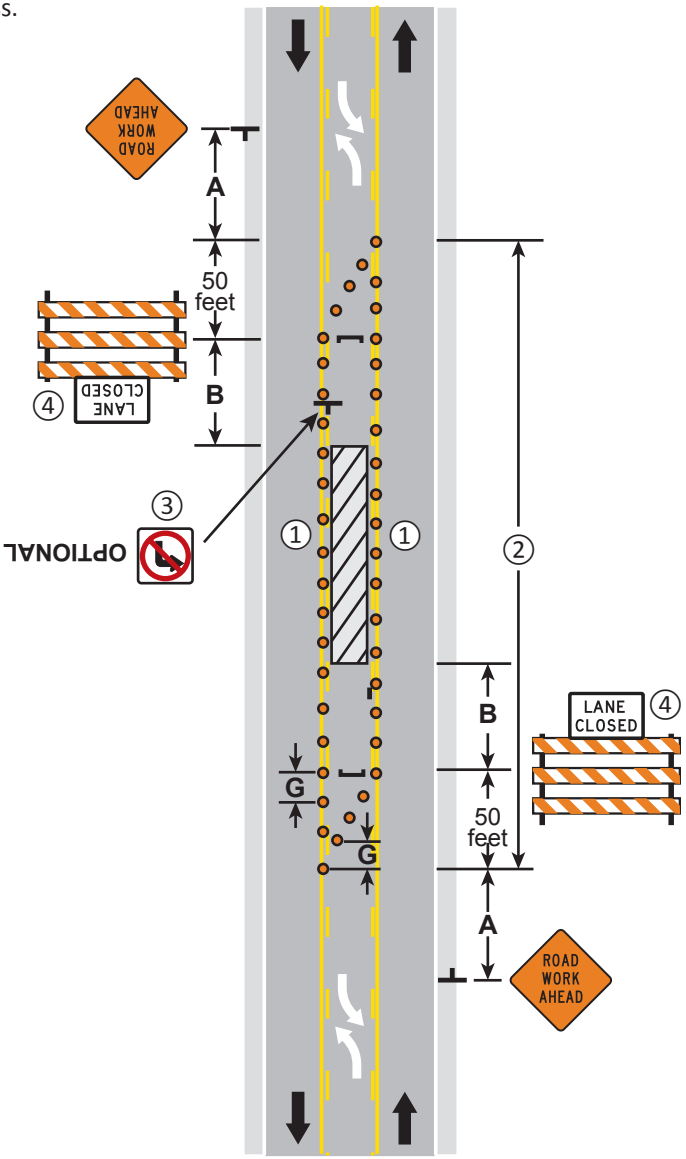
NOTES:

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 and stopping may be prohibited along the work space and taper.

③ Left turning movements should be prohibited along the work space and taper. Reduce spacing of channelizing devices as needed in order to prevent turns. No Left Turn signs may be used throughout the work space and taper as appropriate.

④ The LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.



TURN LANE CLOSURE
TWO-WAY CONTINUOUS LEFT TURN LANE

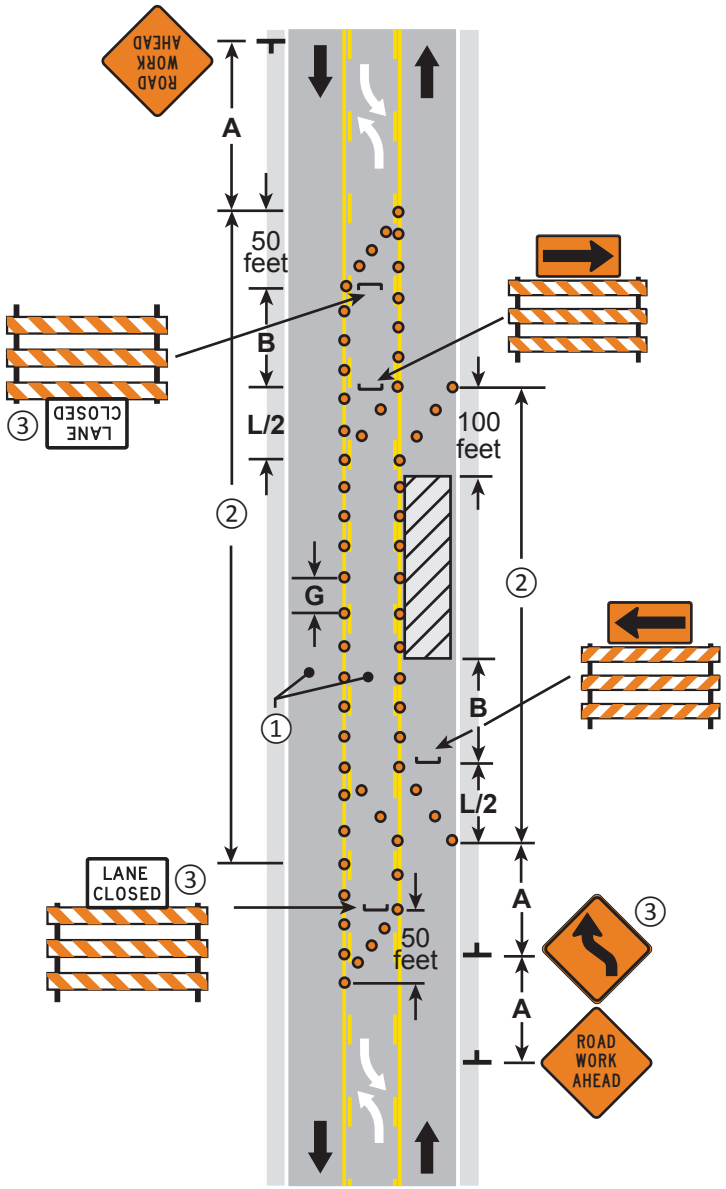
3 DAYS or LESS **LAYOUT 37**

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 work space and taper. Reduce spacing of channelizing devices as needed in order to prevent turns.

③ The LANE CLOSED sign and/or Reverse Curve sign may be omitted when the posted speed limit is 40 mph or less.



LANE CLOSURE - 3 Lane Section
TWO-WAY CONTINUOUS LEFT TURN LANE

3 DAYS or LESS **LAYOUT 38**

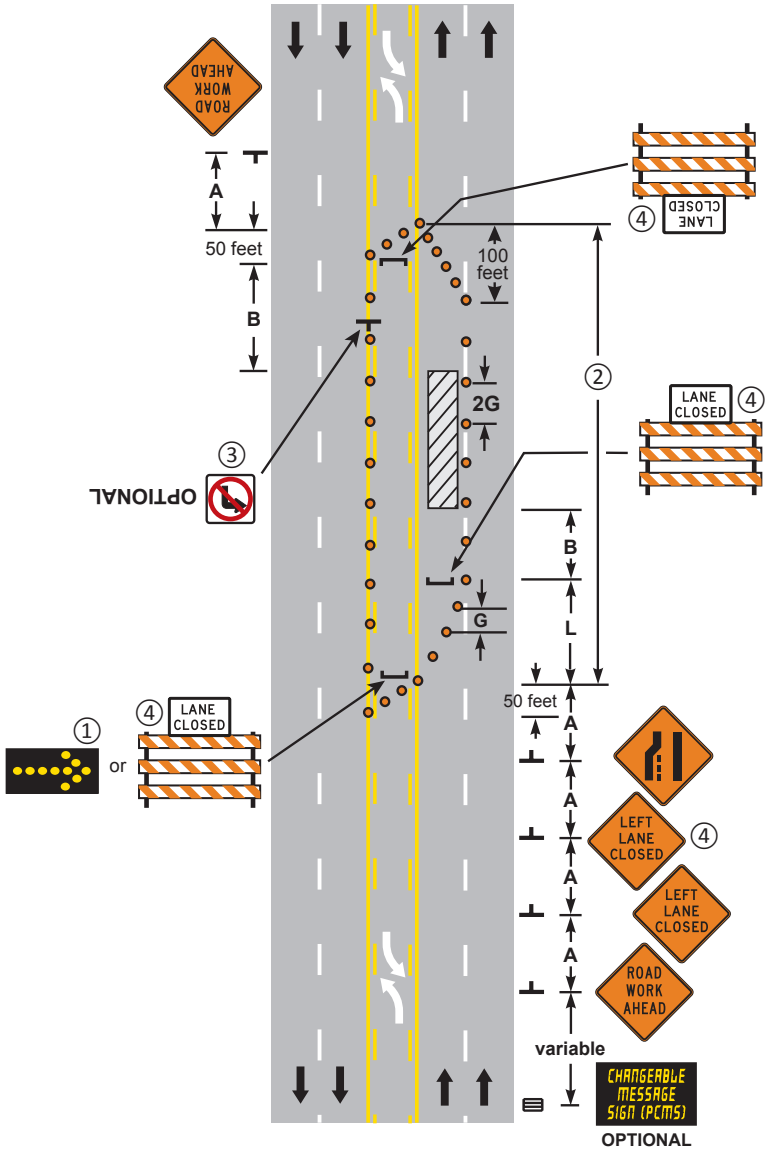
NOTES:

① The Flashing Arrow Board shall be used when the posted speed limit is 45 mph or greater.

② Parking and stopping may be prohibited along the work space and taper.

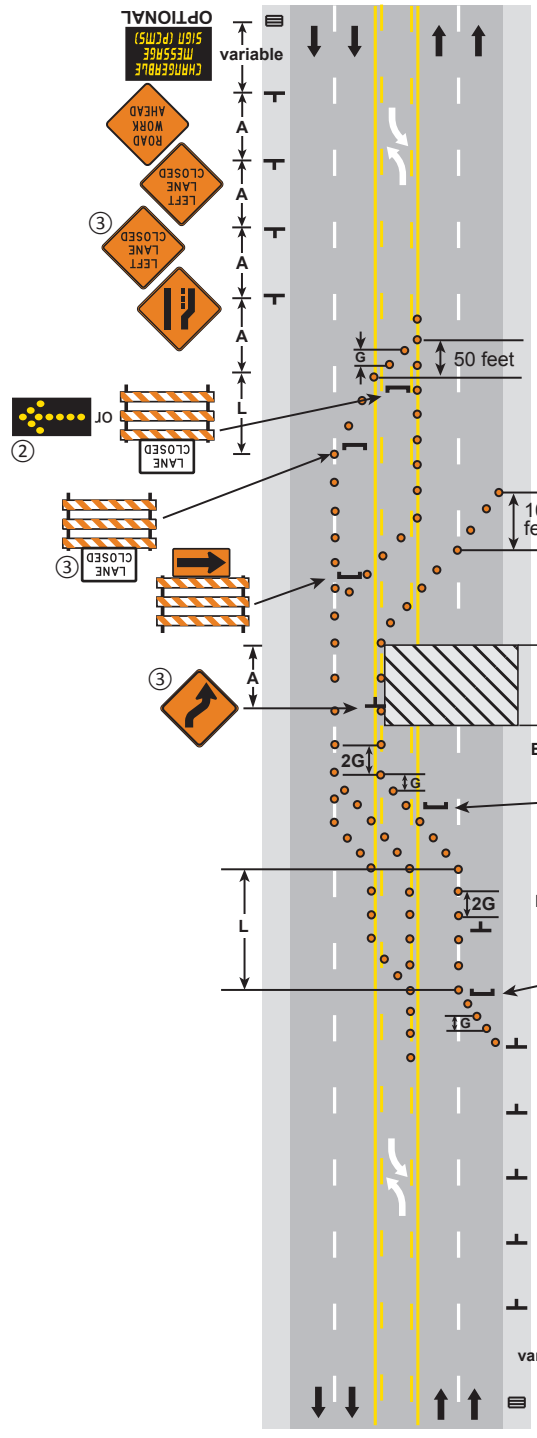
③ Left turning movements should be prohibited along the work space and taper. Reduce spacing of channelizing devices as needed in order to prevent turns. No Left Turn signs may be used throughout the work space and taper as appropriate.

④ The LANE CLOSED sign and/or LEFT LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.



LEFT LANE CLOSURE - 5 Lane Section
TWO-WAY CONTINUOUS LEFT TURN LANE

3 DAYS or LESS **LAYOUT 39**



NOTES:

1. Parking and stopping should be prohibited along the work area and tapers.
2. The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater and placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.
3. The Reverse Curve, RIGHT (LEFT) LANE CLOSED and/or LANE CLOSED signs may be omitted when posted speed limit is 40 mph or less.
4. If tangent length of activity is 600 feet or less, remove the Reverse Curve sign and replace with a Double Reverse Curve Sign.
5. The PCMS shall be used for nighttime operations.

DOUBLE LANE CLOSURE - 5 Lane Section
TWO-WAY CONTINUOUS LEFT TURN LANE

3 DAYS or LESS **LAYOUT 40**

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Multi-Lane Undivided Roads

A roadway having two or more lanes of traffic traveling in the same direction with no physical barriers separating the opposing traffic lane.

**Drawings Not To Scale*

Multi-Lane Undivided

MULTI-LANE UNDIVIDED ROADS

	MOBILE 15 Minutes or Less	SHORT DURATION 1 Hour or Less	SHORT TERM 12 Hours or Less	INTERMEDIATE TERM 3 Days or Less
Work Vehicle Parked on Shoulder	6		8	
Work on Shoulder	9		8	
Work off Shoulder	8			
Work off Roadway	10			
Shoulder or Parking Lane Closure	8			
Partial Shoulder Closure for Trailer Mounted Devices	7			
Lane Closures				
Mobile/Short Duration	41			
Near Intersection	63	33, 34, 45, 46, 47		
Left Lane	43, 46			
Right Lane	42, 45			
Turn Lane	33, 34			
Double Lane	44, 47			
Temporary Road Closure (15 minute intervals)	48			
Temporary Road Closure	32			
Sidewalk Closure	88, 89			
Bike Lane Closure	87			
Crossroad and Confirmation Signing	35			

See Two-Way Left Turn Lane Section for layouts appropriate for roads with Two-Way Continuous Left Turn Lanes.

NOTES:

① Channelizing devices may be omitted if the operation moves at least the Decision Sight Distance (**D**) every 15 minutes or less (mobile operation).

② May use additional Protection Vehicle (not shown on layout) to close shoulder in advance of Work Vehicle.

3. Any Shadow Vehicle or Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

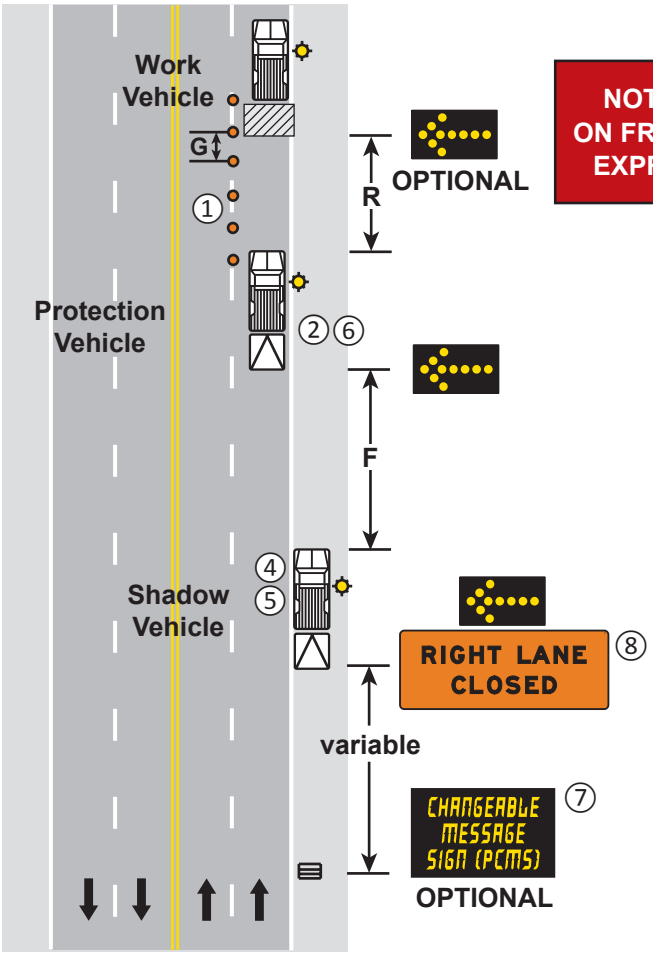
④ The Shadow Vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.

⑤ The Shadow Vehicle may be omitted when the posted speed limit is 40 mph or less.

⑥ If the Shadow Vehicle is not used and there is no PCMS, the Protection Vehicle must have a RIGHT LANE CLOSED sign.

⑦ The PCMS shall be used for nighttime operations.

⑧ When the PCMS is used, the RIGHT LANE CLOSED sign becomes optional.



MOBILE/SHORT DURATION LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD

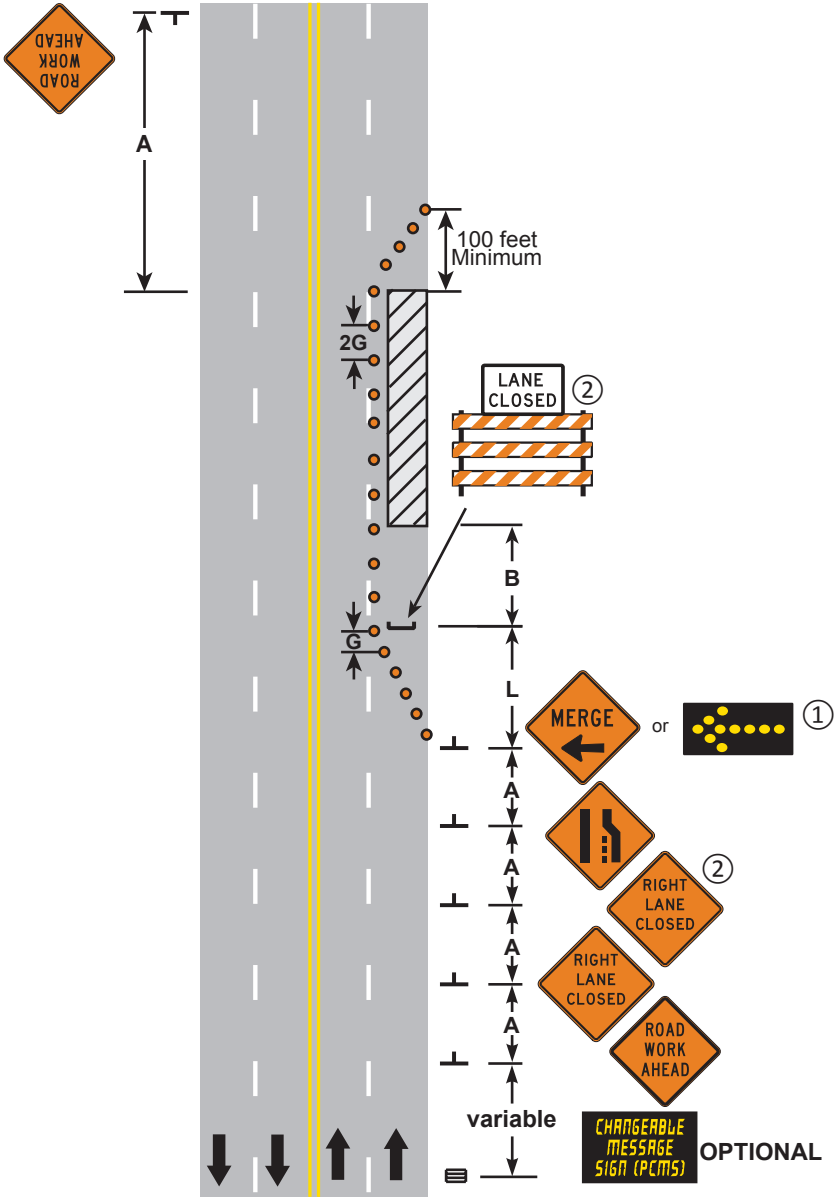
1 HOUR or LESS **LAYOUT 41**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The RIGHT LANE CLOSED sign and/or LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.

3. If there is a shoulder, close the shoulder using a shoulder taper.



RIGHT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 42**

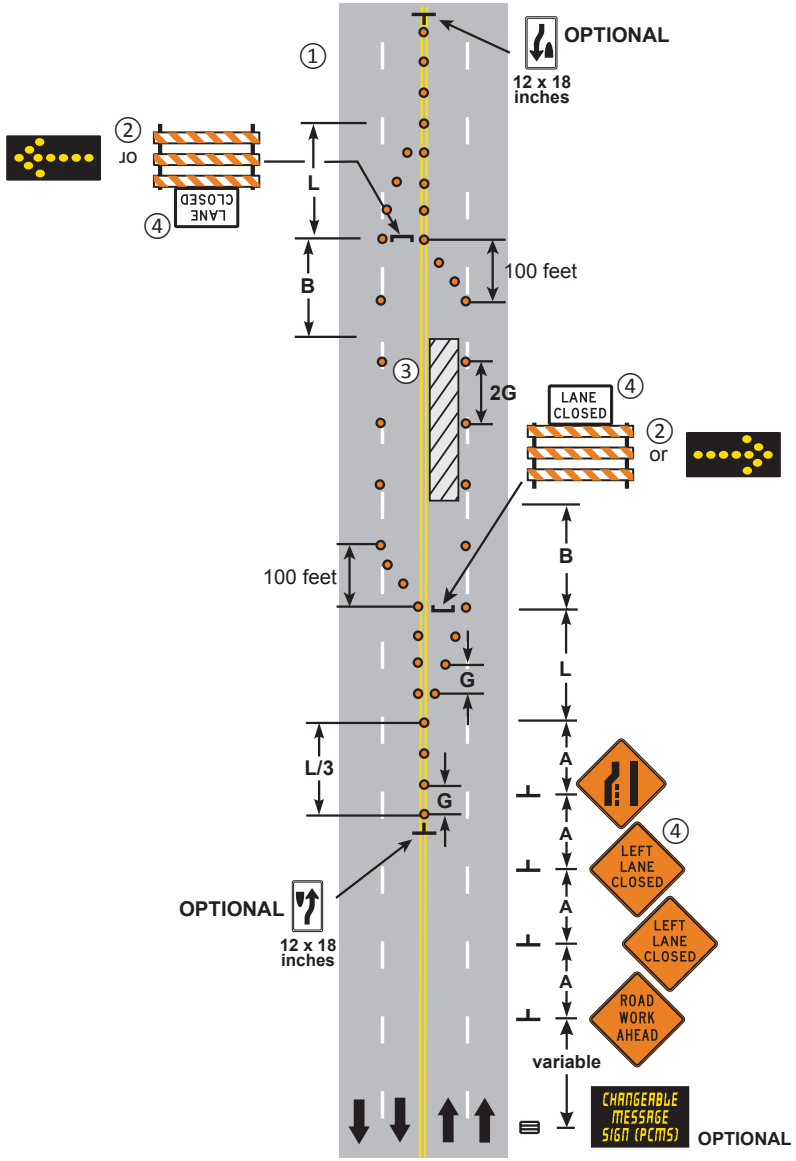
NOTES:

① The advance warning sign sequence is shown for one way direction only. Signing from the other direction shall be identical.

② Place device at the end of the taper. The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater.

③ Lane may be opened when workers are not present in the work area or when the speed limit is 40 mph or less. Place channelizers on centerline when opening lane.

④ The LANE CLOSED sign and/or LEFT LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.



LEFT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 43**

NOTES:

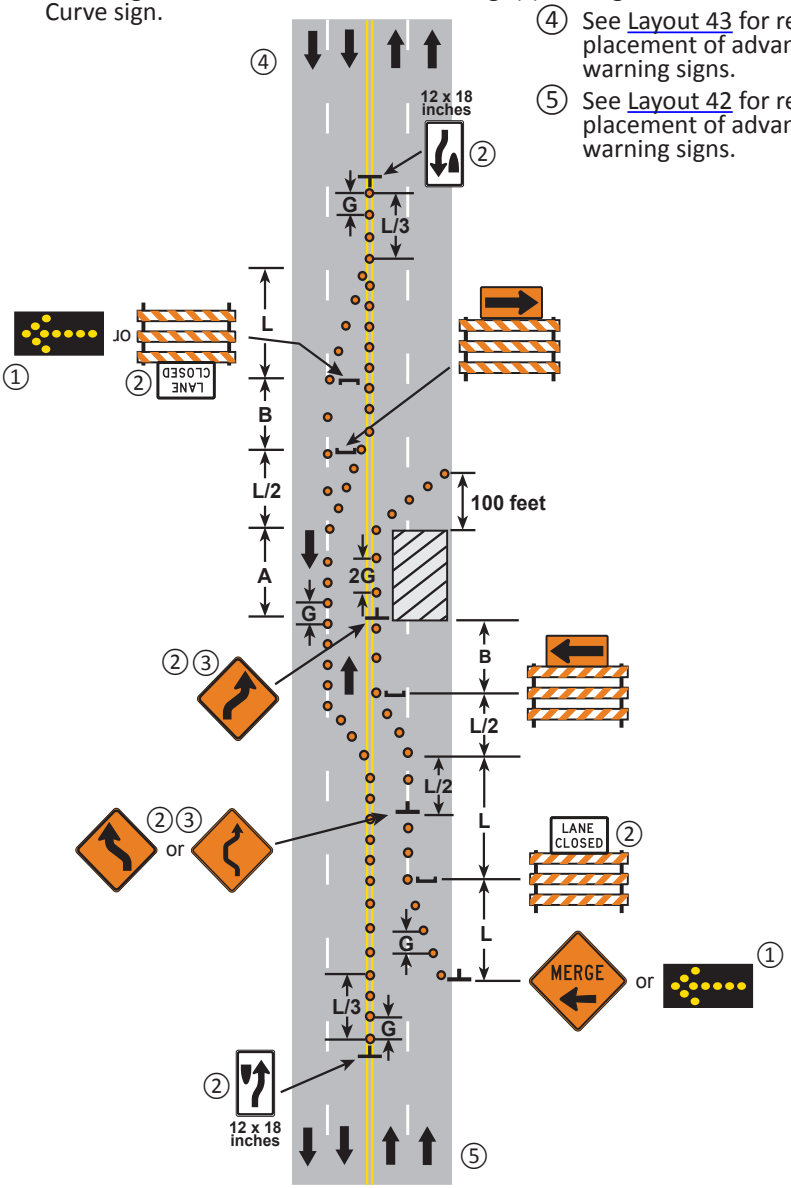
① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The LANE CLOSED, Reverse Curve, Double Reverse Curve, and/or Keep Right signs may be omitted when the posted speed limit is 40 mph or less.

③ If the tangent length of activity area is 600 feet or less, use the Double Reverse Curve sign. Remove the Reverse Curve sign(s) if using the Double Reverse Curve sign.

④ See Layout 43 for required placement of advanced warning signs.

⑤ See Layout 42 for required placement of advanced warning signs.



DOUBLE LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD

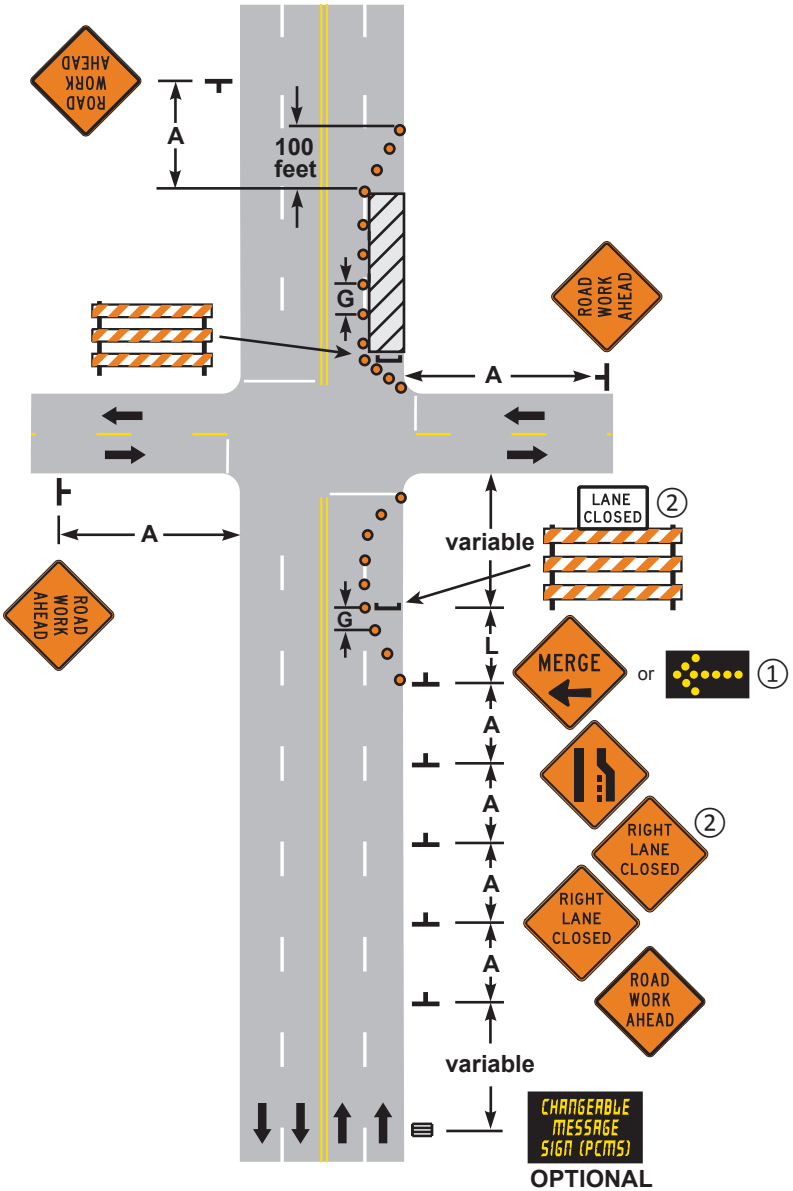
3 DAYS or LESS **LAYOUT 44**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The RIGHT LANE CLOSED and/or LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.

3. If there is a shoulder, close the shoulder using a shoulder taper.



RIGHT LANE CLOSURE

Work Space at Intersection

MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 45**

NOTES:

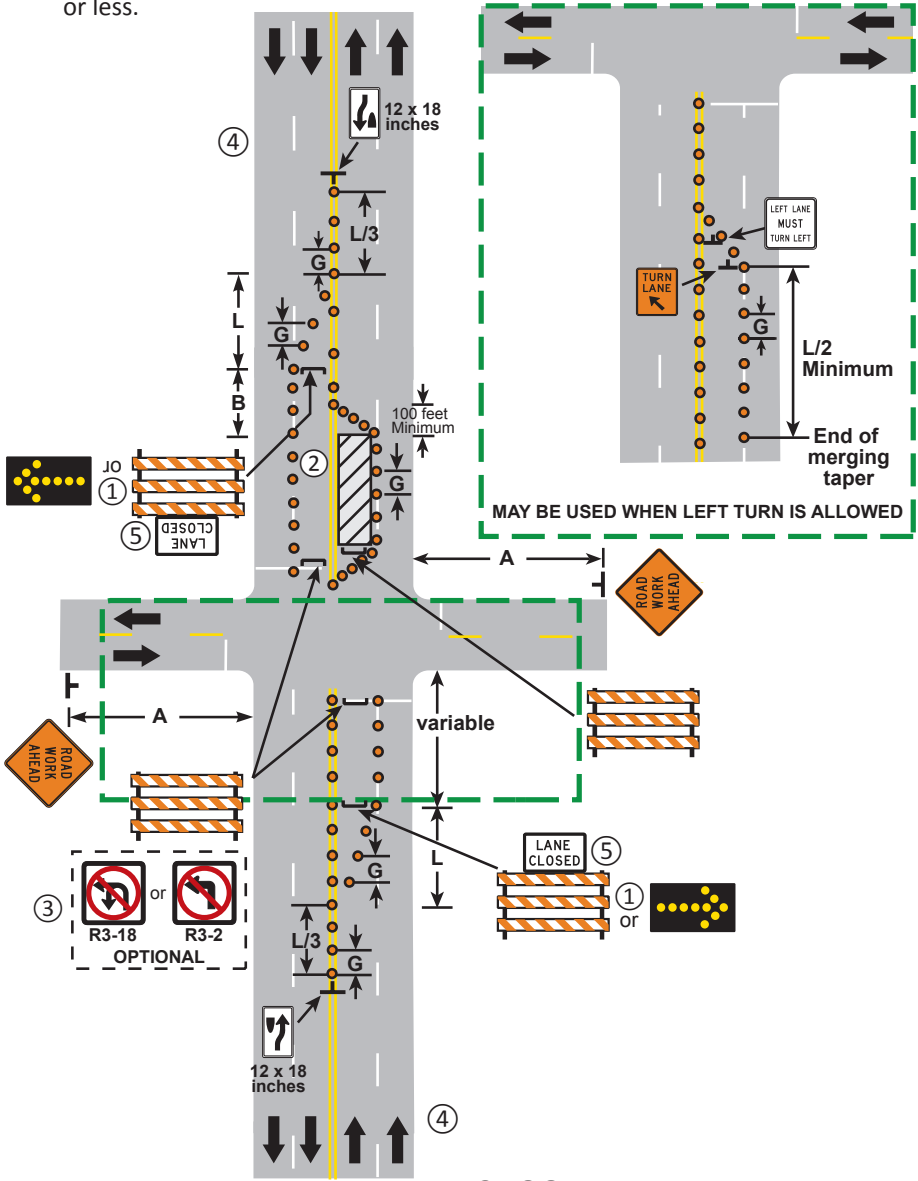
① Place device at the end of the taper. The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater.

② The lane closure may be omitted when the workers are not at the work site.

③ Optional R3-18 or R3-2 signs may be placed on sign stand or top of barricades on side closest to traffic. Signs are required if turns are prohibited.

④ See Layout 43 for required placement of advance warning signs.

⑤ The LANE CLOSED signs may be omitted when the posted speed limit is 40 mph or less.



LEFT LANE CLOSURE
Work Space at Intersection
MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 46**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

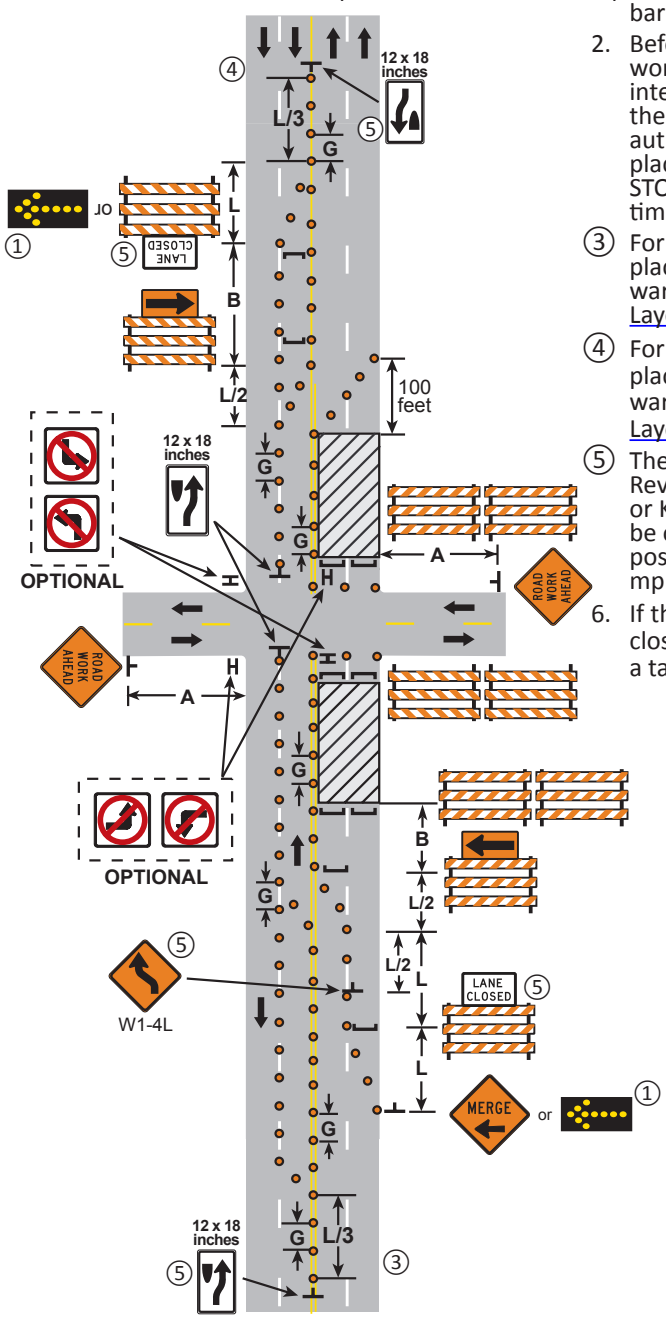
2. Before beginning work at any signalized intersection, contact the appropriate road authority for the placement of temporary STOP signs or signal timing modifications.

③ For the required placement of advance warning signs, see Layout 42.

④ For the required placement of advance warning signs, see Layout 43.

⑤ The LANE CLOSED sign, Reverse Curve sign and/or Keep Right sign may be omitted when the posted speed limit is 40 mph or less.

6. If there is a shoulder, close the shoulder using a taper.

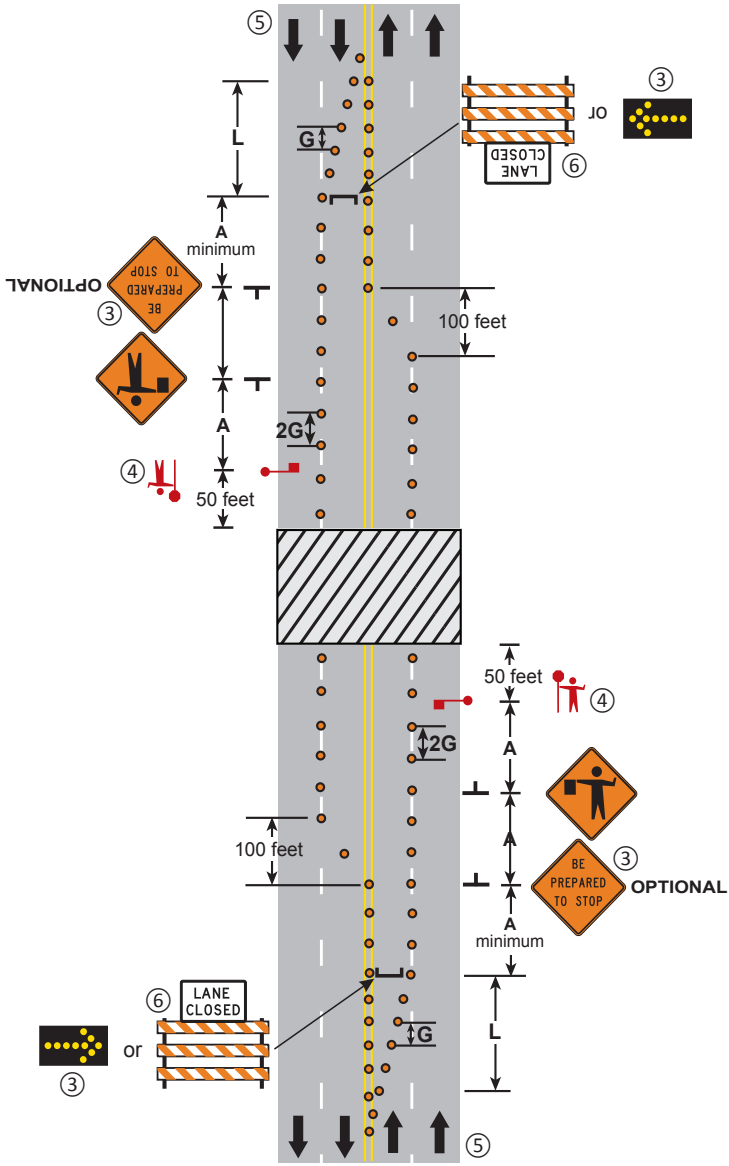


DOUBLE LANE CLOSURE AT INTERSECTION
MULTI-LANE UNDIVIDED ROAD

3 DAYS or LESS **LAYOUT 47**

NOTES:

1. The road authority shall be contacted prior to closure.
2. Traffic should not be stopped for intervals greater than 15 minutes.
3. The BE PREPARED TO STOP sign and the Flashing Arrow Board shall be used when the posted speed limit is 45 mph or greater.
4. Law Enforcement may be used instead of or in addition to a flagger.
5. Traffic control shall be identical for both directions. See Layout 43 for required placement of advance warning signs.
6. The LANE CLOSED sign is optional if posted speed limit is 40 mph or less.



TEMPORARY ROAD CLOSURE
MULTI-LANE UNDIVIDED ROAD

12 HOURS or LESS **LAYOUT 48**

Multi-Lane Divided Road

Two separate roadways where opposing traffic is separated by a median.

**Drawings Not To Scale*

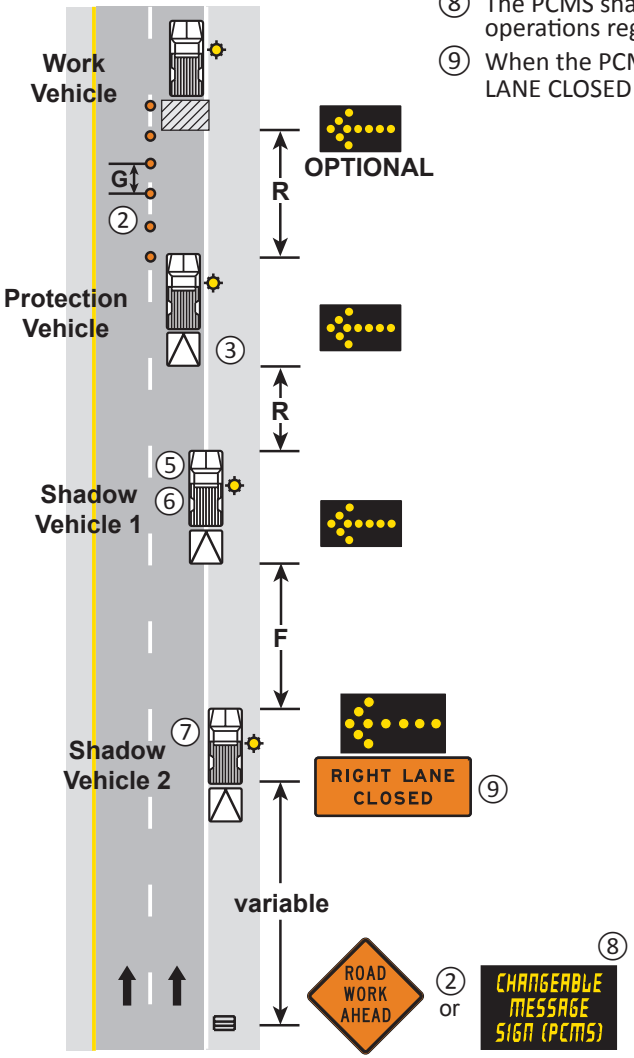
Multi-Lane Divided

MULTI-LANE DIVIDED ROADS				
	MOBILE 15 Minutes or Less	**SHORT DURATION 1 Hour or Less**	**SHORT TERM 12 Hours or Less**	**INTERMEDIATE TERM 3 Days or Less**
Work Vehicle Parked on Shoulder	6		8	
Work on Shoulder	9		8	
Work off Shoulder	8			
Work off Roadway	10			
Shoulder or Parking Lane Closure	8			
Partial Shoulder Closure for Trailer Mounted Devices	7			
Lane Closures				
Mobile/Short Duration	49, 50, 51			
Near Intersection	63	33, 64, 65, 66, 75		
Center Lane	56 *			
Left/Right Lane	57, 58, 64, 65			
Turn Lane	33, 75			
Turn Lane on Dual Turn Lanes	75			
Double Lane	51		59, 60	
Extended Lane	61			
Lane Shift	62			
Near Ramp	67, 68, 69			
Partial Ramp Closure	70			
Ramp Closure	52, 53, 54		71, 72	
Closure at Top of Entrance Ramp	74			
Re-Surfacing Operation	66			
Temporary Road Closure (15 minute intervals)	55		73	
Temporary Road Closure	32			
Sidewalk Closure	88, 89			
Bike Lane Closure	87			
Crossroad and Confirmation Signing	35			

*** NOTE: Posted Speed Limit 35 mph or less only.**

NOTES:

1. When the posted speed limit is 40 mph or less, Layout 41 may be used.
2. Channelizing devices and Advance Warning Sign (PCMS or ROAD WORK AHEAD) may be omitted if the operation moves at least the Decision Sight Distance (**D**) every 15 minutes or less (mobile operation).
3. May use additional Protection Vehicle (not shown on layout) to close shoulder in advance of Work Vehicle.
4. Any Shadow Vehicle and Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.
5. The lateral placement of Shadow Vehicle 1 may be adjusted to create a taper.
6. Shadow Vehicle 1 may be omitted when posted speed limit is 40 mph or less.
7. Shadow Vehicle 2 may encroach into the traffic lane when the shoulder is too narrow to drive on.
8. The PCMS shall be used for nighttime operations regardless of duration.
9. When the PCMS is used, the RIGHT LANE CLOSED sign becomes optional.



MOBILE/SHORT DURATION LANE CLOSURE
MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 49**

NOTES:

① Channelizing devices may be omitted if the operation moves at least the Decision Sight Distance (**D**) every 15 minutes or less (mobile operation).

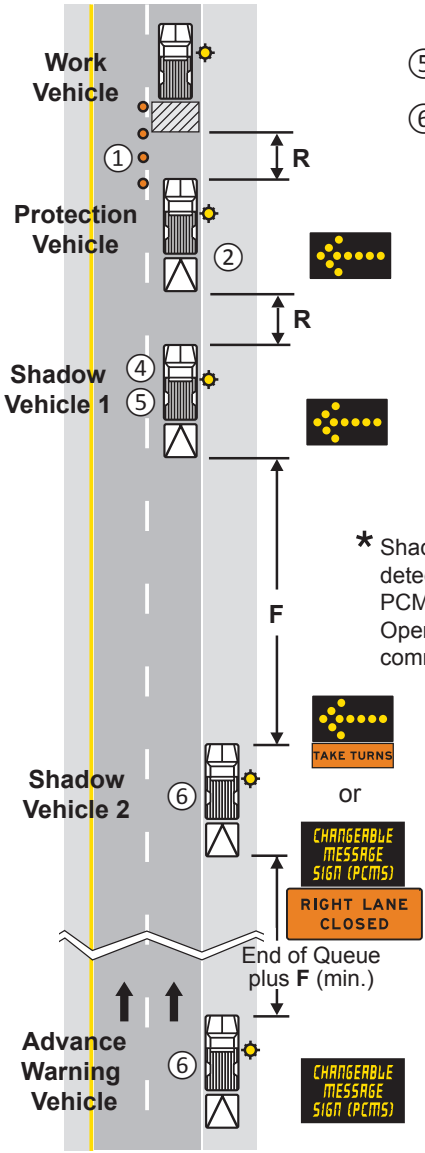
② May use additional Protection Vehicle (not shown on layout) to close shoulder in advance of Work Vehicle.

3. Any Shadow Vehicle, Protection Vehicle, and Advance Warning Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

④ The lateral placement of Shadow Vehicle 1 may be adjusted to create a taper.

⑤ Shadow Vehicle 1 may be omitted when posted speed limit is 40 mph or less.

⑥ Shadow Vehicle 2 and the Advance Warning Vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.



* Shadow Vehicle 2 Operator is responsible for detecting the traffic queue and changing the PCMS message appropriately for the conditions. Operators of the two PCMS's shall have radio communication.

PCMS MESSAGE OPTIONS

MERGE LEFT	RT LANE CLOSED	No Queuing
MERGE LEFT	BEGIN MERGE	*Queuing Detected

Signage shall be at least Distance **F** before queue (area where traffic slows).

PCMS MESSAGE OPTIONS

SLOW TRAFFIC	RT LANE CLOSED	No Queuing
STOPPED TRAFFIC	USE ALL LANES	*Queuing Detected

MOBILE/SHORT DURATION LANE CLOSURE

Active Zipper Merge
MULTI-LANE ROAD

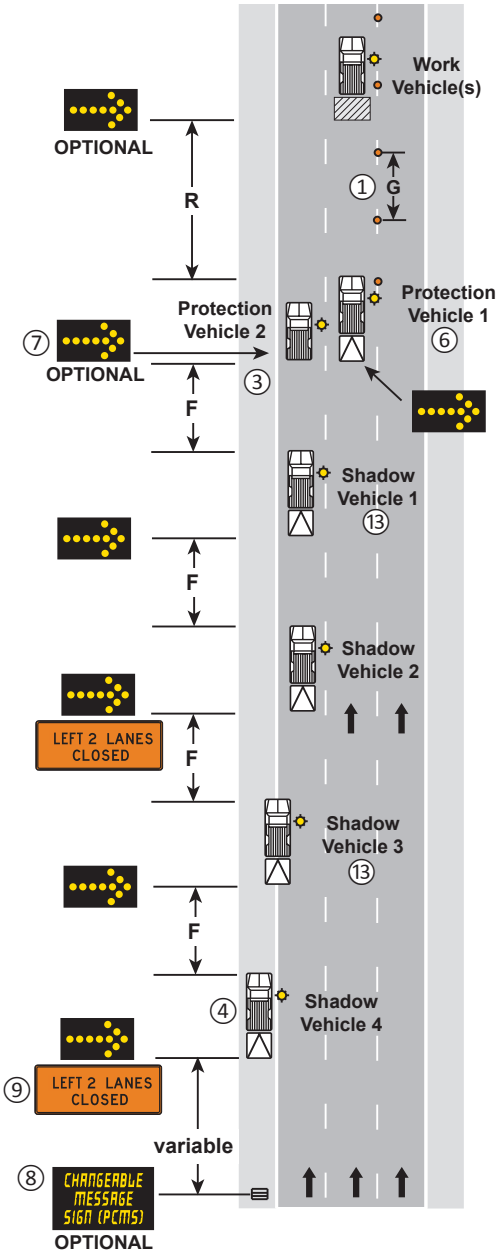
1 HOUR or LESS **LAYOUT 50**

NOTES:

① Channelizing devices may be omitted if the operation moves at least the Decision Sight Distance (**D**) every 15 minutes (mobile operation).

2. May decrease channelizer spacing as needed to prevent intrusions.

③ May use additional Protection Vehicle(s) (not shown on layout) to close shoulder and/or adjacent lane in advance of the Work Vehicle(s).



④ Shadow Vehicle 4 may encroach into the traffic lane when the shoulder is too narrow to drive on. **If so, a PCMS is required.**

5. Any Shadow Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

⑥ Protection Vehicle 1 should be equipped with a TMA.

⑦ Flashing Arrow Board and/or TMA are optional on Protection Vehicle 2.

⑧ The PCMS shall be used for nighttime operations.

⑨ When the PCMS is used, the LEFT 2 LANES CLOSED sign becomes optional.

10. Maximum spacing between Protection Vehicle 1 and closest Work Vehicle should not exceed 2R.

11. When channelizing devices are not used, the maximum distance between work vehicles is R.

12. If closing the right 2 lanes, ramp closures should be considered.

⑬ Shadow Vehicle 3 may be omitted at 40 mph or less.

MOBILE/SHORT DURATION MULTI-LANE CLOSURE

MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 51**

NOTES:

① The Protection Vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. An optional second Protection Vehicle may be needed to block wider exit ramps. If a Protection Vehicle follows the Work Vehicle up the ramp, then it shall remain a minimum distance **R** from the work area.

② Channelizing devices and Advance Warning Sign (PCMS or ROAD WORK AHEAD) may be omitted if the ramp will be opened within 15 minutes.

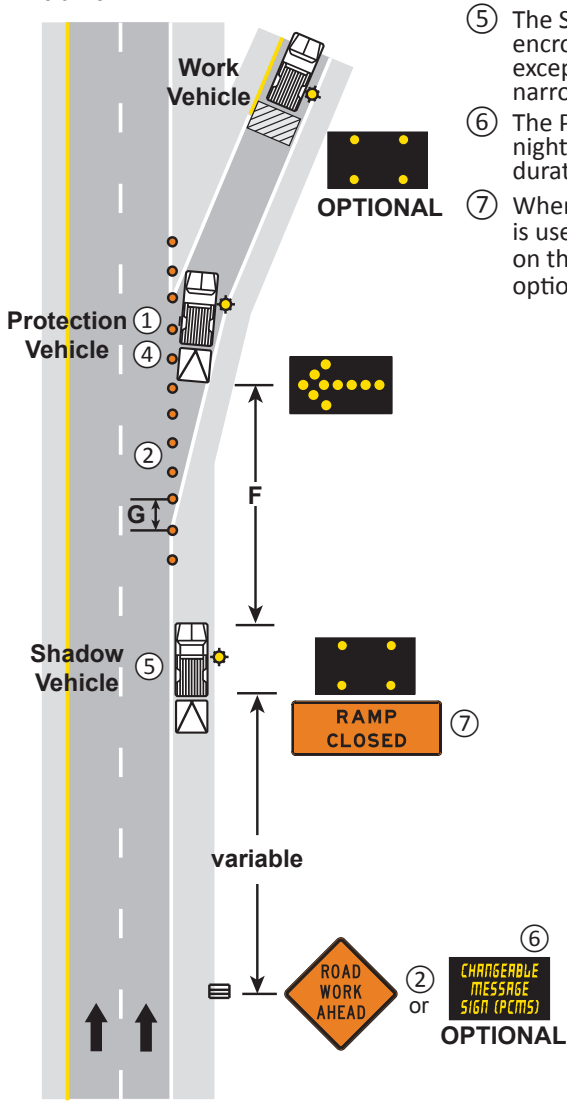
3. Any Shadow Vehicle and Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

④ The vehicle(s) blocking the exit ramp shall not encroach into lanes open to traffic.

⑤ The Shadow Vehicle should not encroach into the traffic lane except when the shoulder is too narrow.

⑥ The PCMS shall be used for nighttime operations regardless of duration.

⑦ When the advance warning PCMS is used, the RAMP CLOSED sign on the Shadow Vehicle becomes optional.



MOBILE/SHORT DURATION RAMP CLOSURE

MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 52**

NOTES:

① The Protection Vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. An optional second Protection Vehicle may be needed to block wider exit ramps. If a Protection Vehicle follows the Work Vehicle up the ramp, then it shall remain a minimum distance **R** from the work area.

② Channelizing devices and Advance Warning Sign (PCMS or ROAD WORK AHEAD) may be omitted if the ramp will be opened within 15 minutes.

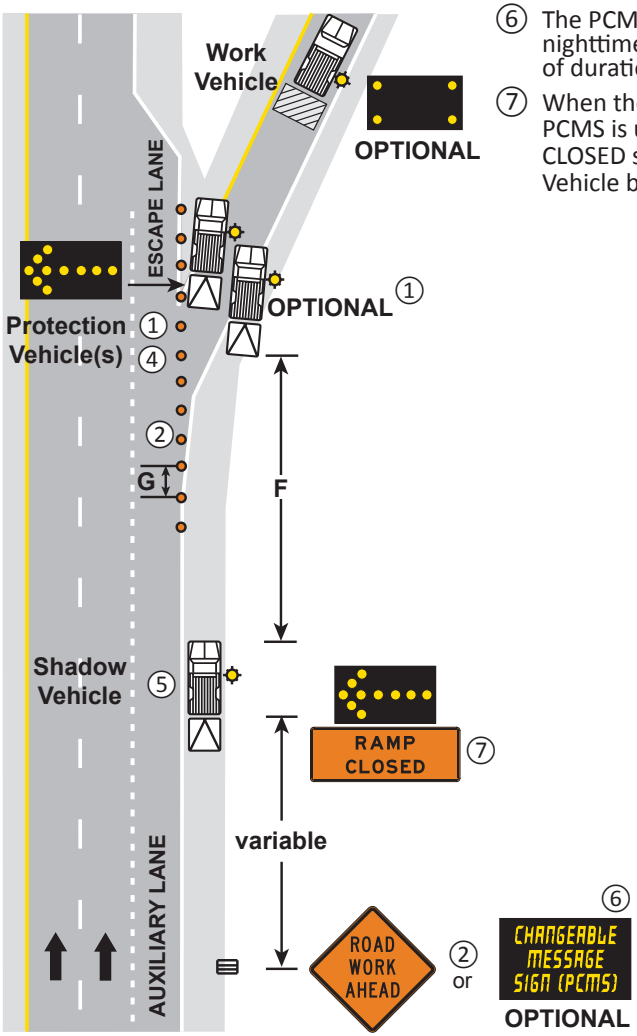
3. Any Shadow Vehicle and Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

④ The vehicle(s) blocking the exit ramp shall not encroach into lanes open to traffic.

⑤ The Shadow Vehicle should not encroach into the traffic lane except when the shoulder is too narrow.

⑥ The PCMS shall be used for nighttime operations regardless of duration.

⑦ When the advance warning PCMS is used, the RAMP CLOSED sign on the Shadow Vehicle becomes optional.



MOBILE/SHORT DURATION
RAMP CLOSURE with ESCAPE LANE
MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 53**

NOTES:

① The Protection Vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. An optional second Protection Vehicle may be needed to block wider exit ramps. If a Protection Vehicle follows the Work Vehicle up the ramp, then it shall remain a minimum distance **R** from the work area.

② Channelizing devices and Advance Warning Sign (PCMS or ROAD WORK AHEAD) may be omitted if the ramp will be opened within 15 minutes.

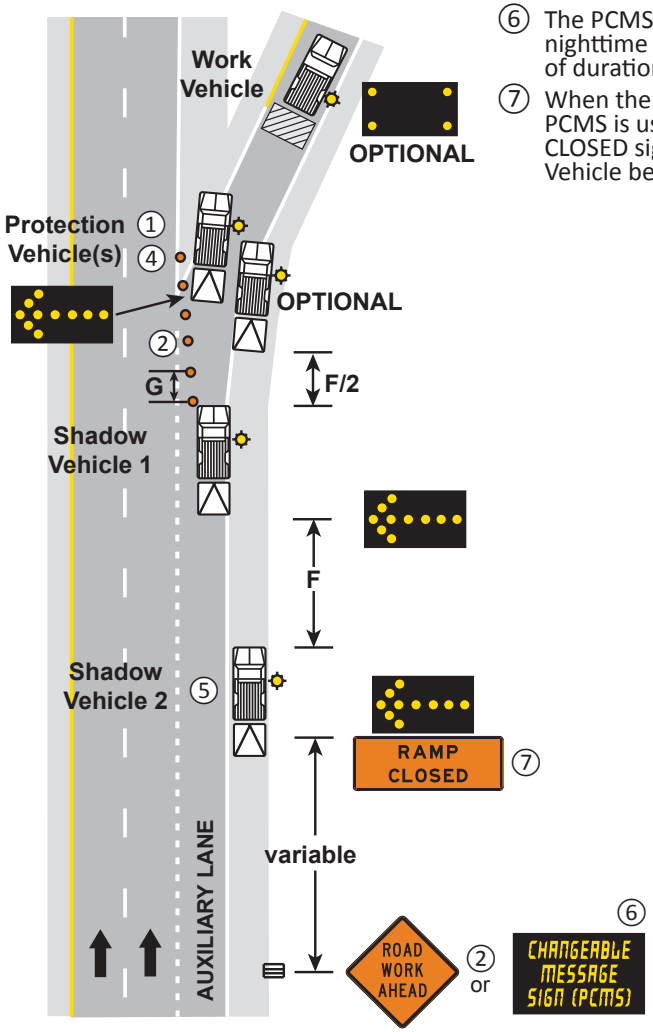
3. Any Shadow Vehicles and Protection Vehicles operating totally or partially in a traffic lane should be equipped with a TMA.

④ The vehicle(s) blocking the exit ramp shall not encroach into lanes open to traffic.

⑤ Shadow Vehicle 2 should not encroach into the traffic lane except when the shoulder is too narrow.

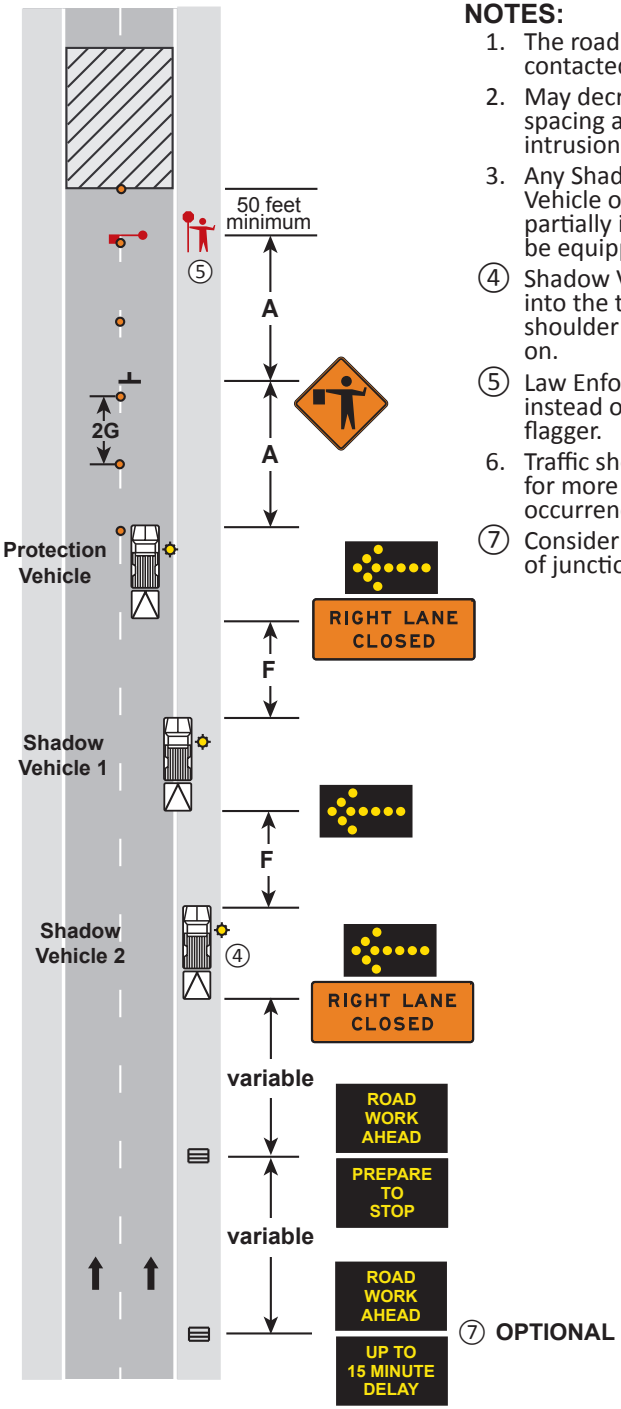
⑥ The PCMS shall be used for nighttime operations regardless of duration.

⑦ When the advance warning PCMS is used, the RAMP CLOSED sign on the Shadow Vehicle become optional.



MOBILE/SHORT DURATION
RAMP CLOSURE with LANE DROP
MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 54**



NOTES:

1. The road authority shall be contacted prior to closure.
2. May decrease channelizer spacing as needed to prevent intrusions.
3. Any Shadow or Protection Vehicle operating totally or partially in a traffic lane should be equipped with a TMA.

④ Shadow Vehicle 2 may encroach into the traffic lane when the shoulder is too narrow to drive on.

⑤ Law Enforcement may be used instead of or in addition to a flagger.

6. Traffic should not be stopped for more than 15 minutes per occurrence.

⑦ Consider placement in advance of junction with alternate route.

MOBILE/SHORT DURATION ROAD CLOSURE

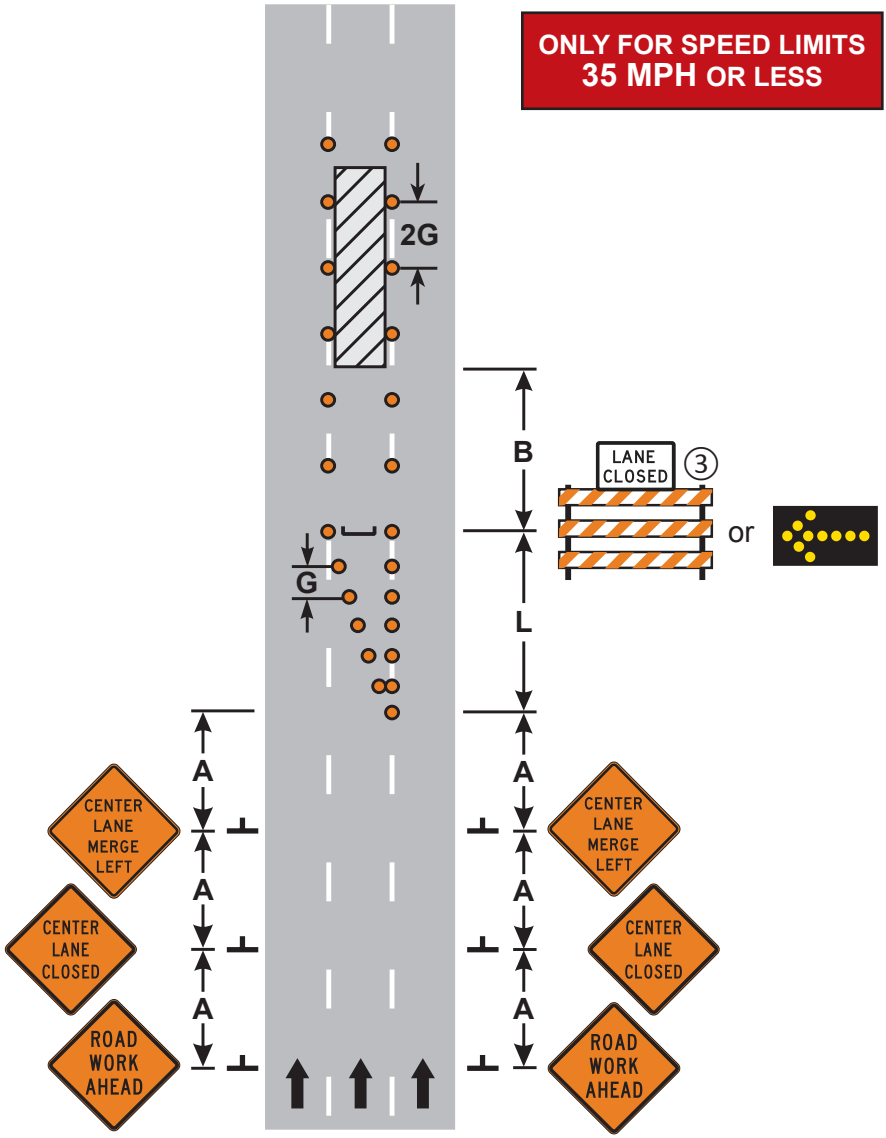
MULTI-LANE DIVIDED ROAD

1 HOUR or LESS **LAYOUT 55**

NOTES:

1. If traffic volumes are low, a double lane closure is preferred.
2. Consider a double lane closure when workers are present.

③ The LANE CLOSED sign is optional.



CENTER LANE CLOSURE
MULTI-LANE DIVIDED OR ONE WAY ROAD

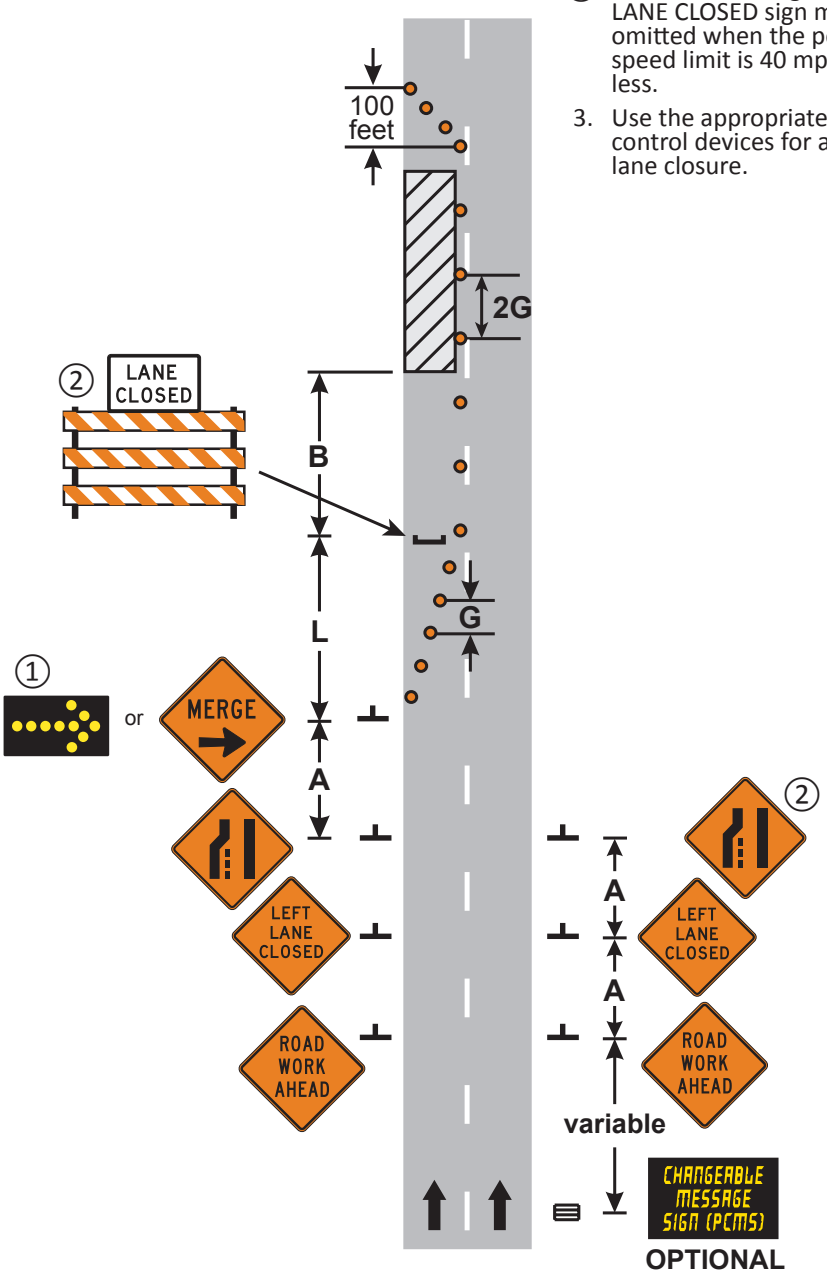
3 DAYS or LESS **LAYOUT 56**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The Lane Ends sign and/or LANE CLOSED sign may be omitted when the posted speed limit is 40 mph or less.

3. Use the appropriate traffic control devices for a right lane closure.



LANE CLOSURE
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 57**

NOTES:

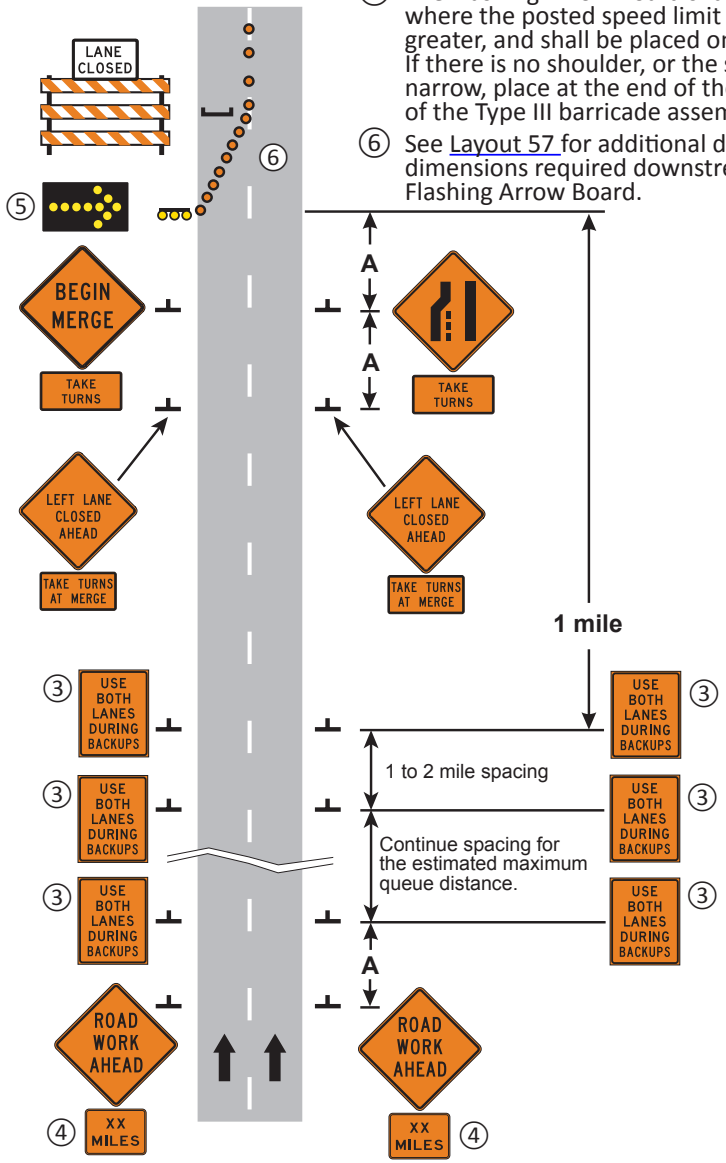
1. This layout should be used on roadways 45 mph and greater where traffic queues may extend at least 0.5 mile upstream of the taper.
2. Use the appropriate traffic control devices for a left lane closure.

③ A PCMS may be used in place of a pair of USE BOTH LANES DURING BACKUPS signs.

④ XX MILES advisory plaques are recommended when the distance is 2 miles or more. Plaques shall be placed directly below or on the lower side of the warning sign nearest traffic.

⑤ The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

⑥ See Layout 57 for additional devices and dimensions required downstream of the Flashing Arrow Board.



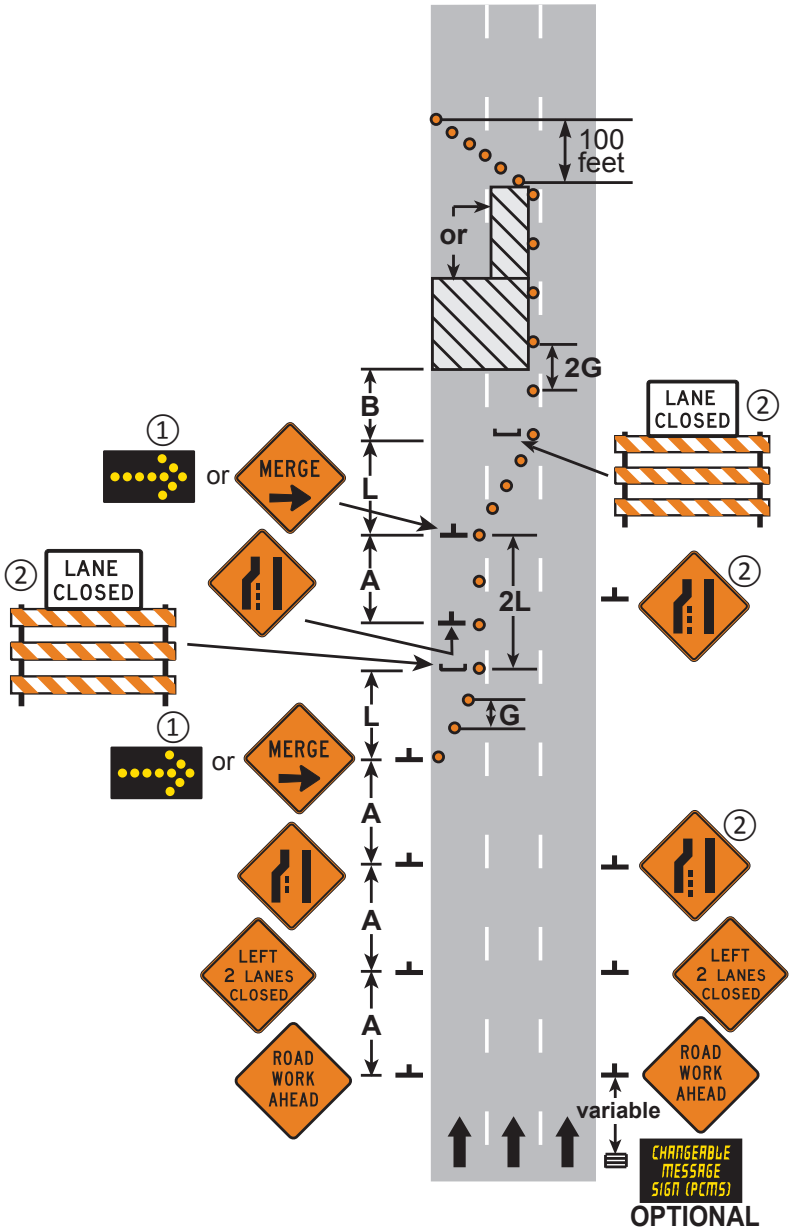
LANE CLOSURE with PASSIVE ZIPPER MERGE
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 58**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The LANE CLOSED and/or the Lane Ends sign may be omitted when the posted speed limit is 40 mph or less.



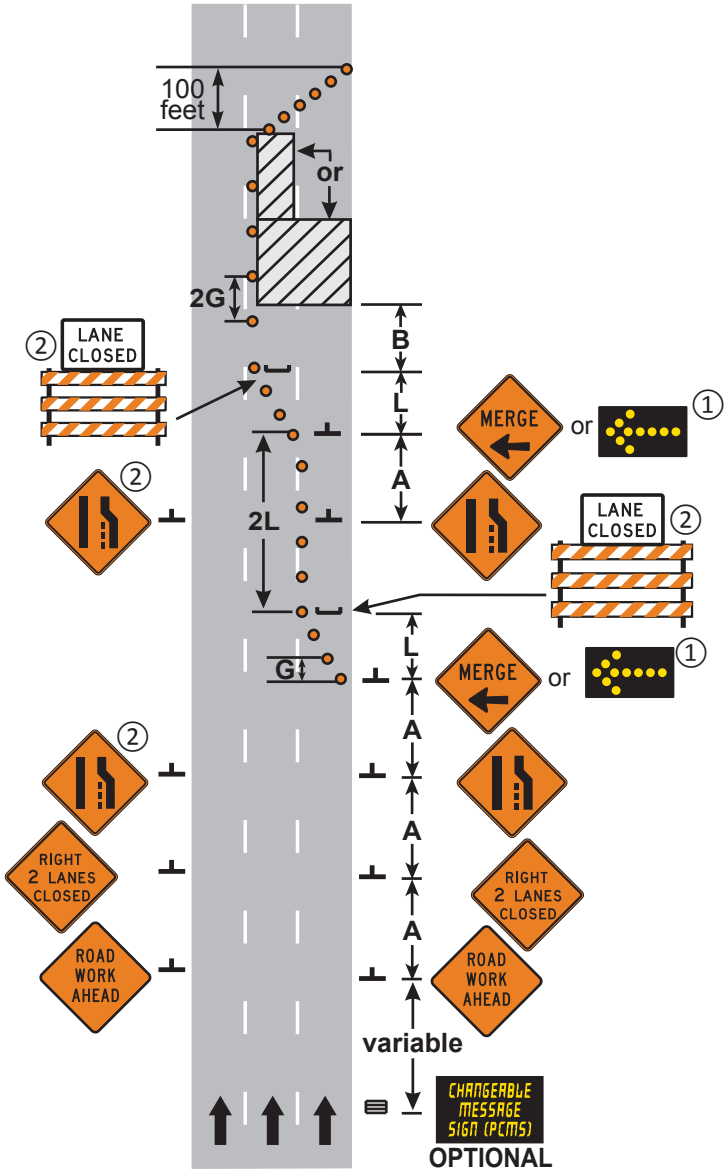
LEFT TWO LANES CLOSED
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 59**

NOTES:

① The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater and placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

② The LANE CLOSED and/or the Lane Ends sign may be omitted when the posted speed limit is 40 mph or less.



RIGHT TWO LANES CLOSED
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 60**

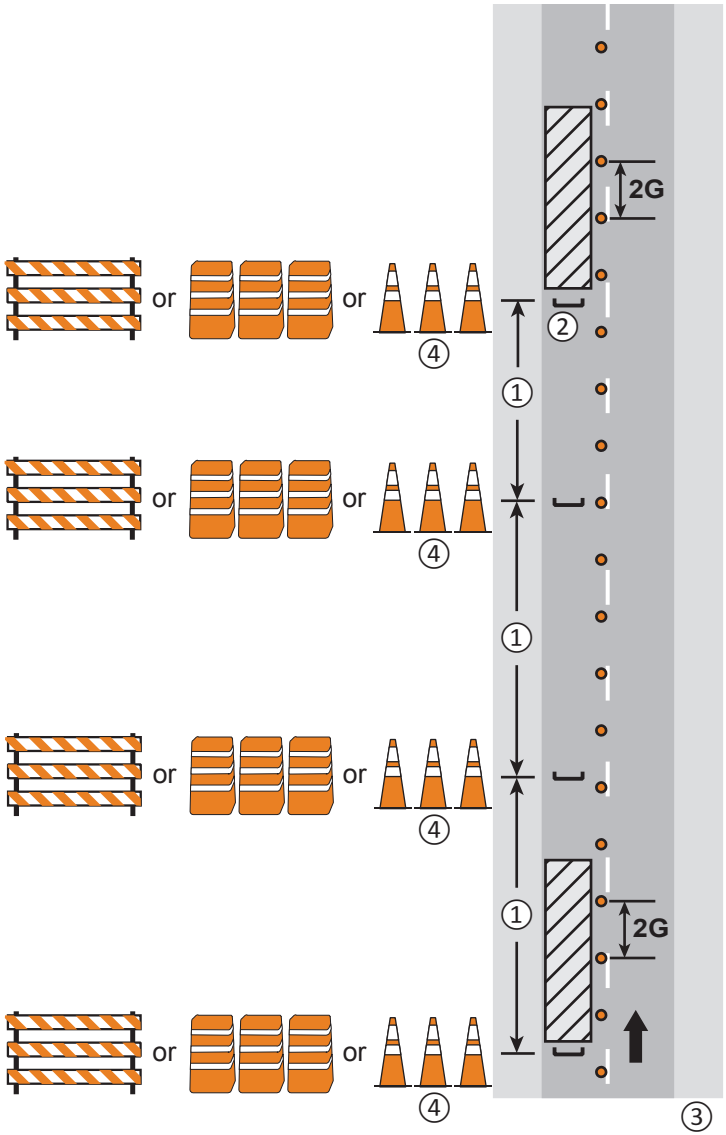
NOTES:

① Install a Type III barricade at the beginning of each work space and at intervals from 500 feet minimum to 1000 feet maximum within the closed lane.

② The Type III barricade within the work space may be temporarily removed when it interferes with active work operations. The barricade must be replaced when active work operations end.

③ For advance signing, placement of traffic control devices, and lane taper, see the appropriate stationary layout.

④ Type A channelizing devices may be used if the temporary traffic control zone is installed for less than 12 hours or is attended.

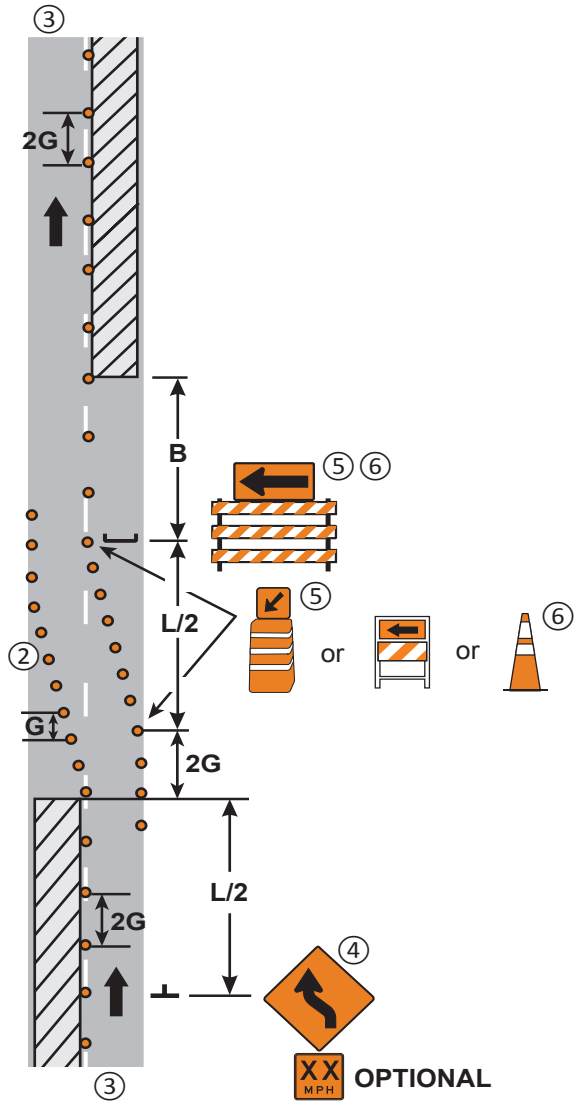


LANE CLOSURE EXTENSION
MULTI-LANE DIVIDED or ONE WAY ROAD

3 DAYS or LESS **LAYOUT 61**

NOTES:

1. For one lane of traffic only.
2. Continue the pattern and the spacing of devices for additional lateral shift if shifting from right lane to left lane on more than a 2 lane roadway.
3. For advance signing, placement of traffic control devices, lane taper, see the appropriate stationary layout.
4. The Reverse Curve sign may be omitted when the posted speed limit is 40 mph or less.
5. Directional arrows shall be used on either the drums or the Type III barricade.
6. Cones may be used if work zone is attended. If using cones, a One Direction Large Arrow shall also be used on the Type III barricade.



LANE SHIFT
MULTI-LANE DIVIDED or ONE WAY ROAD

3 DAYS or LESS **LAYOUT 62**

NOTES:

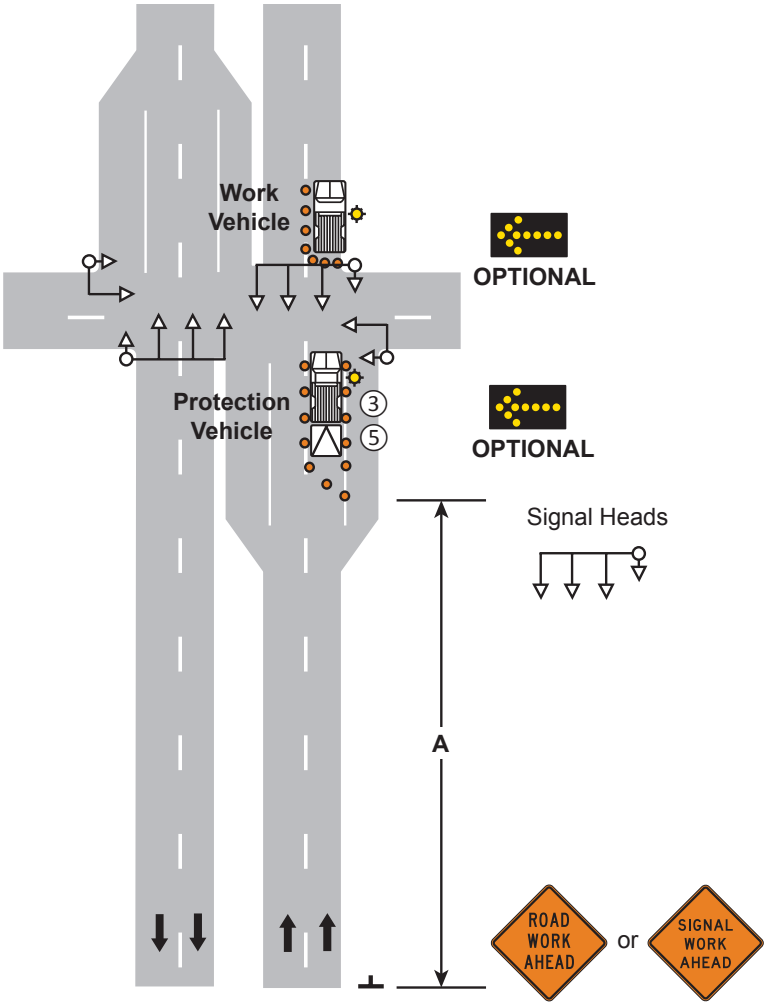
1. The operation shall not remain in one location for more than 15 minutes.
2. If the work space is not visible for at least the Decision Sight Distance (**D**), the appropriate stationary layout shall be used.

③ The traffic control signal should be put in an ALL-RED flash mode to facilitate traffic control at the work site. The Protection Vehicle may be omitted when signal is placed in ALL-RED flash mode. Channelizing devices may be omitted if a Protection Vehicle with a Flashing Arrow Board and TMA is used.

4. There should be little or no encroachment into the cross-street traffic path.

⑤ If signals are not placed in ALL-RED flash, the Protection Vehicle should be equipped with a TMA and a Flashing Arrow Board.

6. The Work Vehicle shall be equipped with operating vehicle warning lights visible for 360 degrees around the vehicle at a minimum height of 3 1/2 feet and a radius of 60 feet or greater.



LANE CLOSURE

At Far Side of Signalized Intersection

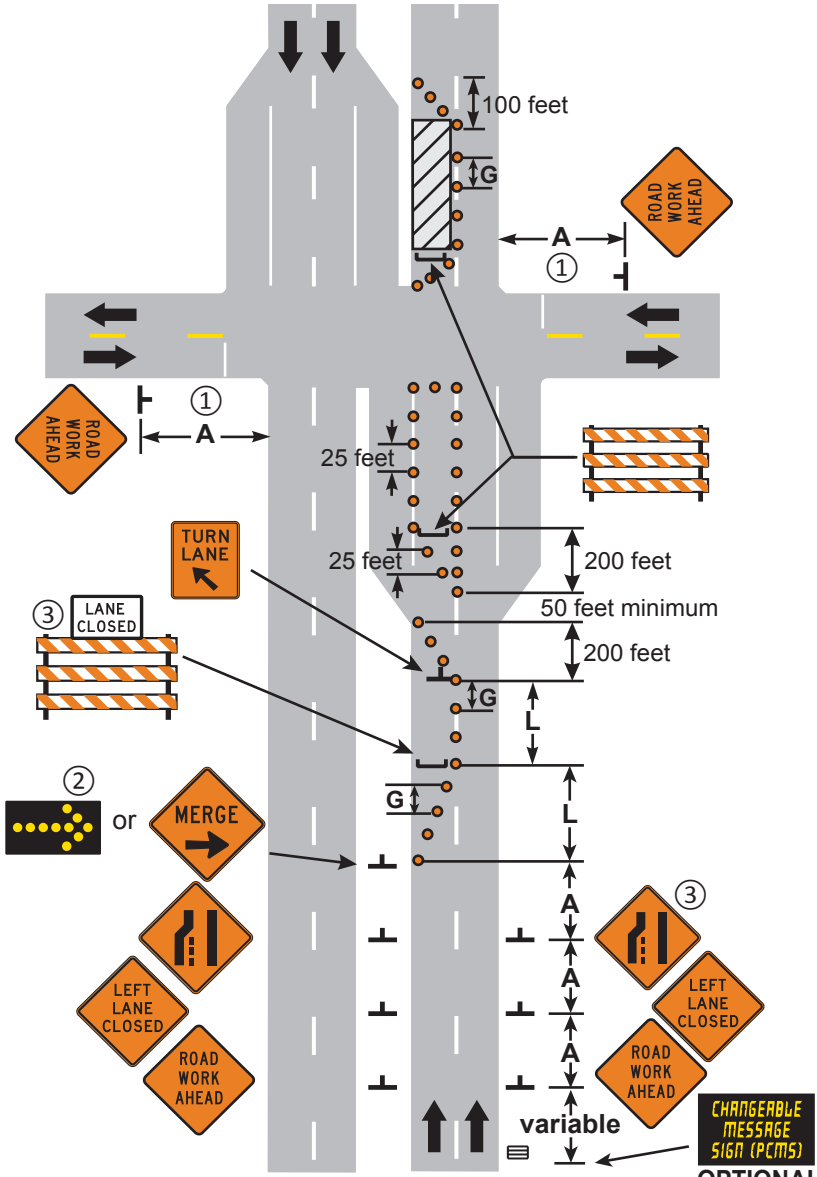
15 MINUTES or LESS **LAYOUT 63**

NOTES:

① Use the appropriate advance warning sign spacing for the speed on the cross road.

② The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater and placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

③ The LANE CLOSED and/or the Lane Ends sign may be omitted when the posted speed limit is 40 mph or less.



LEFT LANE CLOSURE

Work Space Beyond Intersection
MULTI-LANE DIVIDED ROAD

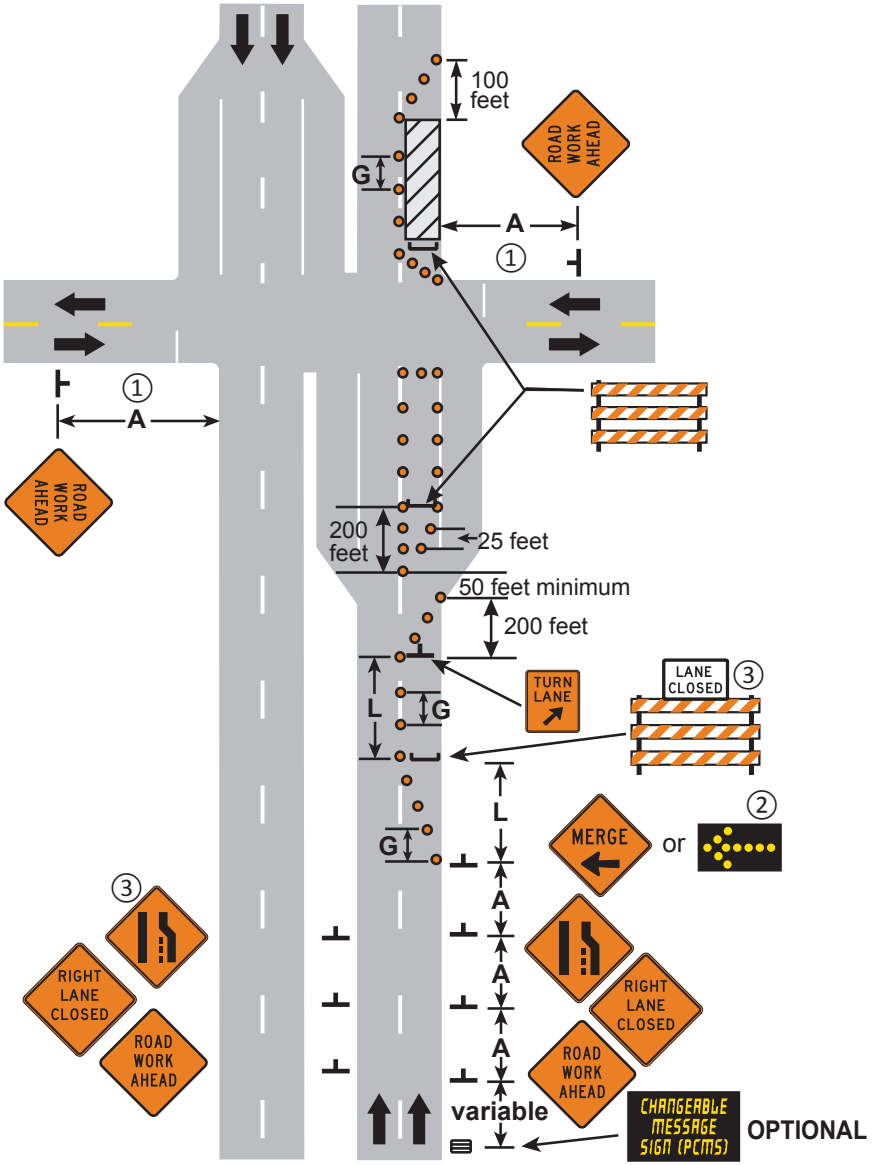
3 DAYS or LESS **LAYOUT 64**

NOTES:

① Use the appropriate advance warning sign spacing for the speed on the cross road.

② The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater, and shall be placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

③ The LANE CLOSED and/or the Lane Ends sign may be omitted when the posted speed limit is 40 mph or less.



RIGHT LANE CLOSURE

Work Space Beyond Intersection
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 65**

NOTES:

① When used, XX MPH advisory speed plaques shall be placed directly below or on the lower side nearest traffic of the appropriate warning sign(s).

② Use the same warning signs and spacings for the other approach to the milled roadway surface area.

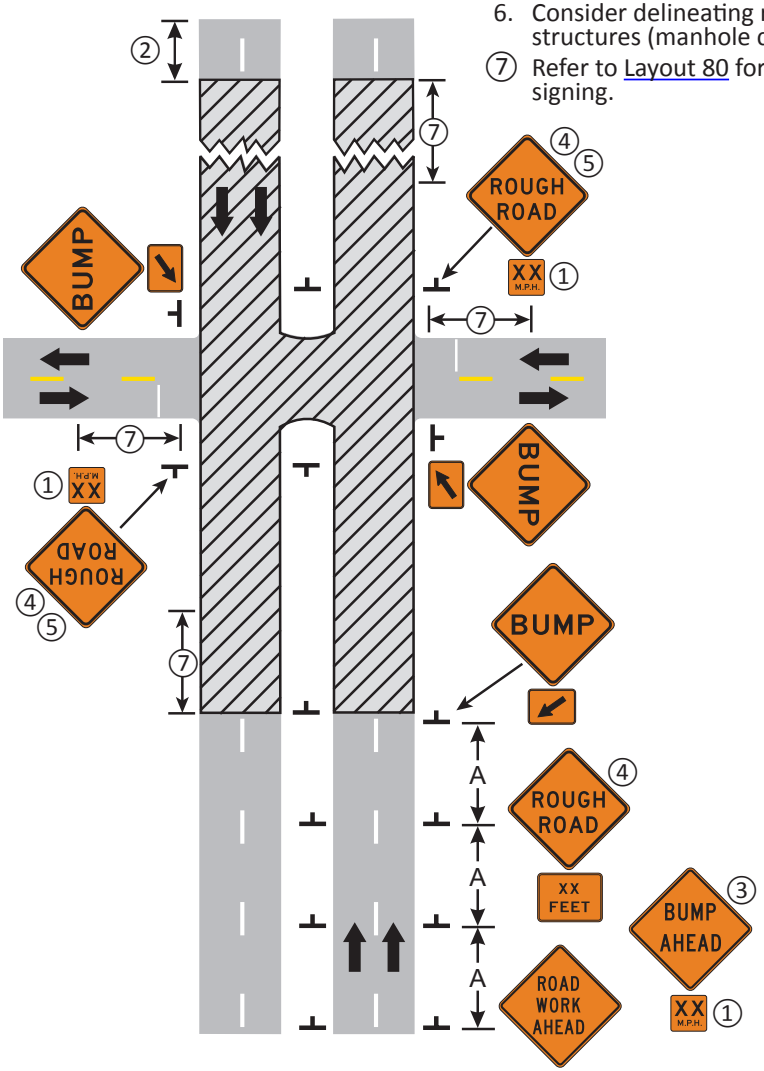
③ The BUMP AHEAD sign may be omitted if the speed reduction to navigate the bump is 10 mph or less.

④ Use the appropriate warning sign for the roadway condition, i.e. GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD. An advisory Motorcycle plaque may be placed below or on the lower side nearest traffic of the appropriate warning sign if the warning is directed primarily to motorcyclists.

⑤ Refer to Layout 35 for confirmation signing.

6. Consider delineating raised structures (manhole covers, etc.)

⑦ Refer to Layout 80 for bump signing.



RE-SURFACING OPERATION

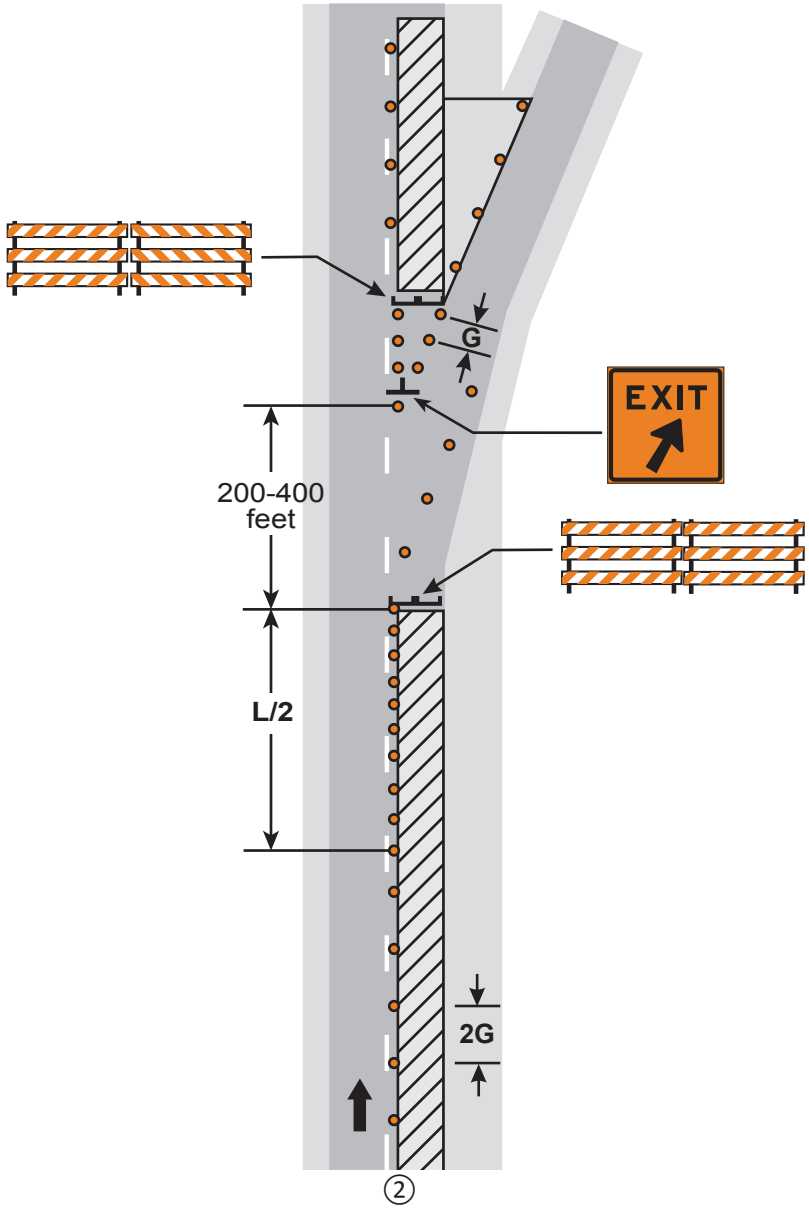
Work Space Before and Through Intersection

MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 66**

NOTES:

1. Adjust the ramp exit to fit the conditions.
2. For advance signing, placement of traffic control devices, and lane closure, see the appropriate stationary layout.



MAINLINE RIGHT LANE CLOSED
EXIT RAMP OPEN

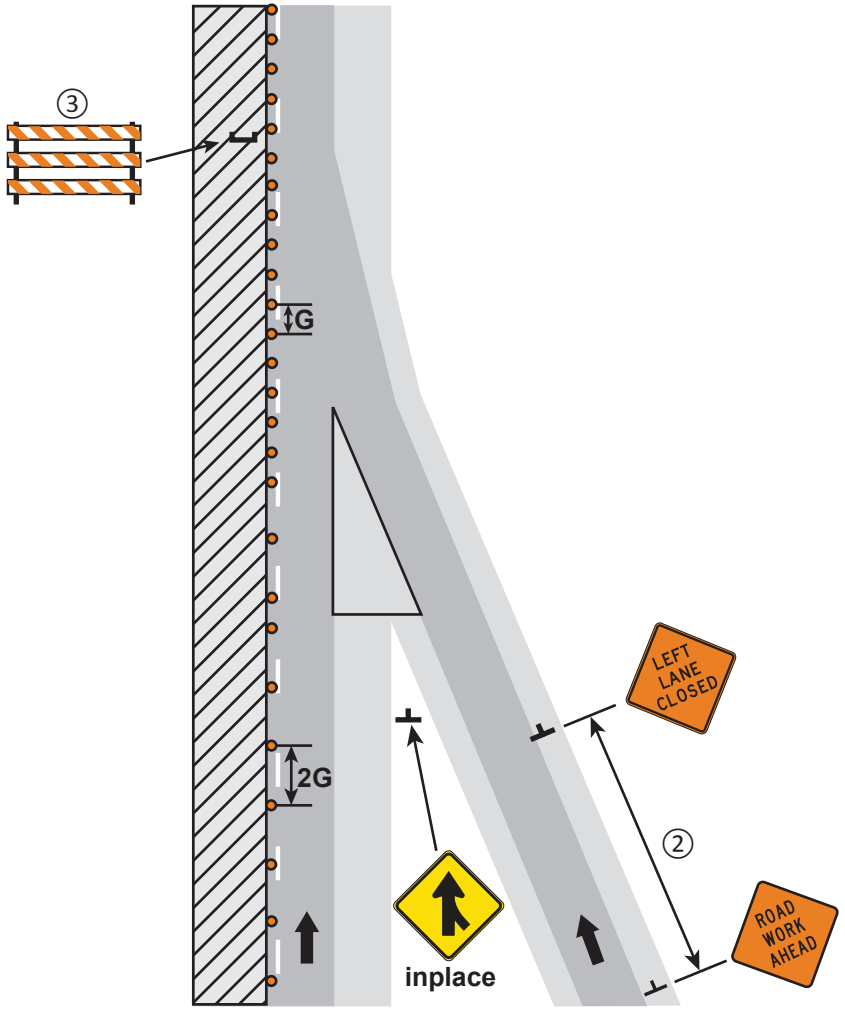
3 DAYS or LESS **LAYOUT 67**

NOTES:

1. YIELD and Yield Ahead signs may be added when geometry and traffic conditions do not allow for normal merging behavior, see Layout 69.

② The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.

③ Place the Type III Barrier approximately opposite the end of the ramp taper.



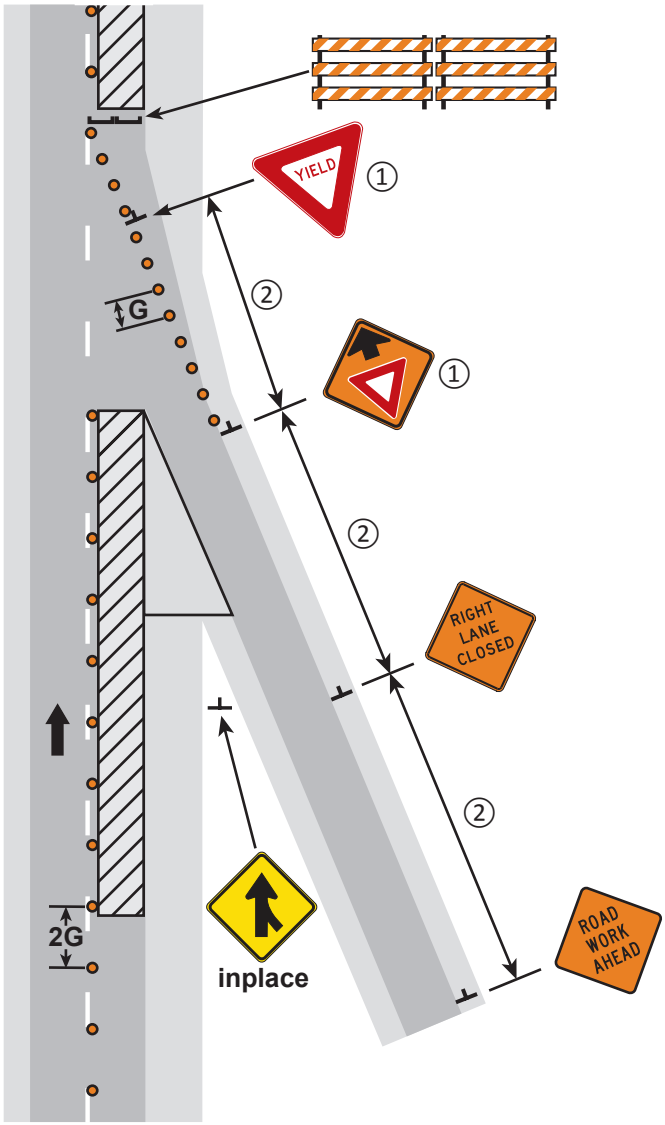
MAINLINE LEFT LANE CLOSED
ENTRANCE RAMP OPEN

3 DAYS or LESS **LAYOUT 68**

NOTES:

① Adjust the ramp entrance to fit the conditions to allow a ramp acceleration lane if possible. YIELD and Yield Ahead signs may be omitted when geometry and traffic conditions allow for normal merging behavior.

② The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.



MAINLINE RIGHT LANE CLOSED
ENTRANCE RAMP OPEN

3 DAYS or LESS **LAYOUT 69**

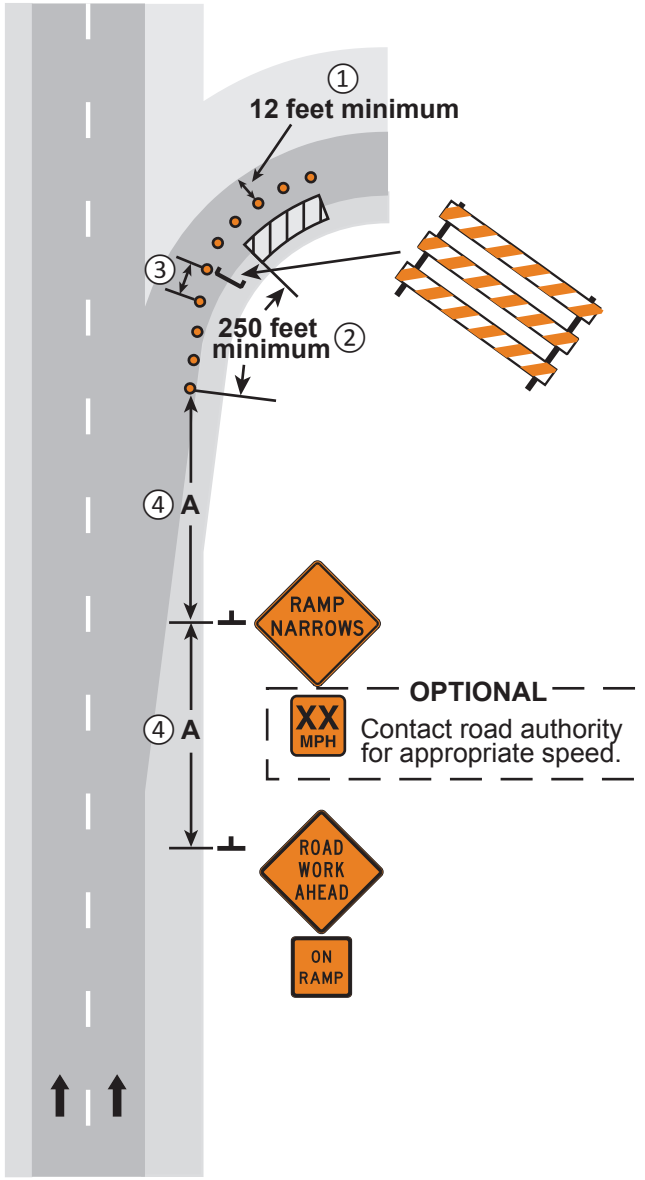
NOTES:

① Truck off-tracking should be considered when determining whether the 12 foot minimum lane width is adequate.

② Use a 250 feet minimum taper.

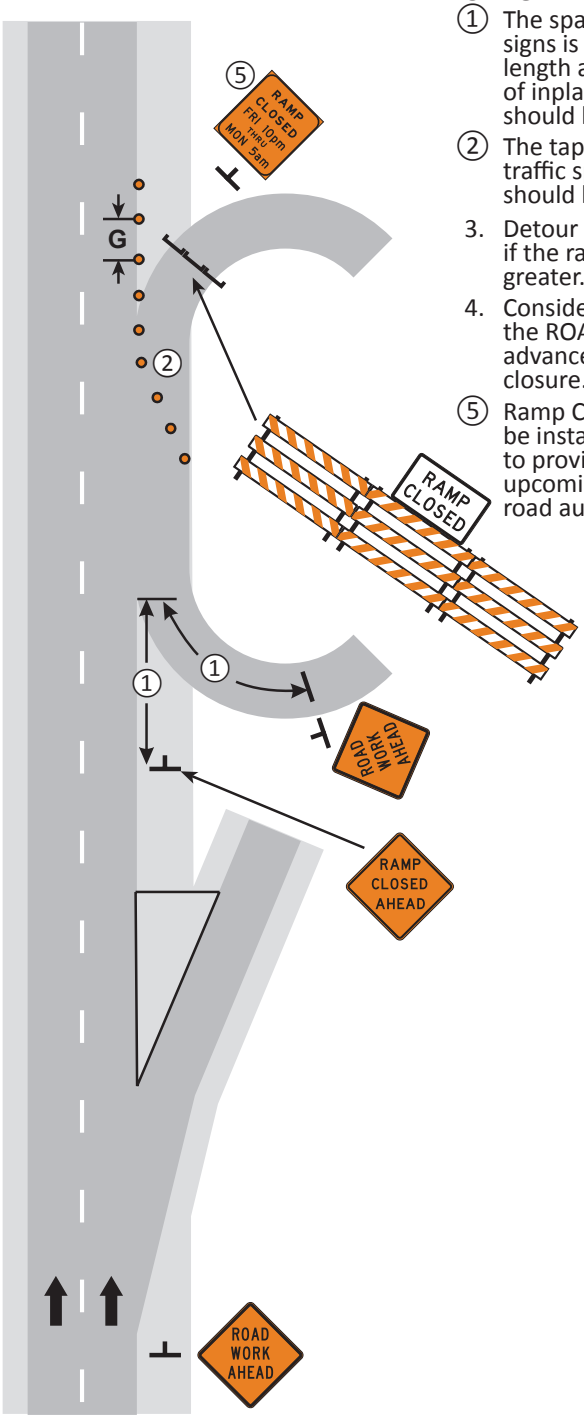
③ For loops use 25 feet spacing between devices. For ramps use 50 feet spacing between devices.

④ Adjust spacing of advanced warning signs depending on the design of the interchange and the location of inplace signing.



PARTIAL RAMP CLOSURE

3 DAYS or LESS **LAYOUT 70**



NOTES:

1. The spacing for advance warning signs is dependent on the ramp length and design, and the location of inplace signing. The spacing should be as long as practical.
2. The taper 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 one hour or greater.
4. Consider adding a PCMS prior to the ROAD WORK AHEAD sign to give advanced notification of the loop closure.
5. Ramp Closure Notice sign should be installed in advance (timewise) to provide adequate notification of upcoming closure as required by the road authority.

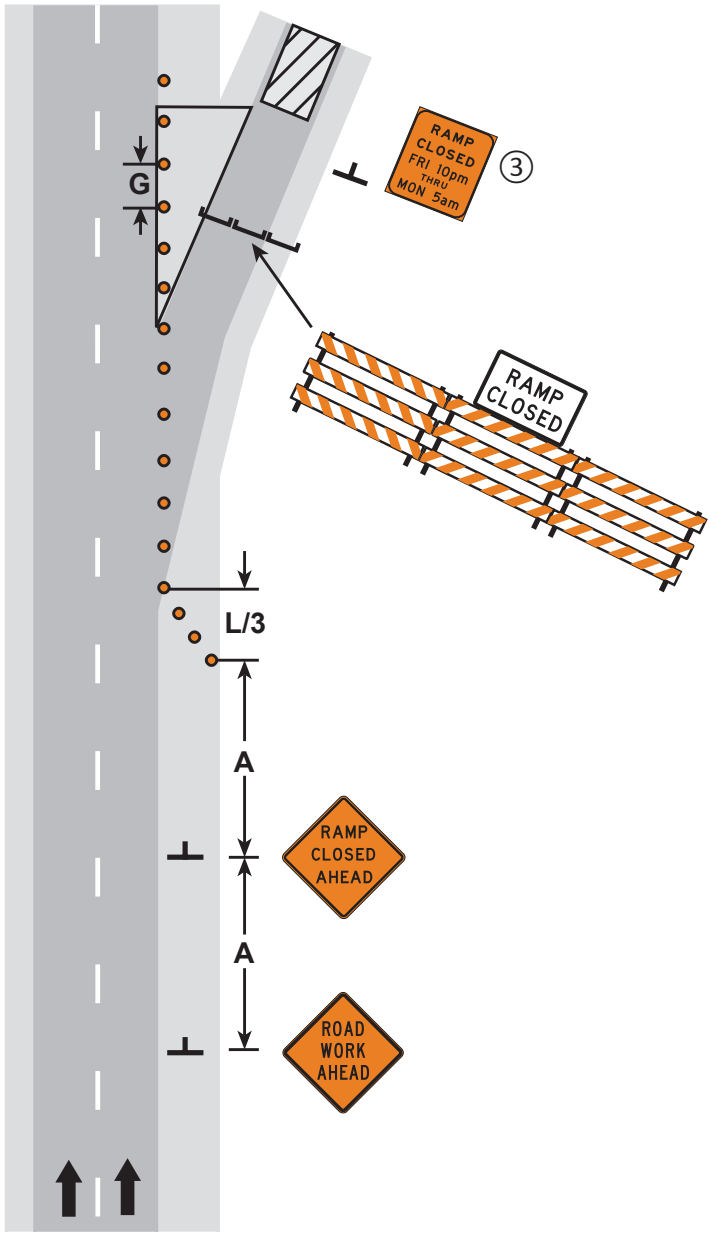
EXIT LOOP CLOSURE

3 DAYS or LESS **LAYOUT 71**

NOTES:

1. Detour signing should be considered if the ramp is closed for one hour or greater.
2. Consider adding a PCMS prior to the ROAD WORK AHEAD sign to give advanced notification of the ramp closure.

③ Ramp Closure Notice sign should be installed in advance (timewise) to provide adequate notification of upcoming closure as required by the road authority.



EXIT RAMP CLOSURE

3 DAYS or LESS **LAYOUT 72**

NOTES:

1. The road authority shall be contacted prior to closure.
2. Traffic should not be stopped for intervals of greater than 15 minutes.

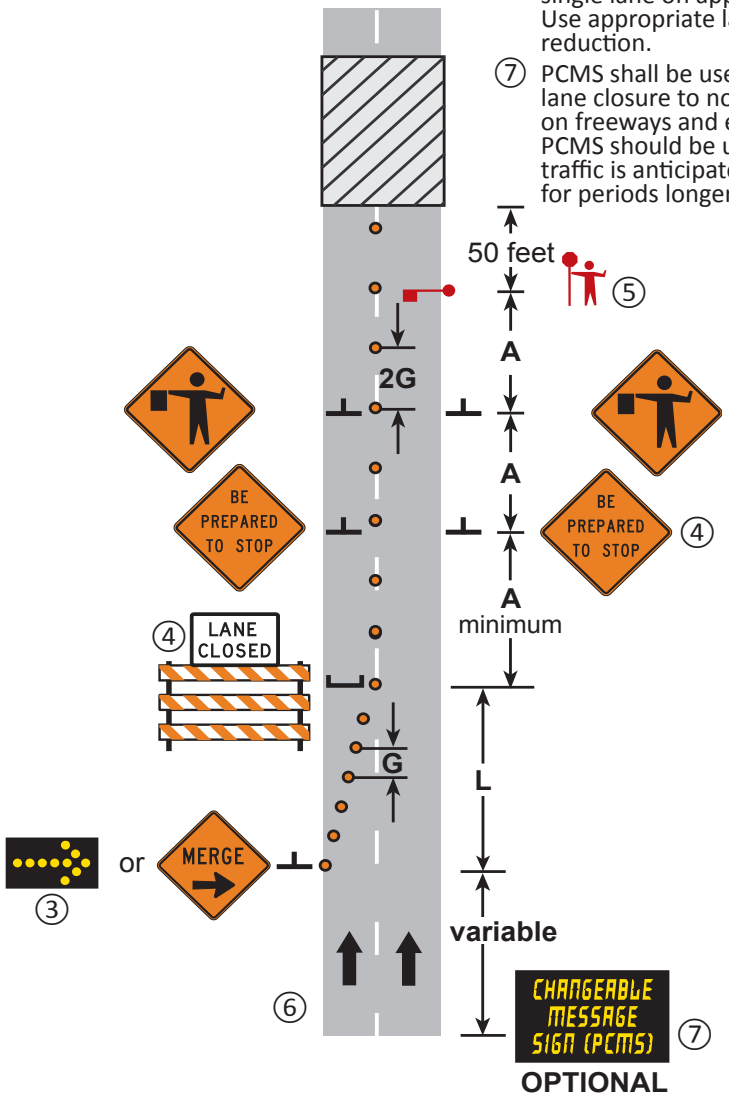
③ The Flashing Arrow Board shall be used when the posted speed limit is 45 mph or greater. The Flashing Arrow Board shall placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

④ The LANE CLOSED sign and/or the BE PREPARED TO STOP sign may be omitted when the posted speed limit is 40 mph or less.

⑤ Law Enforcement may be used instead of or in addition to a flagger.

⑥ Traffic should be reduced to a single lane on approach to flagger. Use appropriate layout(s) for lane reduction.

⑦ PCMS shall be used prior to the lane closure to notify the public on freeways and expressways. PCMS should be used anytime traffic is anticipated to be stopped for periods longer than 5 minutes.



TEMPORARY ROAD CLOSURE
MULTI-LANE DIVIDED ROAD

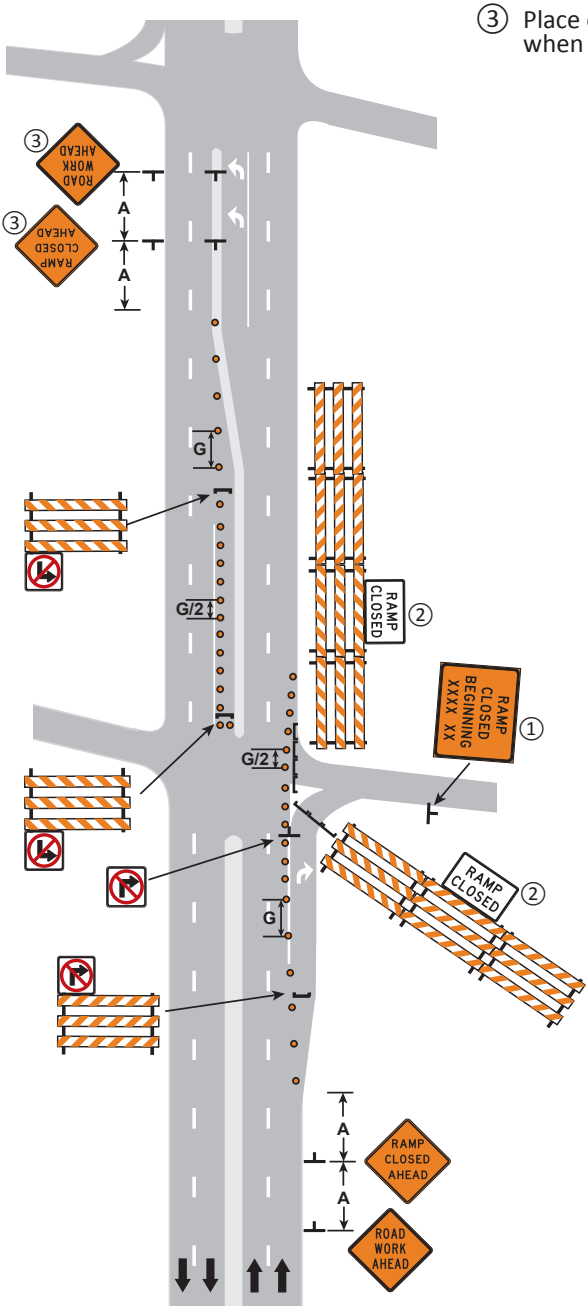
12 HOURS or LESS **LAYOUT 73**

NOTES:

① Ramp Closure Notice sign should be installed in advance (timewise) to provide adequate notification of upcoming closure as required by the road authority.

② Use ROAD CLOSED (R11-2) when road is closed.

③ Place on left shoulder/median when possible.



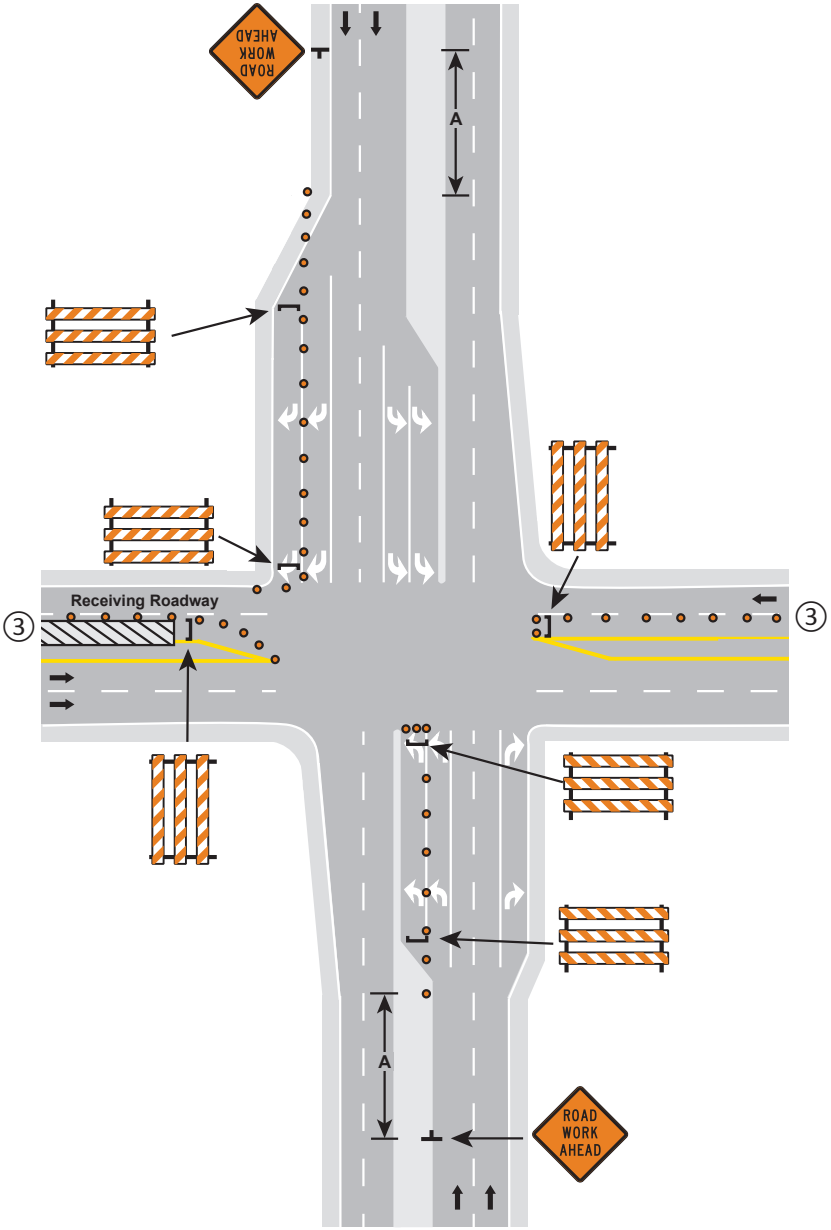
CLOSURE AT TOP OF ENTRANCE RAMP
MULTI-LANE DIVIDED ROAD

3 DAYS or LESS **LAYOUT 74**

NOTES:

1. Contact the road authority for signal timing modifications before beginning work at or near any signalized intersection.
2. It is preferable to close the left-most dual left turn lane and the right-most dual right turn lane regardless of which lane is closed on the receiving roadway. Verify that turning movements can be completed.

③ For traffic control on receiving/intersecting roadway see proper layout.



CLOSING ONE TURN LANE ON DUAL TURN LANES

Work on Intersecting Roadway

3 DAYS or LESS **LAYOUT 75**

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Miscellaneous Layouts

Layouts for Continuously Moving and Miscellaneous Operations.

**Drawings Not To Scale*

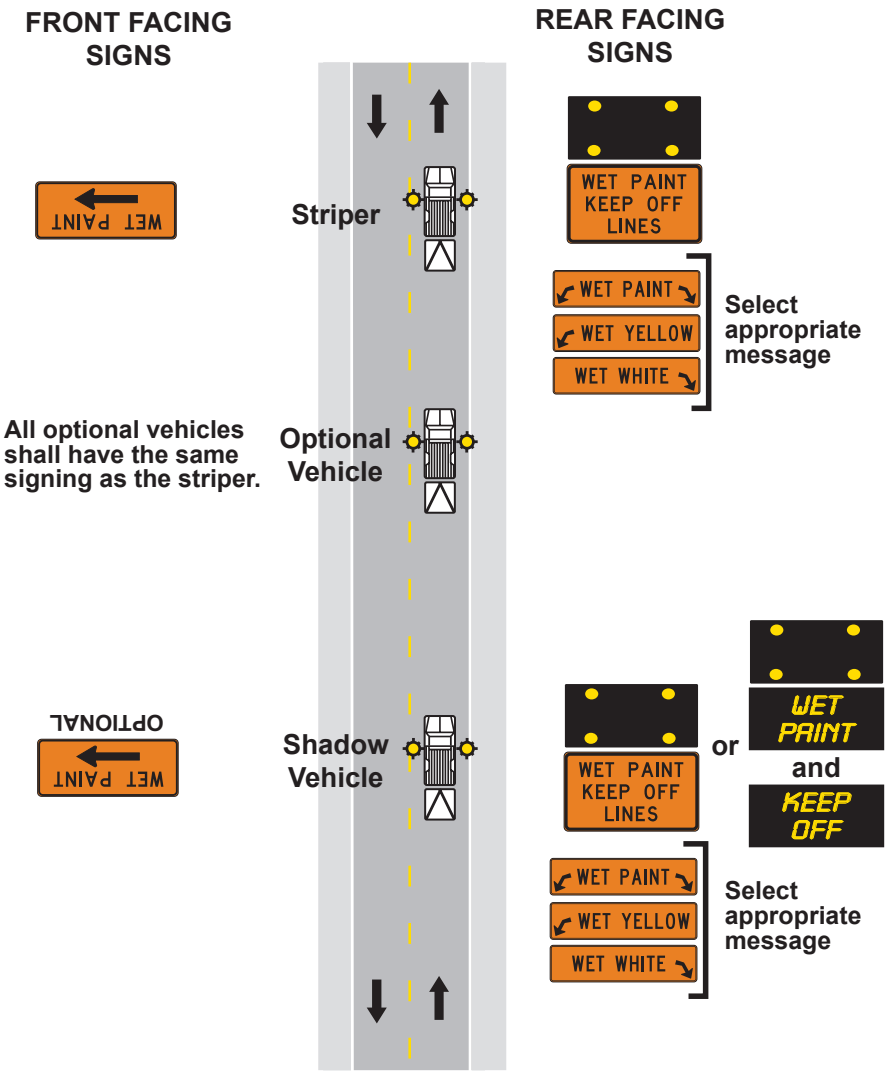
MISCELLANEOUS LAYOUTS

Refer to the layouts for roadway type, volume, or speed limit restrictions.

Miscellaneous Operations	
	Layout Number
Striping Operations - Two-Lane Roads	**76, 77**
Striping Operations - Multi-Lane Roads	**78, 79**
Off Road Operation	**10**
Motor Grader - Gravel Road Maintenance	**30**
Flagging Cross-Roads and Blind Curves	**19**
Flagging at Moving Work Spaces	**17**
Flagging Station Options	**23**
Surfacing Operation at Intersection	**66**
Lane Closure, Single Lane Roundabout	**84**
Left Lane Closure, 2 Lane Roundabout	**85**
Right Lane Closure, 2 Lane Roundabout	**86**
Typical Bump/Dip	**80**
Control Burn	**81**
Crossroad and Confirmation Signing	**35**
Advisory Dynamic Speed Display	**82**
Workers Present Speed Limit	**83**
Closures	
Layouts for closures or roadway, bicycle, or pedestrian facilities.	**Layout Number**
Road Closure for Special Event (ADT <400, Speed Limit ≤ 30 mph)	**5**
Two-Lane, Two-Way Road Closure	**31, 32**
Multi-Lane Undivided Road Closure	**48, 32**
Multi-Lane Divided Closure	**55, 73, 32**
Bicycle Lane	**87**
Sidewalk Detour	**88**
Sidewalk Bypass	**89**

NOTES:

1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the Striper and the most upstream Shadow Vehicle should be determined by the track free time of the pavement marking material and/or traffic conditions.
3. Any vehicle(s) operated totally or partially in a **high speed** traffic lane should be equipped with a TMA.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "WET PAINT" signs should be considered.

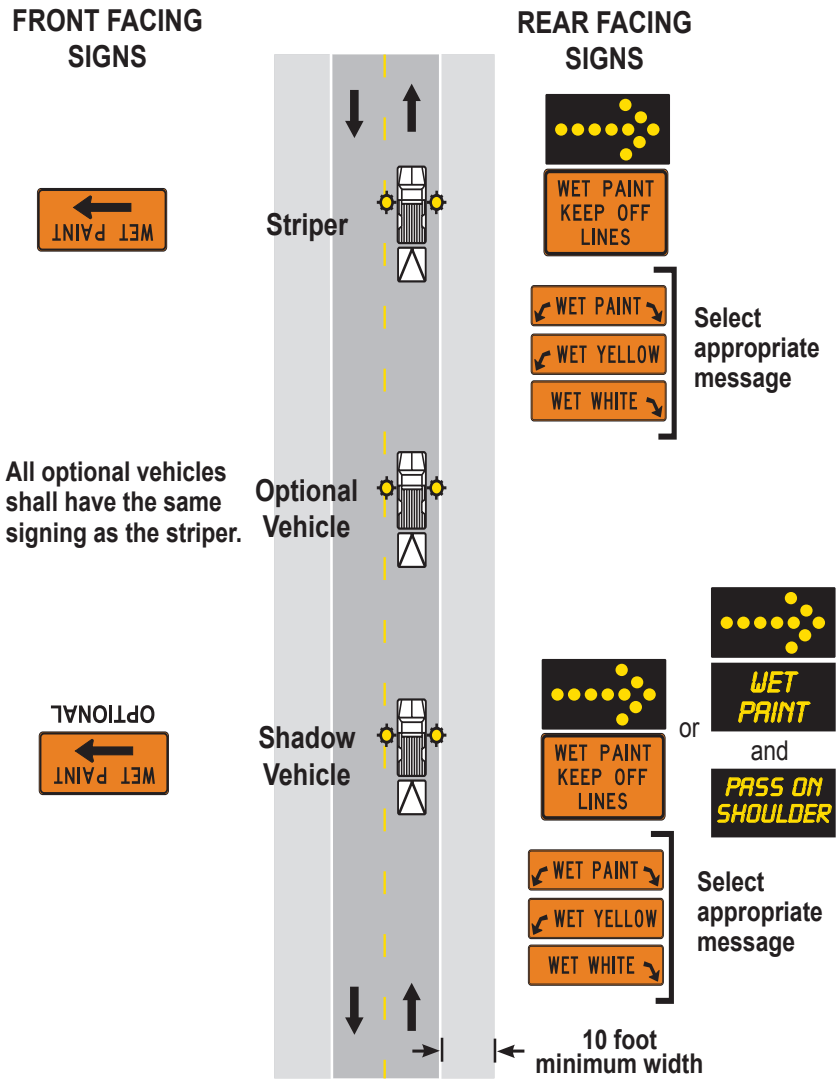


STRIPING OPERATIONS
TWO-LANE, TWO-WAY ROAD

15 MINUTES or LESS **LAYOUT 76**

NOTES:

1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the Striper and the most upstream Shadow Vehicle should be determined by the track free time of the pavement marking material and/or traffic conditions.
3. Any vehicle(s) operated totally or partially in a **high speed** traffic lane should be equipped with a TMA.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "WET PAINT" signs should be considered.



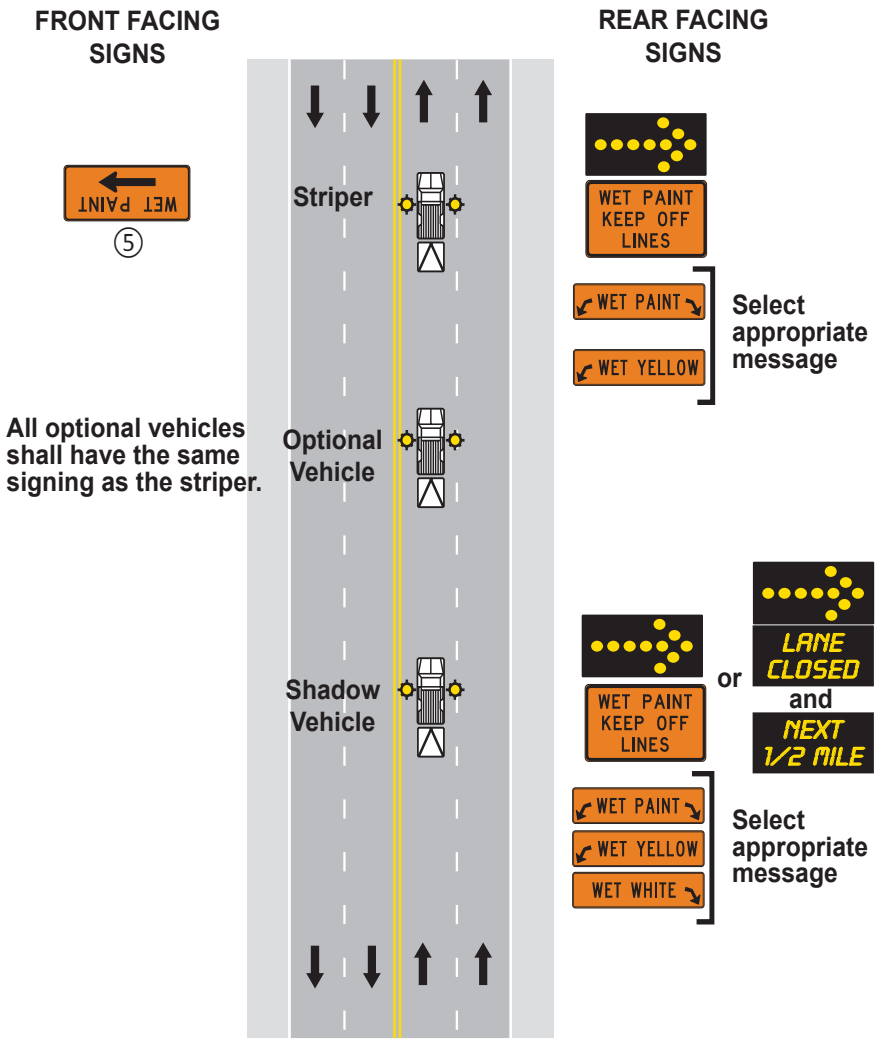
STRIPING OPERATIONS
Passing on Shoulder
TWO-LANE, TWO-WAY ROAD

15 MINUTES or LESS **LAYOUT 77**

NOTES:

1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the Striper and the most upstream Shadow Vehicle should be determined by the track free time of the pavement marking material and/or traffic conditions.
3. Any vehicle(s) operated totally or partially in a **high speed** traffic lane should be equipped with a TMA.
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 the vehicle in the right lane.



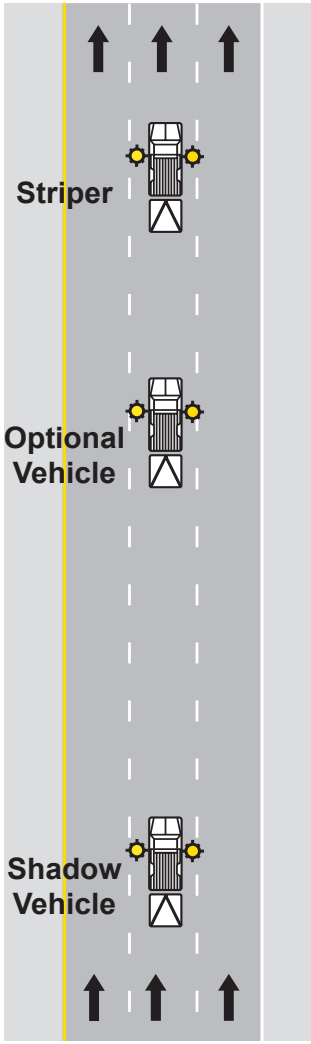
STRIPING OPERATIONS

Centerline - Lane Line - Edgeline Striping
FOUR-LANE UNDIVIDED ROAD

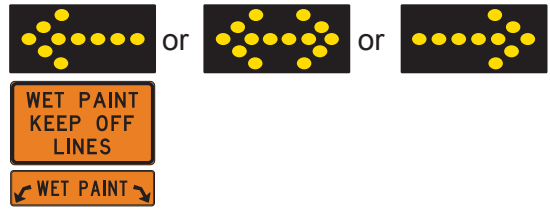
15 MINUTES or LESS **LAYOUT 78**

NOTES:

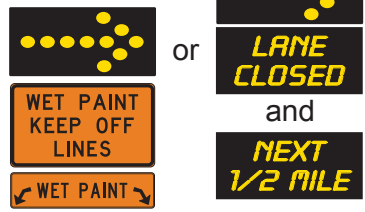
1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the Striper and the last Shadow Vehicle should be determined by the track free time of the pavement marking material.
3. Any vehicle(s) operated totally or partially in a **high speed** traffic lane should be equipped with a TMA.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "WET Paint" signs should be considered.



REAR FACING SIGNS



All optional vehicles shall have the same signing as the striper.



STRIPING OPERATIONS

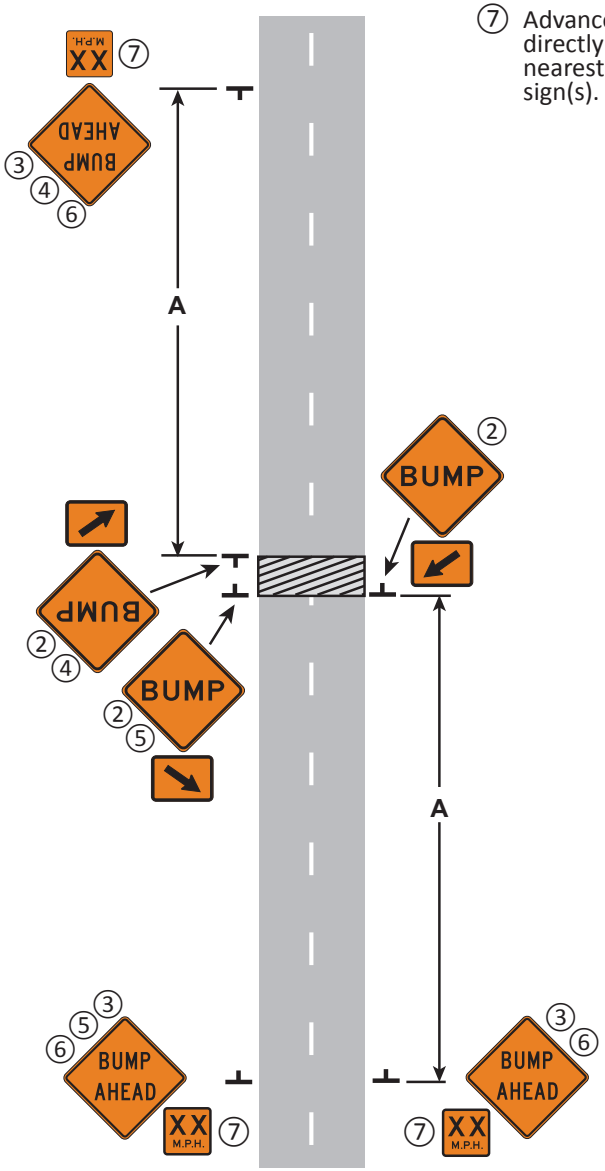
Lane Line Striping - Center Lane Operations

MULTI-LANE DIVIDED ROAD

15 MINUTES or LESS **LAYOUT 79**

NOTES:

1. Multiple bumps should use ROUGH ROAD sign.
2. When a dip, use DIP signs.
3. May use STEEL PLATE AHEAD sign when bump is caused by steel plate.
4. Use on two-lane, two-way roadways.
5. For multi-lane divided or one-way road only.
6. The BUMP AHEAD signs may be omitted if the posted advisory speed is 10 mph or less than the posted regulatory speed.
7. Advance plaques shall be placed directly below or on the lower side nearest traffic of the BUMP AHEAD sign(s).



TYPICAL BUMP/DIP SIGNING

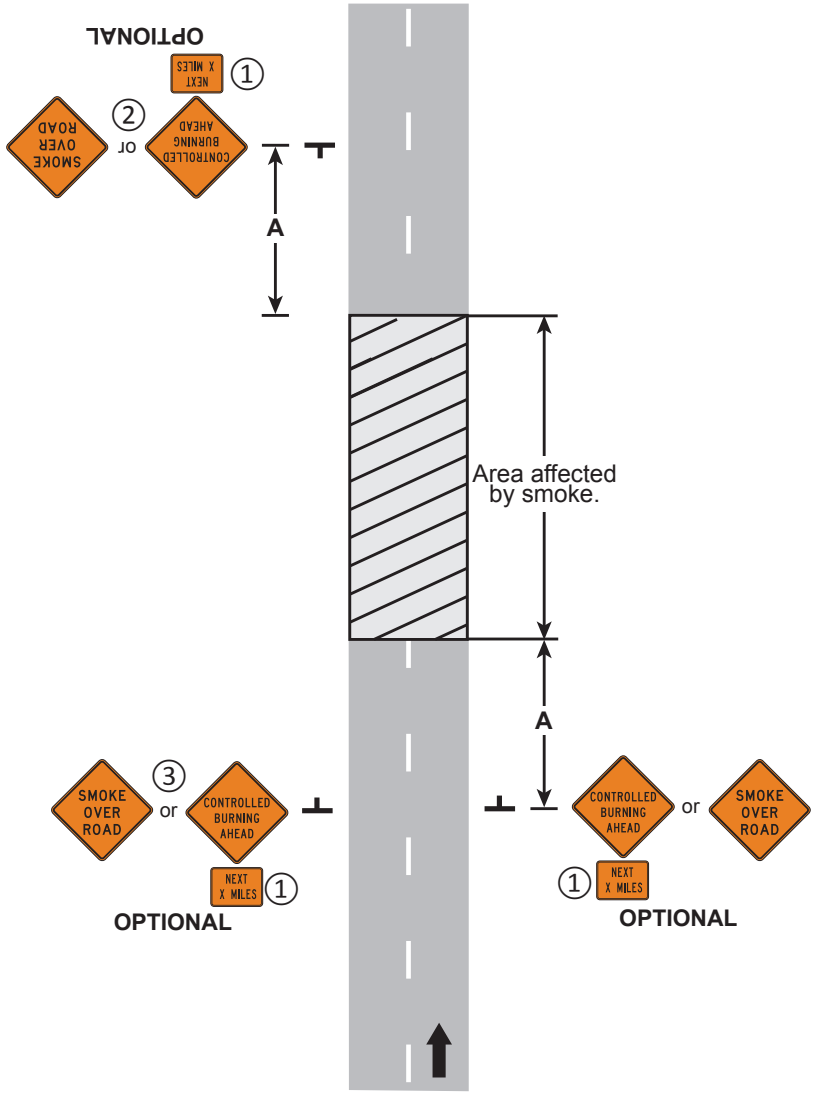
3 DAYS or LESS **LAYOUT 80**

NOTES:

① When the optional NEXT X MILES plaque(s) is used, it shall be placed directly below or on the lower side nearest traffic of the appropriate warning sign(s).

② Use on two-lane, two-way roads.

③ For multi-lane divided or one-way roadways.



CONTROLLED BURN

12 HOURS or LESS **LAYOUT 81**

NOTES:

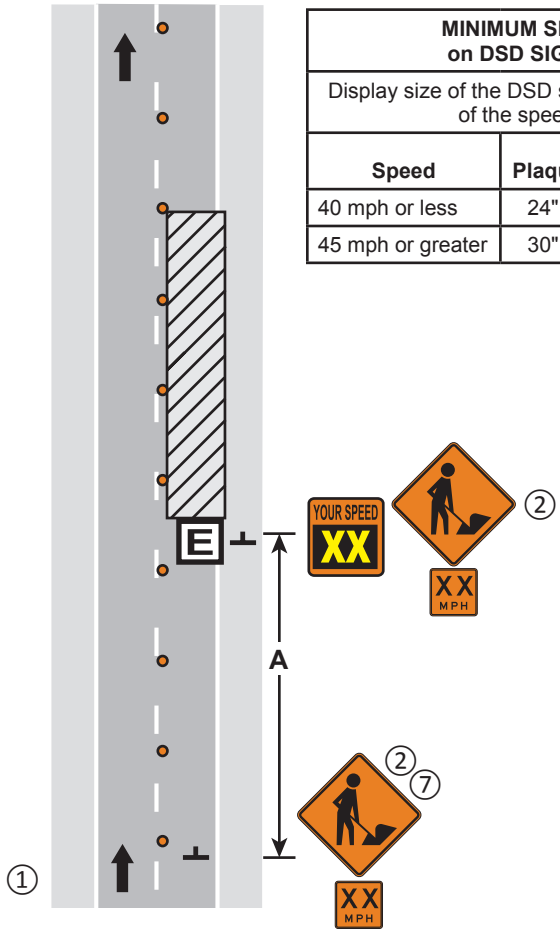
① Use the appropriate layout for channelizing, advance signing, and spacing.

② The XX MPH advisory speed plaque shall be placed directly below or on the lower side nearest traffic of the appropriate warning sign. The sign assembly shall be removed when the conditions that required the sign are no longer present. Dynamic Speed Display (DSD) shall be black on orange.

3. The advisory speed value shall not be higher than any inplace regulatory speed limit.
4. An advance warning sign with an advisory speed plaque should not be placed near a regulatory speed sign. If necessary, consider covering the inplace regulatory speed signs.
5. Advisory speed assemblies may be placed in the buffer or work space as long as the assemblies are not blocked by vehicles or devices.
6. See "Speed Limits in Work Zones Guidelines" (https://www.dot.state.mn.us/speed/pdf/wzspeedlimitguideline.pdf) for more information on work zone speed limits.

⑦ The warning sign assembly may be omitted if the posted advisory speed is 10 mph or less than the posted regulatory speed limit.

MINIMUM SPECIFICATIONS on DSD SIGN EQUIPMENT		
Display size of the DSD sign is dependent on the size of the speed plaque used.		
Speed	**Plaque Size**	**DSD display MIN. Character Height**
40 mph or less	24" X 24"	10"
45 mph or greater	30" X 30"	14"



ADVISORY DYNAMIC SPEED DISPLAY

3 DAYS or LESS **LAYOUT 82**

NOTES:

1. Contact the road authority for requirements to implement a Workers Present Speed Limit.

② All inplace speed limit signs shall be covered when Workers Present Speed Limit is implemented.

3. Workers Present Speed Limit assemblies shall be removed, covered, or modified to the existing posted speed limit when workers are not present directly adjacent to traveled lanes.

4. Workers Present Speed Limit assemblies may be placed in the buffer or work space as long as the assemblies are not blocked by vehicles or devices.

5. As workers proceed through the work area, the assembly shall be no greater than 1 mile in advance of the work crew. For Workers Present Speed Limits where the posted speed limit is 40 mph or less, the assembly should be no greater than 1/2 mile in advance of the work crew.

⑥ The Reduced Speed Ahead sign shall be used when the Workers Present Speed Limit is more than 10 mph below the posted speed limit.

⑦ The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater and placed on the shoulder. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

⑧ The LANE CLOSED and/or the Lane Ends sign may be omitted when the posted speed limit is 40 mph or less.

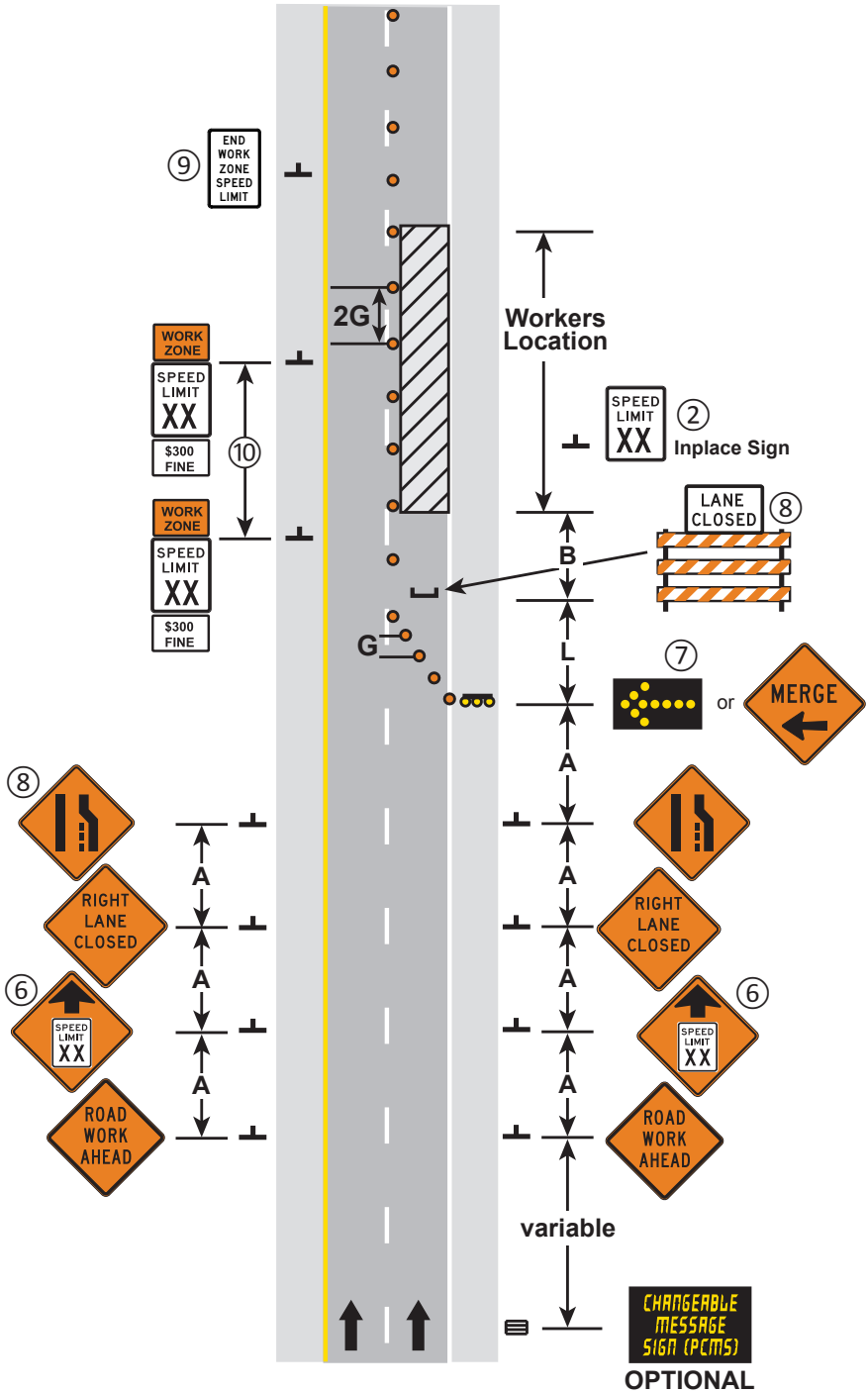
⑨ A black on white END WORK ZONE SPEED LIMIT sign (R2-12) shall be placed within a mile of the last work crew (within 1/2 mile if speed limit is 40 mph or less) to indicate the end of the higher fines area.

⑩ When workers are present adjacent to the traveled lanes throughout the work area, confirmatory Workers Present Speed Limit assemblies may be placed according to the spacing table below.

Typical Spacing for Workers Present Speed Limits	
Workers Present Speed Limit (mph)	**Assembly Spacing (mile)**
≤ 40	1/2
≥ 45	1

WORKERS PRESENT SPEED LIMIT
LAYOUT 83a

3 DAYS or LESS **LAYOUT 83a & b**



WORKERS PRESENT SPEED LIMIT
LAYOUT 83b

3 DAYS or LESS **LAYOUT 83a & b**

NOTES:

1. **Each roundabout is unique and 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. Flagging 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 (or more) can be maintained while shoulder work on an approach is being performed, the driving lane(s) may remain open to traffic.

③ Approach signs are the same in all directions.

4. Flaggers shall control traffic flow on all approaches of the one-lane roundabout.

5. A lead flagger shall be designated and radio communication shall be used by the flaggers.

6. Only one approach of traffic shall be released at a time.

7. At night, flagger stations shall be illuminated. Street lights and vehicle headlights shall not be used to illuminate the flagger station.

8. Type B channelizers may be used.

9. A PCMS 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.

⑩ The two-way taper should be 50 feet using 5 equally spaced channelizing devices.

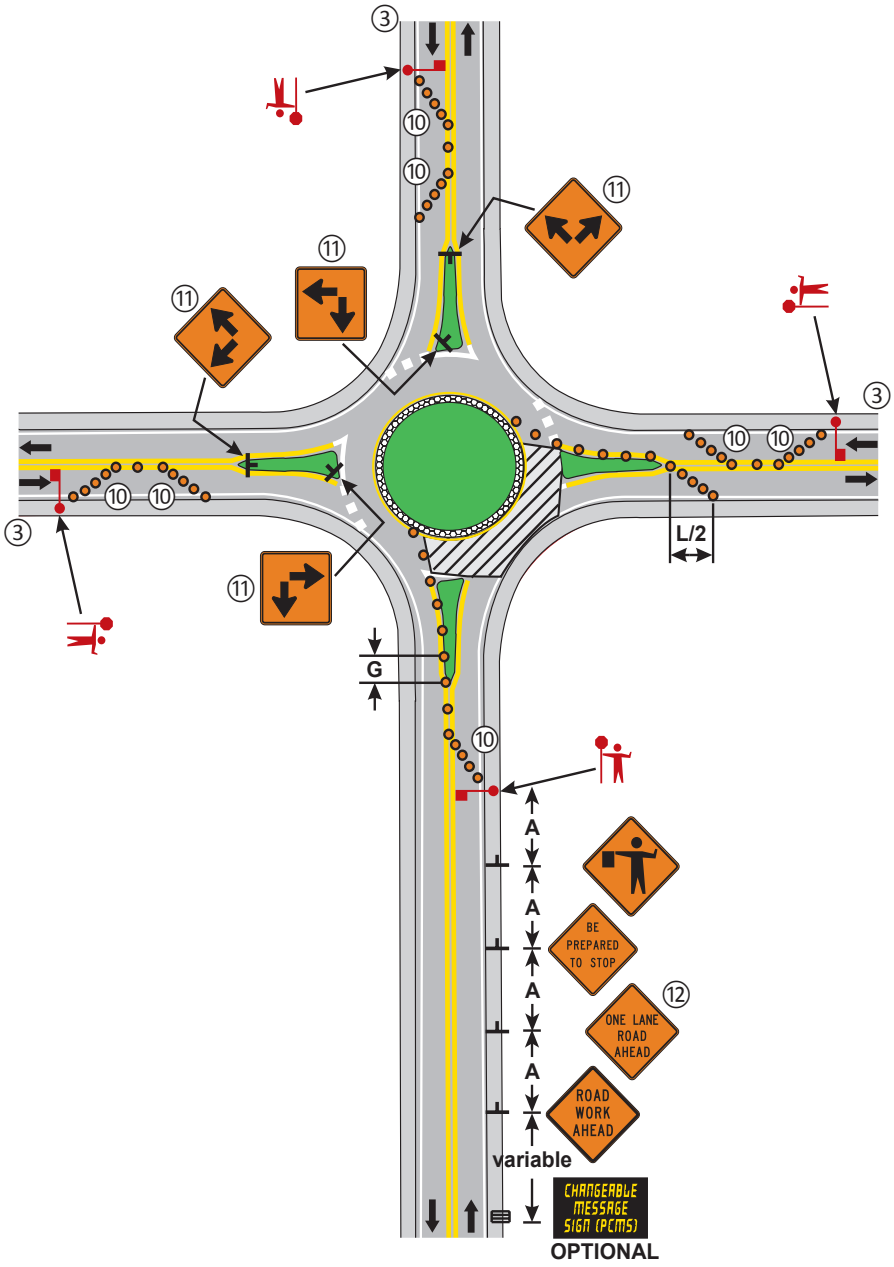
⑪ The Double Arrow sign may be replaced with destination signing.

⑫ The ONE LANE ROAD AHEAD sign may be omitted at 45 mph or less.

LANE CLOSURE IN ROUNDABOUT

Single Lane Roundabout

3 DAYS or LESS **LAYOUT 84a** **LAYOUT 84a & b**



LANE CLOSURE IN ROUNDABOUT

Single Lane Roundabout

LAYOUT 84b

3 DAYS or LESS **LAYOUT 84a & b**

NOTES:

1. **Each roundabout is unique and 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) Traffic control on all approaches are the same.

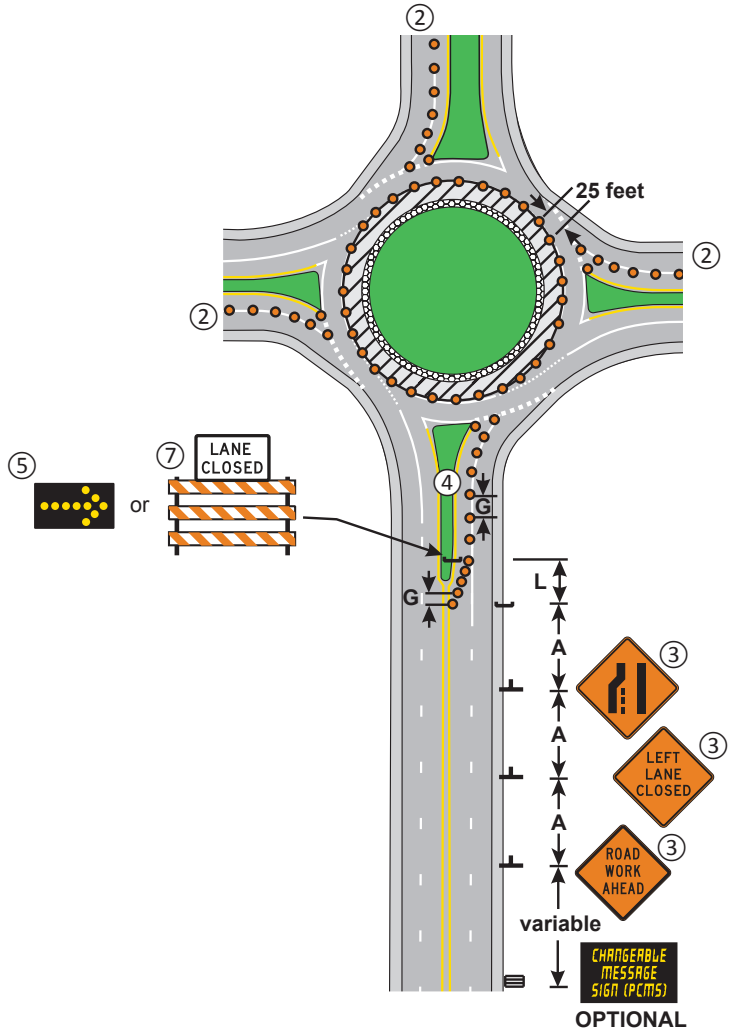
(3) On divided highways having a median wider than 8 feet, right and left sign assemblies shall be required.

(4) Type B channelizers may be used.

(5) The Flashing Arrow Board shall be used when the posted speed limit is 45 mph or greater.

6. Consideration should be given to truck/bus traffic.

(7) The LANE CLOSED sign is optional at 40 mph or less.



LEFT LANE CLOSURE IN ROUNDABOUT

Two-Lane Roundabout

3 DAYS or LESS **LAYOUT 85**

NOTES:

1. **Each roundabout is unique and 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) Traffic control on all approaches are the same.

(3) On divided highways having a median wider than 8 feet, right and left sign assemblies shall be required.

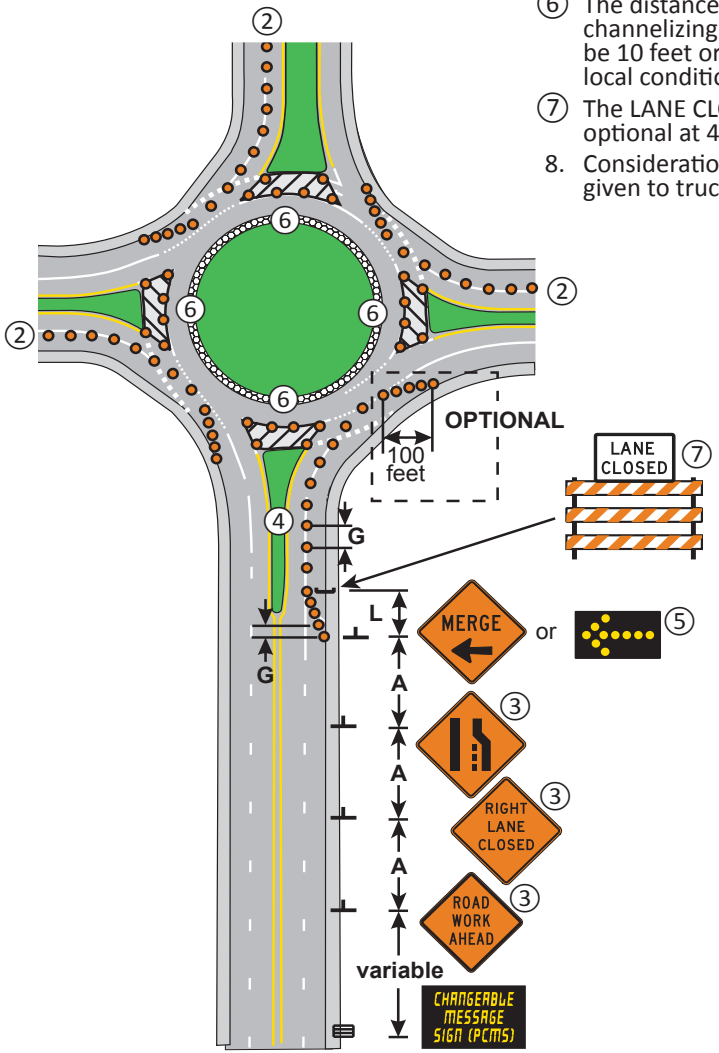
(4) Type B channelizers may be used.

(5) The Flashing Arrow Board shall be used where the posted speed limit is 45 mph or greater and placed on the shoulder when possible. If there is no shoulder, or the shoulder is too narrow, place at the end of the taper in lieu of the Type III barricade assembly.

(6) The distance between channelizing devices should be 10 feet or adjusted for local conditions

(7) The LANE CLOSED sign is optional at 40 mph or less.

8. Consideration should be given to truck/bus traffic.



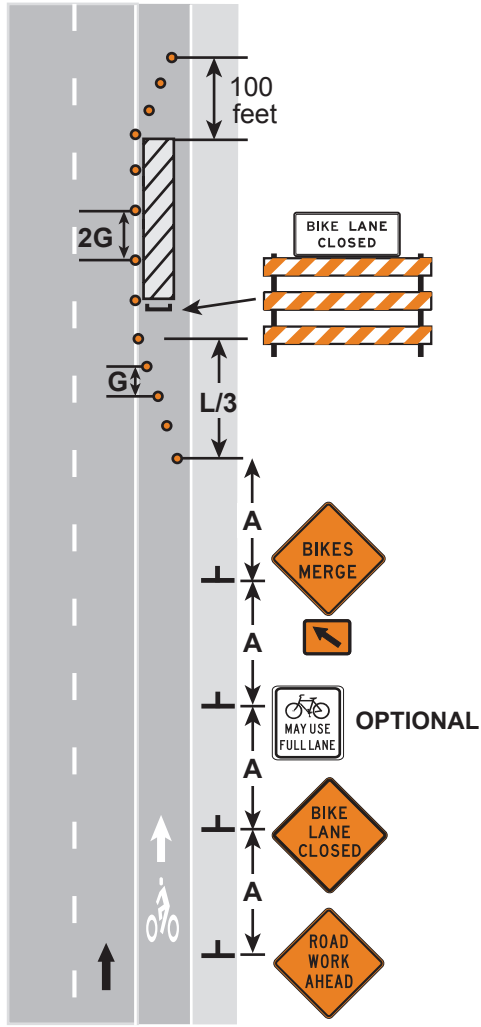
RIGHT LANE CLOSURE IN ROUNDABOUT

Two-Lane Roundabout

3 DAYS or LESS **LAYOUT 86**

NOTES:

1. Use this layout when work is occurring in the bicycle lane or traffic is to be diverted into the bicycle lane downstream.
2. The road authority shall be contacted prior to closure and may provide requirements related to detours and/or additional temporary traffic control.
3. A designated bicycle lane should be maintained through the work zone if possible.
4. On multi-lane roads with bicycle lanes or bikeable shoulders, one or more travel lanes may be closed or narrowed to maintain space for the bicycle lane.
5. On-road bicyclists should not be directed onto a path or sidewalk except where such a path or sidewalk is a shared-use path or there is no practical alternative.
6. Avoid shoulder rumble strips when placing taper (except when continuous rumble strips are present).



BICYCLE LANE CLOSURE

3 DAYS or LESS **LAYOUT 87**

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NOTES:

1. When crosswalks, sidewalks, or other pedestrian facilities are blocked, closed, or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. When a sidewalk is closed but workers are present to halt operations and provide safe passage through the work site, the devices shown are not required. Pedestrians may be delayed for a short period of time for project personnel to move equipment and material to facilitate passage. Project personnel may also assist pedestrians in navigating the work zone.

3. The examples show only key typical dimensions. Refer to the MnDOT Pedestrian Accommodations Through Work Zones website (http://www.dot.state.mn.us/trafficeng/workzone/apr.html) for standards, guidance, and options when blocking, closing, or relocating pedestrian facilities.

4. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.

⑤ An approved audible message device or tactile message should be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian detour including duration, length of (and/or distance to) the by-pass, any restrictions or hazards, and project information. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.

⑥ The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be TPAR compliant. The Symbol of Accessibility shall not be displayed if the detour is not fully accessible.

7. Pedestrian traffic signal displays controlling closed crosswalks shall be covered.

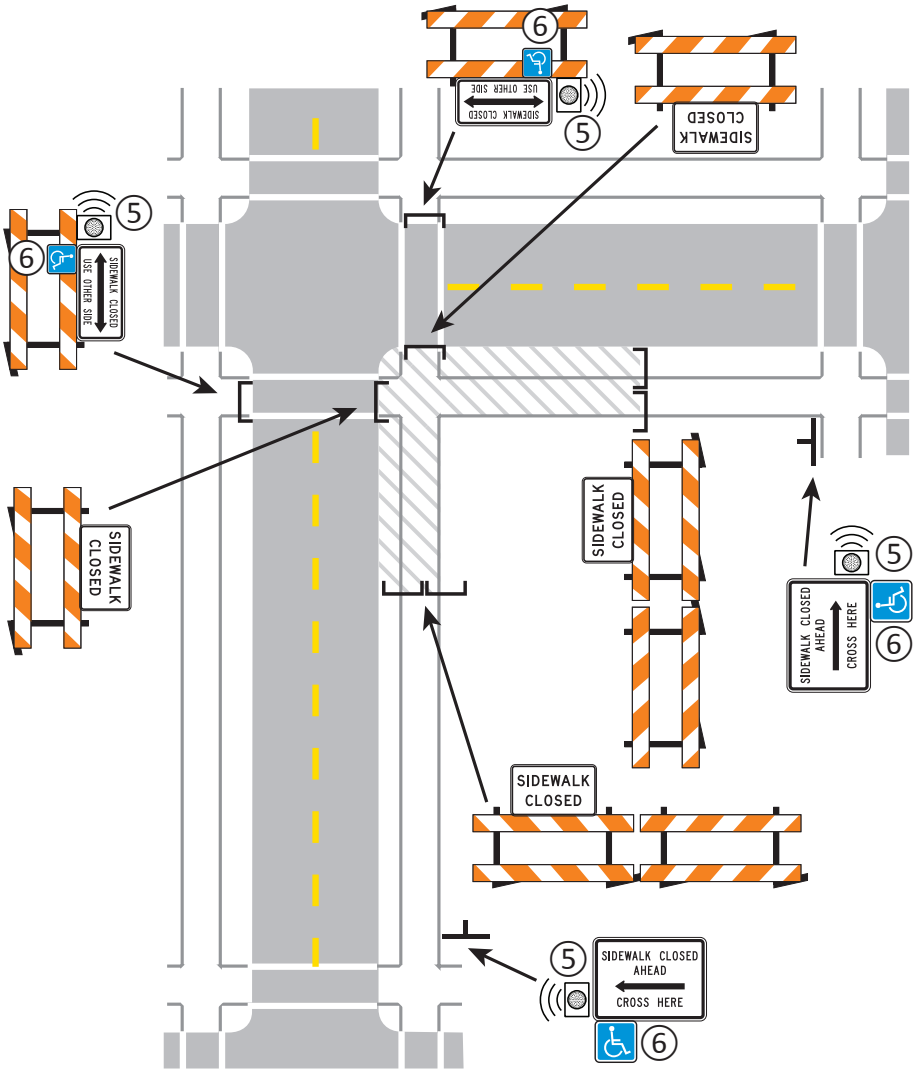
8. Pedestrian detour trailblazing signs should be used if the pedestrian detour is located someplace other than across the street from the sidewalk closure.

9. Place signs and barricades in such a way as to minimize hazard to pedestrians from walking into signs. If not possible, protect with detectable edges and/or channelizing devices.

ALTERNATE PEDESTRIAN ROUTE
CROSSWALK CLOSURES AND PEDESTRIAN DETOURS
LAYOUT 88a

3 DAYS or LESS

LAYOUT 88a & b



ALTERNATE PEDESTRIAN ROUTE
CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

3 DAYS or LESS **LAYOUT 88b** **LAYOUT 88a & b**

6K-88b

NOTES:

1. When crosswalks, sidewalks, or other pedestrian facilities are blocked, closed, or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. When a sidewalk is closed but workers are present to halt operations and provide safe passage through the work site, the devices shown are not required. Pedestrians may be delayed for a short period of time for project personnel to move equipment and material to facilitate passage. Project personnel may also assist pedestrians in navigating the work zone.

3. The examples show only key typical dimensions. Refer to the MnDOT Pedestrian Accommodations Through Work Zones website (http://www.dot.state.mn.us/trafficeng/workzone/apr.html) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.

4. Where high speeds and/or high traffic volumes are anticipated, barrier should be used to separate the temporary pedestrian walkway from vehicular traffic. When used, barriers shall be installed as detailed in the MN MUTCD, Part 6F.

5. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.

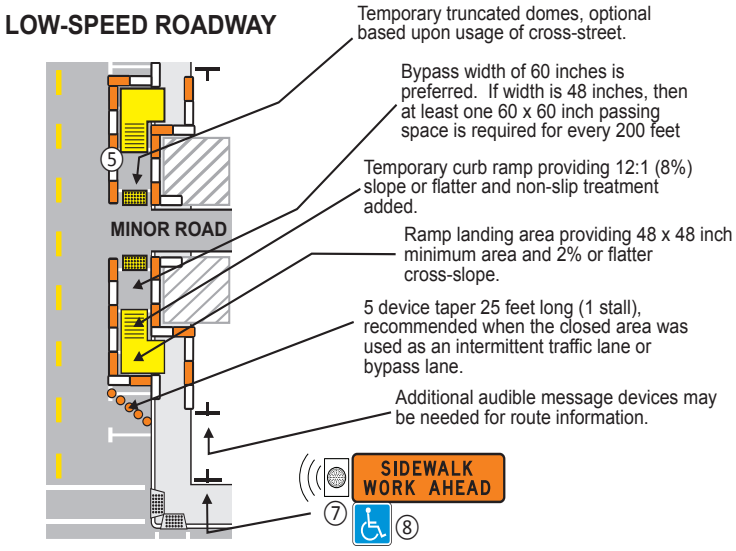
6. When both sides of a temporary pedestrian bypass require channelizing devices, the devices should be a similar type (railing system, barricade, or fencing system), excluding when a barrier (such as concrete barrier) is used to protect pedestrians from an open traffic lane.

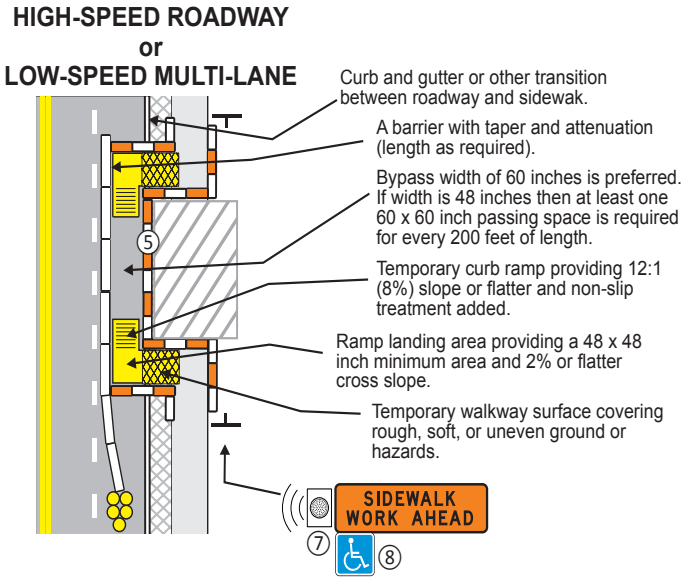
⑦ An approved audible message device or tactile message may be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian by-pass including duration, length of (and/or distance to) the bypass, any restrictions or hazards, and project information. The message device(s) may also describe an alternate route. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.

⑧ The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be fully accessible. The Symbol of Accessibility shall not be displayed if persons with disabilities should not enter the temporary pedestrian by-pass.

ALTERNATE PEDESTRIAN ROUTE
SIDEWALK BY-PASS

3 DAYS or LESS **LAYOUT 89a** **LAYOUT 89a & b**





ALTERNATE PEDESTRIAN ROUTE
SIDEWALK BY-PASS
LAYOUT 89b

3 DAYS or LESS

6K-89b

LAYOUT 89a & b

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Quality Standards

Methods to determine whether the various traffic control devices are Acceptable, Marginal, or Unacceptable.

Contents

These standards as well as the entire Field Manual, Flagging Handbook, and other documents are available on the MnDOT Traffic Engineering website:

www.dot.state.mn.us/trafficeng

Introduction

Traffic controls are a necessary part of a Temporary Traffic Control (TTC) zone to warn motorists of hazards, advise them of the proper path through the zone, delineate areas where they may not operate, and to separate them from the workers. This is accomplished by the deployment of a system of devices. The success of this system depends on the visibility of each device at the time of a project's initial installation as well as throughout the life of the project. 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. The standards in this publication should aid in the determination of the quality of temporary traffic control devices.

The use of TTC devices subjects them to wear which does not occur with permanent devices. Although errant vehicles cause much of the damage to the devices, they also deteriorate in appearance from wear that occurs during storage, shipment, installation, relocation, and removal. When many of these worn and damaged devices appear on the same project, the general appearance of the temporary traffic control zone deteriorates, reducing the level of safety provided to the workers, pedestrians, and traveling public.

The following quality standards have been developed in an effort to offset the deterioration in the appearance of TTC devices. A determination of the condition of device quality should be made 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 the work. Suppliers and contractors are encouraged to apply this standard prior to delivery of devices to the job site. Doing so will minimize agency involvement and reduce costs related to on-site replacement.

These standards are intended to cover the quality of TTC devices for planned work and are not meant to cover the needs of emergency situations.

Quality Classifications and Requirements

Temporary Traffic Control (TTC) devices in this standard have been divided into three quality classifications: **Acceptable, Marginal, and Unacceptable**.

1. **Acceptable Devices** meet MN MUTCD requirements such as design, size, color, weight, etc., are properly placed as specified, and clearly perform their intended function.

2. **Marginal Devices** are considered marginally acceptable or reaching the lower end of acceptability.

3. **Unacceptable Devices** shall not be delivered to the job site.

All TTC devices (except Category 4 trailer mounted devices) used in work zones shall be crashworthy.

The required minimum percentage of acceptable devices has been established for each type of device and varies upon the duration of the Temporary Traffic Control (TTC) zone.

Intermediate and Long Term Duration
The following requirements shall be followed for TTC zones that are to remain inplace for more than twelve (12) hours:

- At the time of the initial set up or at the time of major stage changes, one hundred percent (100%) of each type of device (channelizers, barricades, signs, warning lights, arrow boards, portable changeable message signs, pavement tape, and raised pavement markers) shall be classified as "acceptable".
- Throughout the duration of the project, the number of acceptable devices may decrease to seventy-five percent (75%) of the initial quantity of each particular device, as a result of damage and/or deterioration during the course of the work with the remainder of the devices in the “marginal” category.
- Devices in the marginal category may remain in the temporary traffic control zone until their total number exceeds the twenty-five percent (25%) maximum for that type of device, which is considered an “unacceptable“ situation. Should the percentage of devices in the marginal category exceed twenty-five percent (25%), all marginal devices shall be replaced so as to bring the group of devices back up to acceptable standards.
- All devices categorized as unacceptable shall be replaced within twelve (12) hours of notification.
- Missing or knocked down devices should be replaced or re-set in a timely manner.

Short Term Duration

The following requirements may be followed for TTC zones that are to remain in place for less than twelve (12) hours:

- At the time of the initial set up, one hundred percent (100%) of all TTC devices except channelizing devices and barricades shall be classified as "acceptable". During the short term duration of the project, the intermediate and long term duration standards shall be maintained for these devices.
- At the time of the initial set up, a minimum of seventy-five percent (75%) of each type of channelizer and barricade shall be classified as "acceptable". Up to a maximum of twenty-five percent (25%) of these devices may be classified as "marginal". “Unacceptable” devices shall not be installed.
- During the short term duration of the project, the number of marginal devices may increase beyond the twenty-five percent (25%) of the initial quantity, as a result of damage and/or deterioration during the course of the work.
- Missing or knocked down devices should be replaced or re-set in a timely manner.

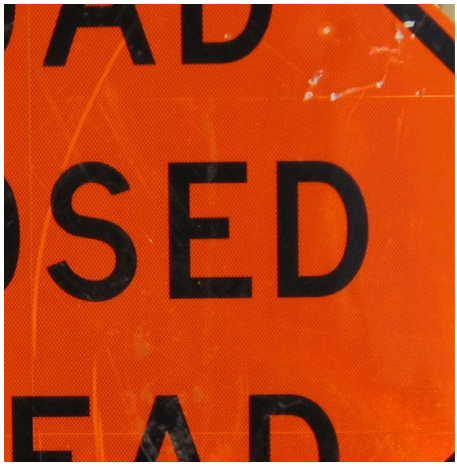
The following descriptions, together with the accompanying photographs, should be used to determine if a device is acceptable, marginal, or unacceptable.

EVALUATION GUIDE:
Warning Signs

Acceptable
To be considered acceptable, a sign shall meet all of the following conditions:

- There may be several abrasions on the surface, but very little loss of lettering.
- There has been no touch up of the lettering.
- The message is legible both day and night.
- Sign faces shall be approximately perpendicular to the roadway. Post-mounted signs are no more than 3 inches out-of-plumb for the entire height of the assembly. Signs on portable stands are no more than 3 inches per foot out-of-plumb for the entire height of the assembly.
- The back side is free of any retroreflective materials except small logos or identification markings and have a bare surface or be painted a uniform color as approved by the road authority.
- The sign is inplace at the specified spacing and properly aligned to traffic.

Examples of "Acceptable" warning signs.



EVALUATION GUIDE:
Warning Signs, cont.

Marginal
Signs are considered marginal if they meet all conditions listed under acceptable with the exception of either of the following conditions:

- There are many surface abrasions throughout the sign face, and 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.

Examples of "Marginal" warning signs.

EVALUATION GUIDE:
Warning Signs, cont.

Unacceptable
A sign is considered unacceptable if it meets any of the following conditions:

- Asphalt splatter, cement slurry, other residue, or abrasions that are evident on the face of the sign.
- Portions of letters are missing such that they become confusing to identify.
- The message is illegible or defaced.
- There is noticeable color fading or loss of retroreflectivity at night.
- Sign face is not perpendicular to the roadway.
- Signs on post-mounted structures are installed more than 3 inches out-of-plumb for the entire height of the assembly.
- Signs on portable structures are more than 3 inches per foot out-of-plumb for the entire height of the assembly.
- Signs are damaged or defaced in a way that they no longer have the same shape as a new sign.

Examples of "Unacceptable" warning signs.

EVALUATION GUIDE:
Type A & B Channelizing Devices

Acceptable
To be considered acceptable, a channelizing device shall meet all of the following conditions:

- The shape should remain clearly identifiable with no significant distortion and shall be free standing in its normal position.
- Surface is free of punctures and abrasions.
- Surface is free of asphalt splatter, cement slurry, or other material, and will readily respond to washing.
- The retroreflective 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
The channelizing device is considered marginal if it meets any of the following conditions:

- The surface has some asphalt splattering or cement slurry and may not be readily cleaned due to abrasions and discoloration.
- The retroreflective bands have numerous tears and scratches; but have no large areas of residue or missing retroreflective material.
- Any dents do not reduce the strength of the device.

EVALUATION GUIDE:
Type A & B Channelizing Devices, cont.

Unacceptable
A channelizing device is considered unacceptable if it meets any of the following conditions:

- Punctures and large areas of staining asphalt splatter or cement slurry that cannot be cleaned due to abrasions or discoloration.
- There is noticeable fading of the device's color.
- Large areas of missing or stained retroreflective material.
- Substantial deformation of a device, which reduces the original dimensions, or the device has lost the intended shape.
- Several dents or fractures that affect their stability or ability to retain the retroreflective sheeting.

EVALUATION GUIDE:
Type I, II, or III Barricade Panels or Vertical Panels

Acceptable
To be acceptable, the panel shall meet all of the following conditions:

- Panels are not deformed to an extent so as to decrease the panels target value.
- There may be several abrasions on the surface but very little loss of retroreflective sheeting.
- The orange is vivid and the stripes provide contrast.
- The Type III barricade has been fabricated according to the approved crashworthy requirements.

Marginal
The panel is considered marginal if it meets any of the following conditions:

- Panels are not deformed to an extent so as to decrease the panels target value.
- There are numerous surface abrasions through the panel surface.
- Some color fading is evident; however, it has no large areas of residue or missing retroreflective material.

- The Type III barricade has been fabricated according to the approved crashworthy requirements.

Unacceptable
A panel is considered unacceptable if it meets any of the following conditions:

- The surface is marred over a high percentage of the panel area.
- There is a noticeable loss of retroreflectivity and obvious color fading.
- Panels with asphalt splatter, cement slurry, and/or other residue or any combination of missing and covered retroreflective material.

- Barricades have bent or twisted legs, or deformation of the support assembly to the extent that the barricade panel is not reasonably parallel to the roadway surface.

EVALUATION GUIDE:
Warning Lights

Acceptable
To be acceptable, warning lights shall meet all of the following conditions:

- One hundred percent (100%) of all warning lights shall be operating properly. Any warning light that is out of alignment from the intended driver's line of vision is considered not operating properly.
- Type A Low-Intensity Flashing warning lights and Type C Steady-Burn warning lights shall be maintained so as to be capable of being visible on a clear night from a distance of 3000 feet.
- Type B High-Intensity Flashing warning lights shall be maintained so as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1000 feet.
- Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens.

Marginal
The warning light is marginal when it meets any of the following conditions:

- Type A and C warning lights - at least ninety percent (90%) of the warning lights shall be operating properly with no more than three (3) adjacent lights failing.
- Type B warning lights - one (1) light failing.

Unacceptable
A warning light is considered unacceptable if it meets any of the following conditions:

- Type A and C warning lights - less than ninety percent (90%) of the warning lights operating properly, or more than three (3) adjacent lights failing.
- Type B warning lights - more than one (1) light failing.

EVALUATION GUIDE:
Flashing Arrow Boards

Acceptable conditions for all arrow boards
An arrow board is acceptable if it meets all of the following conditions:

- All lamps are properly aligned for the intended driver's line of vision. Any operating lamp which is out of alignment shall be considered not functioning properly.
- No lamps are burnt out.
- All lamps dim properly.
- All lamps are the same level of intensity.

Unacceptable conditions only for truck or trailer-mounted arrow boards
An arrow board is unacceptable if it meets any of the following conditions:

- 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.

FLASHING ARROW MODE and SEQUENTIAL ARROW MODE

Marginal
An arrow board in this mode is marginal if it meets the following condition:

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

Unacceptable
An arrow board in this mode is unacceptable if it meets any of the following conditions:

- Any lamp out in the head.
- More than two (2) lamps out in the stem.
- The arrow board message is not visible at 1000 feet.

EVALUATION GUIDE:
Flashing Arrow Boards, cont.

CHEVRON MODE

Marginal
An arrow board in this mode is marginal if it meets the following condition:

- No more than one (1) lamp out in any one chevron segment.

Unacceptable
An arrow board in this mode is unacceptable if it meets any of the following conditions:

- Two (2) or more lamps out in any one chevron segment.
- The arrow board message is not visible at 1000 feet.

CAUTION MODE (4 Corners, Bar, or Alternating Diamonds)

Marginal
An arrow board in this mode is marginal if it meets the following condition:

- At least seven (7) lamps functioning properly in each diamond shape (on the Alternating Diamonds).

Unacceptable
An arrow board in this mode is considered unacceptable if it meets any of the following conditions:

- Less than four (4) lamps functioning properly (on the 4 Corners or Bar), or less than seven (7) lamps functioning properly in either of the 2 diamond shapes (on the Alternating Diamonds).
- The arrow board message is not visible at 1000 feet.

EVALUATION GUIDE:
Flashing Arrow Boards, cont.

DOUBLE ARROW MODE

Marginal
An arrow board in this mode is marginal if it meets the following condition:

- Two (2) lamps out in the stem and both heads completely functional with no lamps out.

Unacceptable

- An arrow board in this mode is considered unacceptable if it meets any of the following conditions:
- More than two (2) lamps out in the stem.
- One (1) lamp out in the head.
- The arrow board message is not visible at 1000 feet.

EVALUATION GUIDE:
Portable Changeable Message Signs (PCMS)

Acceptable
A PCMS is acceptable if it meets the following condition:

- One hundred percent (100%) of the pixels per character module shall be operating properly.

Marginal
A PCMS is marginal if it meets the following condition:

- At least ninety percent (90%) of the pixels per character module shall be operating properly.

Unacceptable for all PCMSs
A PCMS is unacceptable if it meets any of the following conditions:

- Less than ninety percent (90%) of the pixels per character module are operating properly.
- The PCMS is not properly aligned for the intended driver's line of vision.
- The PCMS message is not legible.

Unacceptable for Trailer-Mounted PCMS
A trailer-mounted PCMS is unacceptable if it meets any of the following conditions:

- The sign panel more than 3 inches out of plumb.
- The sign panel is raised less than 5 feet above the roadway surface on rural roadways or less than 7 feet on urban roadways (measured to the bottom of the board).

EVALUATION GUIDE:
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
An electronic traffic control device is acceptable if it meets all of the following conditions:

- The device shall be operating 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. Any operating lamp, LED display, or sign which is out of alignment shall be considered not functioning properly.
- One hundred percent (100%) of the LED pixels per character module are operating properly.
- One hundred percent (100%) of the lamps are operational.
- All lamps and LED displays dim properly.
- The signs meet or exceed the quality standards for acceptable "Warning Signs".
- The device's leveling stands shall be adjusted to properly plumb the device.
- The bottom of any overhead signal head shall be between 17 and 19 feet above the roadway surface.

Marginal
An electronic traffic control device is marginal if it meets the following conditions:

- At least ninety percent (90%) of the LED pixels per character module are operating properly.
- The signs meet the quality standards for marginal "Warning Signs".

Unacceptable

An electronic traffic control device is unacceptable if it meets any of the following 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 ninety percent (90%) of the LED pixels per character module are operating properly.
- The device is not properly aligned for the intended driver's line of vision.
- The lamps and LED displays are not dimming properly.
- The device is not within 3 inches of plumb for the height of the device (excluding an overhead signal head mast).
- The bottom of any overhead signal head is lower than 17 feet or higher than 19 feet above the roadway surface.

MINNESOTA FLAGGING HANDBOOK

DEPARTMENT OF TRANSPORTATION

January, 2018

Flagging Handbook

This Flagging Handbook has been developed following the guidelines of the 2011 edition of the Minnesota Manual on Uniform Traffic Control Devices, including its latest update.

According to Minnesota Statute 169.06, Subd. 4(e), a flagger is permitted to stop and hold traffic as necessary to ensure the safety of highway workers and the motoring public.

The Flagging Handbook as well as the Field Manual and other documents are available on the MnDOT Traffic Engineering website:

www.dot.state.mn.us/trafficeng

INTRODUCTION

To You, the Flagger:
REMEMBER - *Your job is the most important one on the crew. The lives of all individuals in and traveling through the work space depend on YOU!*

Every flagger should be trained in flagging operations. Check with the road authority for training requirements. This handbook will give you basic guidelines regarding flagging operations. Familiarize yourself with these procedures. If you have any questions or concerns, don't hesitate to ask your supervisor.

For your personal safety as a flagger NEVER fully turn your back to or stand in the path of moving traffic.

EQUIPMENT

Clothing
Flaggers shall wear high-visibility clothing meeting ANSI/ISEA 107-2004 (or ANSI/ISEA 107-2010) Performance Class 3 requirements. ANSI/ISEA 107-2015 Type R, Performance Class 3 is also acceptable. The Class 3 requirements shall be met by wearing a Class 2 or Class 3 vest, shirt, or jacket; as well as Class E pants. Clothing shall have an attached original label indicating the Performance Class.

- Clothing background color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two.
- Retroreflective material on the clothing shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors. The material shall be visible at a minimum distance of 1000 feet.
- The vest, shirt, or jacket shall be worn such that 360 degree visibility in a horizontal plane of the clothing is maintained.
- A retroreflective hat in the above colors should be worn.
- A retroreflective wrist band in the above colors may be used. The wrist band helps differentiate the flagger from work zone devices.
- A neat appearance and clean clothing shall be maintained in order to help command respect of the drivers.

Tools

- Standard STOP/SLOW (W21-X7) paddle shall be used unless it is not available in an emergency situation or as otherwise specified in this handbook.
  - 18 x 18 inch minimum octagon with legible letters at least 6 inches high.
  - 5 foot minimum staff (to the bottom of the sign), 7 foot is recommended.
  - Fully retroreflectorized in standard colors with minimal abrasions or fading.
- Two-way communication devices should be used for multiple flagger situations.
- A 24 x 24 inch fluorescent red/orange flag or retroreflective red flag to be used only in an emergency or at an intersection.
- Flashlight with red glow cone may be used:
  - to supplement the STOP/SLOW paddle at night,
  - at intersections, and/or
  - for emergency situations.

Flagger stations shall be illuminated at night except in emergency situations.

FLAGGING POSITION

- Be alert, remain standing at all times.
- Face traffic approaching the work zone. NEVER fully turn your back to traffic or stand in the path of any moving vehicle (see Figure 1 below).
- A flagger's normal station is on the shoulder of the road.
- Always have an escape route.
- Park your vehicle off the road and away from your station in order to maintain an escape route and to not be obscured by your vehicle. Stand alone, do not mingle with the work crew or the public.
- Make sure you are visible to oncoming approaching traffic. Consider not standing where the sun is impeding visibility or in a shadow.
- Stand in a location that allows approaching traffic adequate time to respond. Use the Decision Sight Distance (**D**) in the following chart to determine a location with good visibility. The driver must be able to recognize you as a flagger for at least the Decision Sight Distance (**D**).
- Make sure YOU can see approaching traffic for the length of the Decision Sight Distance (**D**).

Decision Sight Distance (D)	
Posted Speed (mph)	**Decision Sight Distance (feet)**
0 - 30	550
35 - 40	700
45 - 50	900
55	1200
60 - 65	1400
70 - 75	1600

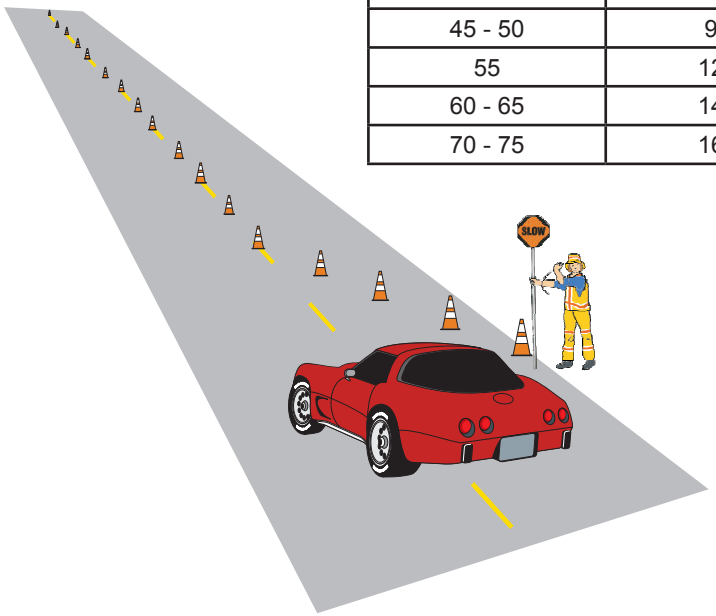


Figure 1: Preferred Flagging Position

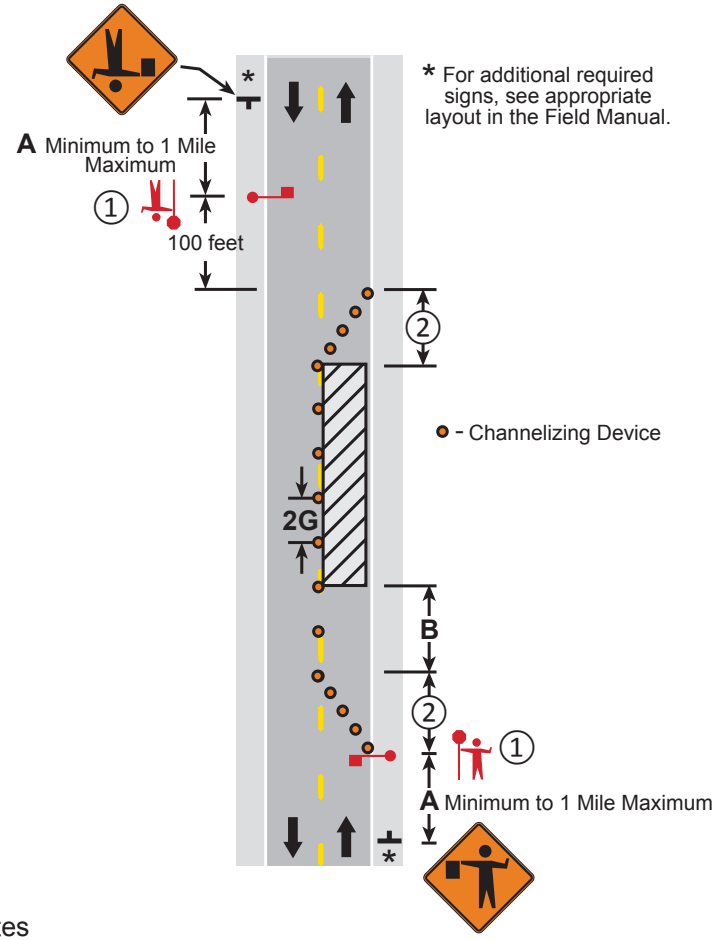
FLAGGING APPLICATIONS

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

When the temporary traffic control 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 1 mile.** In low speed areas consider reducing the spacing between the flagger and flagger ahead sign to ½ mile or less.

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 flagged area, an additional flagger(s) may be needed to control traffic entering the temporary traffic control zone from the roadway intersection.

Posted Speed Limit Prior to Work Starting (mph)	Advance Warning Sign Spacing (feet) **(A)**	Channelizing Device Spacing (feet) **(G)**	Buffer Space (feet) **(B)**	Decision Sight Distance (feet) **(D)**
0 - 30	100	25	200	550
35 - 40	325	25	305	700
45 - 50	600	50	425	900
55	750	50	500	1200
60 - 65	1000	50	650	1400
70 - 75	1200	50	820	1600



Notes

① The approach sight distance to the flagger shall be at least the Decision Sight Distance (**D**) .

② The two-way taper should be 50 feet using 5 equally spaced channelizing devices.

Figure 2: Flagger Location for a Lane Closure

Traffic queuing over long distances due to flagging operations may cause potentially dangerous situations. These situations may include traffic backed up through an intersection, up an exit ramp onto a freeway, or stopped prior to the first warning signs. When the flagger observes any of these occurring, they should immediately notify their supervisor. The flagger may be given instructions on how to help maintain a shorter backup of vehicles.

Single Flagger

There are three different applications of the single flagger situation.

1) **Temporarily stopping and directing traffic across the center line.**
   On an intermediate volume road **(less than 1500 ADT)** with good visibility, a single flagger may be used to control one direction of traffic while the other direction flows free. In this situation, the flagger is positioned in the closed lane at the beginning of the taper. The flagger stops the traffic approaching in the closed lane. When the open lane is clear, the flagger allows traffic to proceed. If the Decision Sight Distance (**D**) is not available beyond the work space for the flagger to detect oncoming traffic, two flaggers shall be used. Two flaggers may also be required during high peak traffic periods or if there is a major intersection near the activity area.
2) **Temporarily stopping and releasing traffic in the same lane.**
   A single flagger may also be used to stop traffic in a lane while that lane is temporarily closed. An example would be a truck depositing material off the edge of the roadway. In this situation, the flagger would stop traffic in the lane being blocked by the truck while the other lane flows free. When the lane is no longer blocked, the flagger would allow traffic to proceed. After stopped traffic is allowed to proceed, the flagger should turn the flagger paddle parallel to traffic so that no message is displayed to either direction of traffic.
3) **Intersections.**
   For flagging intersections see the "Flagging at Intersections" section in this Handbook.

Two Flaggers

When two flaggers are required, lines of communication must be established prior to the start of flagging operations. The two flaggers must be able to see each other or have two-way communication devices designated for proper communication. One flagger **SHALL** be the lead flagger and coordinate all activities.

Figure 3: Two Flagger Operation

An effective method to ensure that traffic from the opposite direction is not released prematurely is the ***flag transfer***. A flagger gives the driver of the last vehicle proceeding into the one lane section a flag (or other token object) and instructs the driver to deliver it to the flagger at the other end. The opposite flagger then knows that it is safe to allow traffic to move in the other direction. The flag (or token object) being carried should always be clean and dry.

Flagging with a Pilot Car

Two (or more) flaggers may also be used in conjunction with a Pilot Car, which is a specially marked vehicle that leads motorists through a work zone. In this application, the flagger stops traffic until the Pilot Car has pulled into position to lead traffic through or around the activity area. The flagger then releases traffic to follow the Pilot Car. When a large gap in traffic or a predetermined 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. A Pilot Car is an effective method of regulating the speed of traffic through the work zone. To help keep the traffic group tight, flaggers should not allow additional vehicles to follow the group if the last vehicle 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.

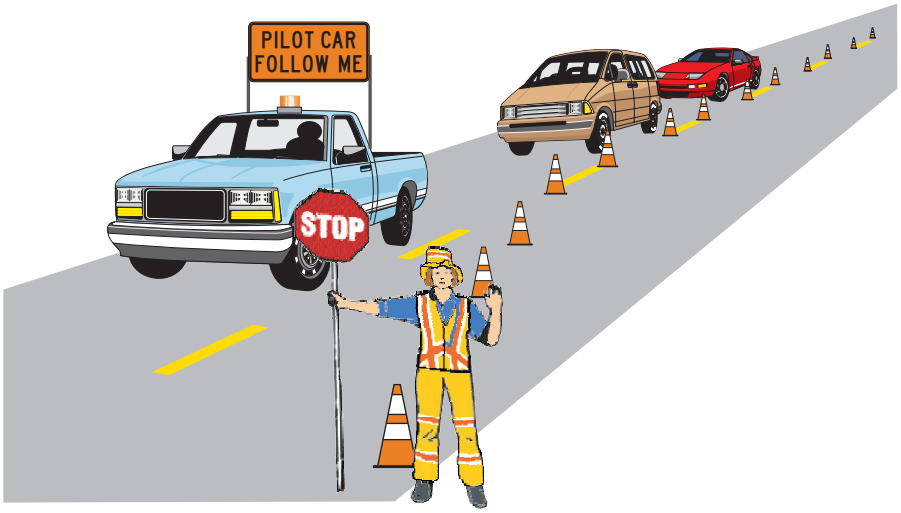


Figure 4: Use of a Pilot Vehicle

Advance Flagger

Consider using an advance flagger where there is limited sight distance to the activity area or where long lines of traffic form. In a situation such as limited sight distance, the advance flagger should stop each vehicle and inform the driver of the situation ahead. Where there are long lines of stopped traffic waiting to proceed, the advance flagger should move down the line and inform each driver of the reason for the delay and the approximate length of the delay.

Intersection Flagging

Only a licensed uniformed law enforcement officer has the authority to override a fully operating traffic control signal system (operating through the green, yellow, red cycle). 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. A flagging operation within a non-signalized intersection may override STOP and YIELD signs in the intersection. Approval from the road authority shall be acquired prior to placing signals into red flash mode or turning signals off.

When flagging within an intersection, consider the following:

- High-volume intersections, large intersections, roundabouts, or complicated situations may require additional flaggers. When multiple flaggers are used, a lead flagger shall be designated to coordinate flagging operations.
- The flagger(s) should use hand signals with a flag or flashlight with red glow cone to control traffic movements rather than the typical STOP/SLOW paddle.
- The flagger(s) 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 sign, the flagger has no authority to prevent traffic from stopping and must allow for stopping within the operation.
- The flagger(s) should be aware of traffic conditions at adjacent intersections and coordinate operations to minimize traffic backups and conflicts.

Automated Flagger Assistance Devices (AFADs)

When using AFADs, see MN MUTCD (mndot.gov/mnmutcd) Sections 6E.4 through 6E.6.

Automated Flagger Assistance Devices (AFADs) enable the operator to be positioned out of the lane of traffic and are used to control road users through temporary, one- lane, two-way traffic control zones. They can be remotely operated by one operator at a central location or by separate operators near each device location. When using a single operator, the AFADs shall be located so the operator can see both devices.

FLAGGING PROCEDURES

To Stop Traffic

Stand on the shoulder of the road, away from moving traffic. Face traffic and extend the STOP paddle in a stationary position with your arm extended horizontally away from your body. Your free arm should be raised with the palm of your hand toward approaching traffic. Look directly at the approaching driver. Make sure that you make direct eye contact with this driver!

Remain on the shoulder of the road after the first vehicle has stopped. Always make certain that the flagger and the paddle are visible to the drivers of all stopped vehicles. The flagger should never stand in the traffic lane unless, in the flagger's opinion, the drivers of the stopped vehicles are unaware of the flagger's presence. If it is necessary for the flagger to stand in the traffic lane, the flagger may only stand near the centerline and never cross it. When the flagger is satisfied that the drivers of all stopped vehicles are aware of his/her presence, the flagger should return to the shoulder of the road.

NOTE: Anytime the flagger is required to take a position near the centerline of the traffic lane, the flagger should remain aware of the traffic traveling in the opposite direction.

To Direct Stopped Traffic to Proceed
Remain at the flagger station on the shoulder. If the flagger is in the stopped traffic lane, return to the shoulder. Face traffic and turn the SLOW paddle to face traffic. Hold the SLOW paddle in a stationary position with the arm extended horizontally away from the body. The flagger may motion with the free hand for traffic to proceed. Do not wave the paddle.

To Alert or Slow Traffic
Stand on the shoulder of the road and face traffic with the SLOW sign paddle held 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. Never stand in the path of oncoming traffic. The STOP side of the panel shall not be displayed to traffic unless traffic is required to stop.

Proper Conduct
- Do not abandon your post for any reason until the work is finished or a replacement flagger arrives.
- Do not put yourself in danger.
- 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, turn, or cover all signs indicating the presence of a flagger when a flagger is not actually flagging. This includes lunch and breaks. This also includes situations in which flagging is intermittent, such as allowing trucks entering and exiting construction sites.
- Be alert for emergency vehicles. They have priority rights. Allow them to pass as quickly as possible.

Nighttime Flagging
Flagger stations shall be well illuminated with auxiliary lighting such as floodlights or balloon lighting except in emergency situations. If the emergency is expected to last an extended period, an attempt to illuminate the flagger station should be made. Auxiliary lighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers. A flashlight with a red glow cone may be used to supplement the STOP/SLOW paddle. Retroreflective channelizing devices shall be used.

To stop traffic, the flagger shall hold the flashlight with glow cone in left hand with arm extended and pointed down toward the ground. To direct traffic to proceed, the flagger shall point the flashlight with glow cone at the first vehicle's bumper then slowly aim the flashlight toward the open lane, holding the flashlight in that position. To alert or slow traffic, the flagger shall point the flashlight with glow cone toward oncoming traffic and quickly wave the flashlight in a figure eight motion.

EMERGENCY SITUATIONS

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

To stop traffic, the flagger shall face traffic and extend the flag staff horizontally across the road user's lane in a stationary position so that the full area of the flag is visibly hanging below the staff. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic. To direct traffic to proceed, the flagger shall face traffic with the flag and arm lowered to the flagger's side, and shall motion with the free hand for traffic to proceed. Flags shall not be used to signal traffic to proceed. To alert or slow traffic, the flagger shall face traffic and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down without raising the arm above a horizontal position. The flagger shall keep the free hand down at their side.

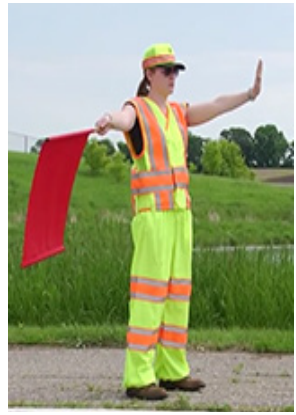
Notes to the Supervisor

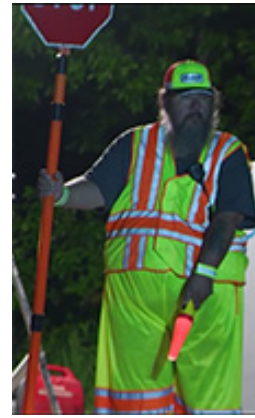
- All flaggers should be properly instructed prior to the start of work. Training should be based on the requirements of individual road authorities.
- Appoint a lead flagger.
- Flagger(s) should know their specific duties in relation to the operation.
- The importance of the job should be impressed upon the flagger. They are responsible for the safety of all workers and motorists.
- Arrange for the flagger to have rest breaks.
- Drive through the temporary traffic control zone after all signs, devices, and flagger(s) are inplace. Check the visibility of the signs, flagger(s), and the activity area. Monitor behavior of traffic; make and document field modifications as necessary.
- Remove, turn, or cover all flagging related devices when flagging operations are suspended.

Refer to Sections 6C and 6E of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) at mndot.gov/mnmutcd for further information on flaggers and flagging procedures.

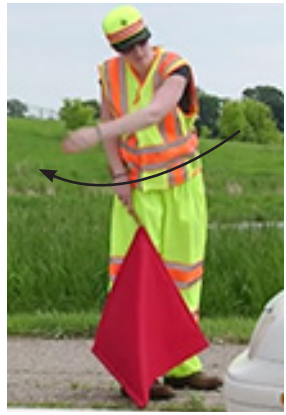
The Use of Hand Signaling Devices by a Flagger

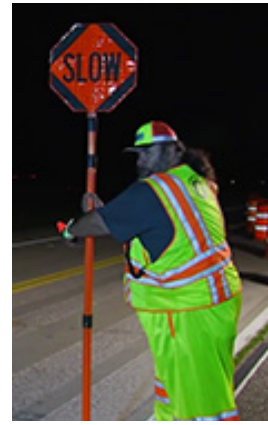
To Stop Traffic





To Release Traffic





To Alert and Slow Traffic

Preferred Flagging Method Using a Paddle.

Preferred Flagging Method Using a Flag.

Nighttime Flagging with Glow Cone.

CHECKLIST FOR FLAGGER TRAINING

❑ **Remember your job is the most important one on the crew. The lives of all individuals in and traveling through the work space depend on <u>YOU!</u>**

❑ **For your personal safety as a flagger <u>NEVER</u> fully turn your back on or stand in the path of moving traffic.**

❑ **Clothing**

- Flaggers shall wear appropriate high-visibility apparel.

❑ **Tools**

- Standard STOP/SLOW paddle shall be used unless it is not available in an emergency situation or as otherwise specified in this Handbook.
- Two-way communication devices should be used for multiple flagger situations.
- A 24 x 24 inch fluorescent red/orange flag or retroreflective red flag to be used only in an emergency or at an intersection.
- Flashlight with red glow cone may be used:
  - to supplement the STOP/SLOW paddle at night,
  - at intersections, and/or
  - for emergency situations.
- Flagger stations shall be illuminated at night except in emergency situations.

❑ **Flagging position on the road way:**

- Be alert, remain STANDING at all times.
- Face oncoming traffic. **<u>NEVER</u>** fully 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.
- **Plan your escape route**. 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 Minnesota Flagging Handbook.
- Stand alone, do not mingle with the work crew or motorists.
- Make sure you are visible to approaching traffic. Consider not standing where the sun is impeding visibility or in a shadow.
- Review the Decision Sight Distance (**D**) Chart in the Minnesota Flagging Handbook. Drivers should be able to recognize you as a flagger for at least the Decision Sight Distance (**D**). This means YOU should be able to see vehicles at the Decision Sight Distance (**D**). Avoid blind spots past curves in the roadway or just over hills.
- Emergency vehicles have priority rights. Allow them to pass as safely and quickly as possible.

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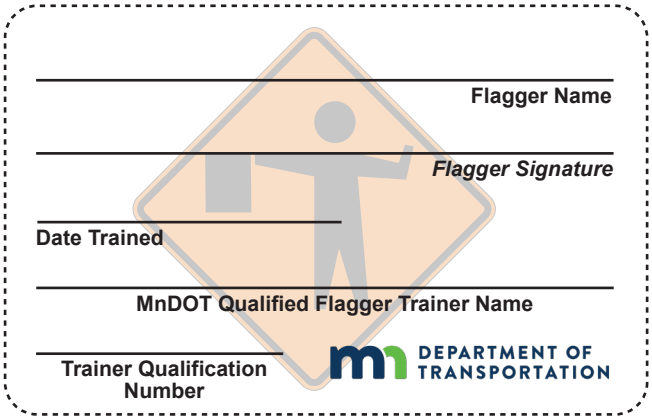
Flagger Qualification Card

Below is the Flagger Qualification Card to be used as proof of training received from a qualified MnDOT Flagger Trainer. This training is required to fulfill the MnDOT flagger training specification contained in the traffic control special provision of selected jobs.



The bearer of this card has reviewed the Minnesota Flagging Handbook checklist, viewed the “MnDOT Flagging Operations and Procedures” video and has received instruction from the MnDOT qualified flagger trainer listed on the front of the card.

A yearly review of flagging operations and procedures is recommended.

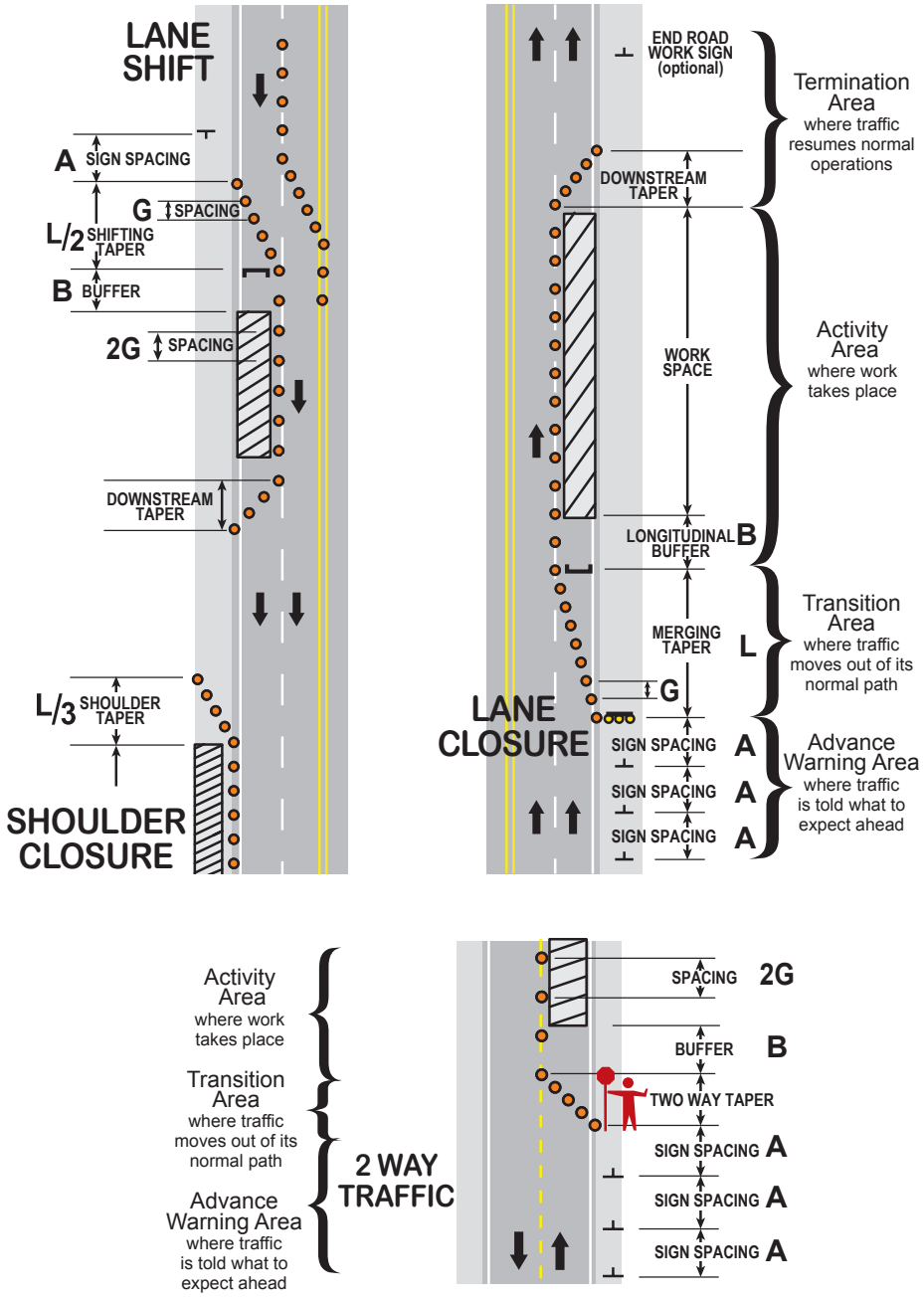
mndot.gov/flagging

NOTES

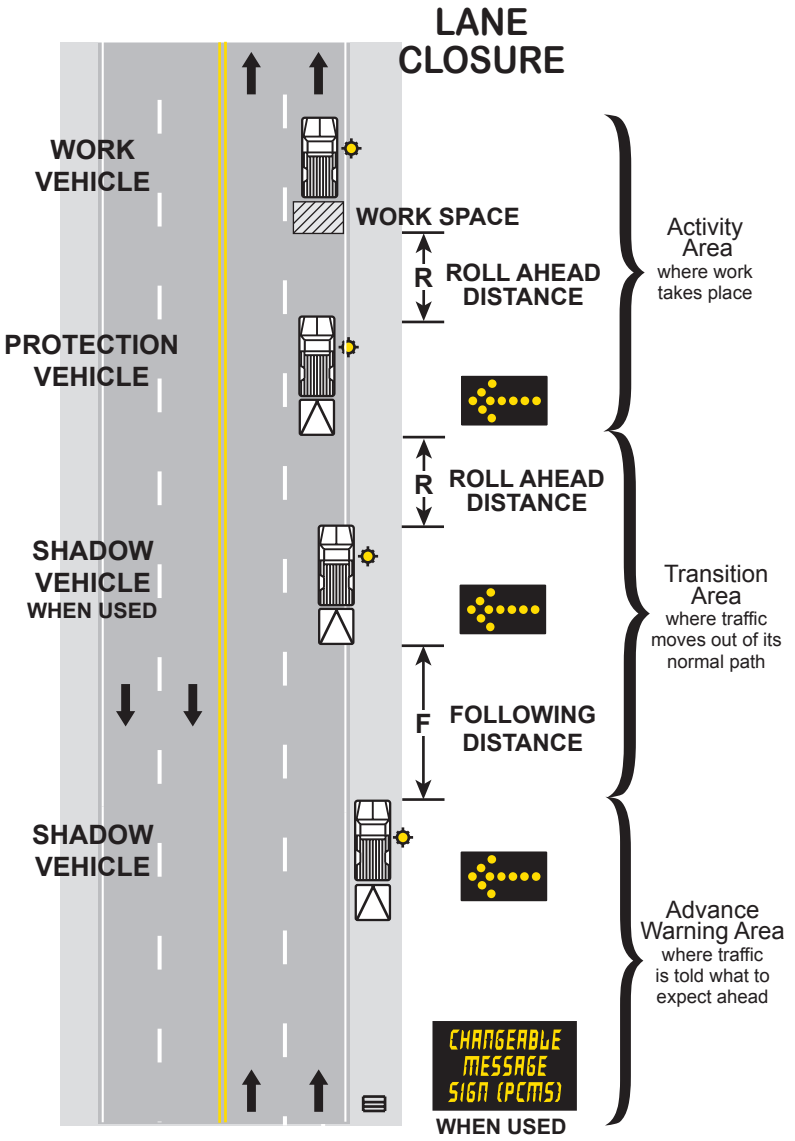
NOTES

MnDOT District & Central Office and Gopher State One-Call Office Phone Numbers		
District 1 Headquarters	Duluth	Minnesota Department of Transportation 1123 Mesaba Avenue Duluth, MN 55811 Phone: 218-725-2700
District 1	Virginia	Minnesota Department of Transportation 101 N. Hoover Road Virginia, MN 55792 Phone: 218-742-1100
District 2A	Bemidji	Minnesota Department of Transportation 3920 Highway 2 West Bemidji, MN 56601 Phone: 218-755-6500
District 2B	Crookston	Minnesota Department of Transportation 1320 Sunflower Street Crookston, MN 56716 Phone: 218-277-7950
District 3 Headquarters	Baxter	Minnesota Department of Transportation 7694 Industrial Park Road Baxter, Mn 56425-8096 Phone: 218-828-5700 or 800-657-3971
District 3	St. Cloud	Minnesota Department of Transportation 3725 12th Street North St. Cloud, Mn 56303-2107 Phone: 320-223-6500 or 800-657-3961
District 4 Headquarters	Detroit Lakes	Minnesota Department of Transportation 1000 Highway 10 West Detroit Lakes, MN 56501 Phone: 218-846-3600 or 800-657-3984
District 4	Morris	Minnesota Department of Transportation 51 Minnesota Drive Morris, MN 56267 Phone: 800-657-3984
District 6 Headquarters	Rochester	Minnesota Department of Transportation 2900 48th Street NW Rochester, MN 55901-5848 Phone: 507-286-7500
District 6	Owatonna	Minnesota Department of Transportation 1010 21st Avenue NW Owatonna, MN 55060-1005 Phone: 507-446-5500
District 7 Headquarters	Mankato	Minnesota Department of Transportation 2151 Bassett Drive Mankato, MN 56001-6888 Phone: 507-304-6100 or 800-657-3747
District 7	Windom	Minnesota Department of Transportation 180 South County Road 26 Windom, MN 56101 Phone: 507-831-8000

MnDOT District & Central Office and Gopher State One-Call Office Phone Numbers		
District 8 Headquarters	Willmar	Minnesota Department of Transportation 2505 Transportation Road Willmar, MN 56201 Phone: 320-231-5195 or 800-657-3792
District 8 Regional Office	Marshall	Minnesota Department of Transportation 1800 East College Drive Marshall, MN 56258 Phone: 507-537-6146 or 800-657-3748
District 8 Regional Office	Hutchinson	Minnesota Department of Transportation 1400 Adams Street SE Hutchinson, MN 55350 Phone: 320-234-8480 or 877-682-8249
MnDOT Metropolitan District		Minnesota Department of Transportation 1500 West Co Rd B-2 Roseville, MN 55113 Phone: 651-234-7500
MnDOT Central Office Office of Traffic, Safety,and Technology		Minnesota Department of Transportation Mail Stop 725 1500 West Co Rd B-2 Roseville, MN 55113 Phone: 651-234-7500
To order more manuals:		Minnesota Department of Transportation Mail Stop 260, Manual Sales 395 John Ireland Boulevard St. Paul, MN 55155-1899 651-366-3017
Gopher State One Call http://www.gopherstateonecall.org/		Twin Cities Area: 612-454-0002
		Greater Minnesota: 800-252-1166
		Call Center: 811



Components of a Stationary Temporary Traffic Control Zone



Components of a Mobile Temporary Traffic Control Zone

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (*12 ft lane*) (L) feet	Shifting Taper (*12 ft lane*) (L/2) feet	Typical Shoulder Taper (L/3) feet	Buffer Space (B) feet
0-30	G = 25 ft.	100	550	200	100	75	200
35-40		325	700	325	175	125	305
45-50	G = 50 ft.	600	900	600	300	200	425
55		750	1200	700	350	250	500
60-65		1000	1400	800	400	275	650
70-75		1200	1600	900	450	300	820

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Following Distance (F) feet	Roll Ahead Distance Charts			
			Recommended Spacing for Vehicles Weighing 9900 to 22,000 lbs GVW (R) feet		Recommended Spacing for Vehicles Weighing Greater than 22,000 lbs GVW (R) feet	
			Stationary Operation	Moving Operation 15 MPH max	Stationary Operation	Moving Operation 15 MPH max
0-30	G = 25 ft.	100 - 550	100	100	75	100
35-40		325 - 700	100	100	75	100
45-50	G = 50 ft.	600 - 900	125	175	100	150
55		750 - 1200	125	175	100	150
60-65		1000 - 1400	175	225	150	175
70-75		1200 - 1600	175	225	150	175

Shadow and Protection Vehicle wheels should be pointed straight ahead.

Temporary Traffic Control Distance Charts

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (*12 ft lane*) (L) feet	Shifting Taper (*12 ft lane*) (L/2) feet	Typical Shoulder Taper (L/3) feet	Buffer Space (B) feet
0-30	G = 25 ft.	100	550	200	100	75	200
35-40		325	700	325	175	125	305
45-50	G = 50 ft.	600	900	600	300	200	425
55		750	1200	700	350	250	500
60-65		1000	1400	800	400	275	650
70-75		1200	1600	900	450	300	820

Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Following Distance (F) feet	Roll Ahead Distance Charts			
			Recommended Spacing for Vehicles Weighing 9900 to 22,000 lbs GVW (R) feet		Recommended Spacing for Vehicles Weighing Greater than 22,000 lbs GVW (R) feet	
			Stationary Operation	**Moving Operation 15 MPH max**	**Stationary Operation**	**Moving Operation 15 MPH max**
0-30	G = 25 ft.	100 - 550	100	100	75	100
35-40		325 - 700	100	100	75	100
45-50	G = 50 ft.	600 - 900	125	175	100	150
55		750 - 1200	125	175	100	150
60-65		1000 - 1400	175	225	150	175
70-75		1200 - 1600	175	225	150	175

Shadow and Protection Vehicle wheels should be pointed straight ahead.

Temporary Traffic Control Distance Charts

TOWARD ZERO DEATHS

Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD)
mndot.gov/mnmutcd