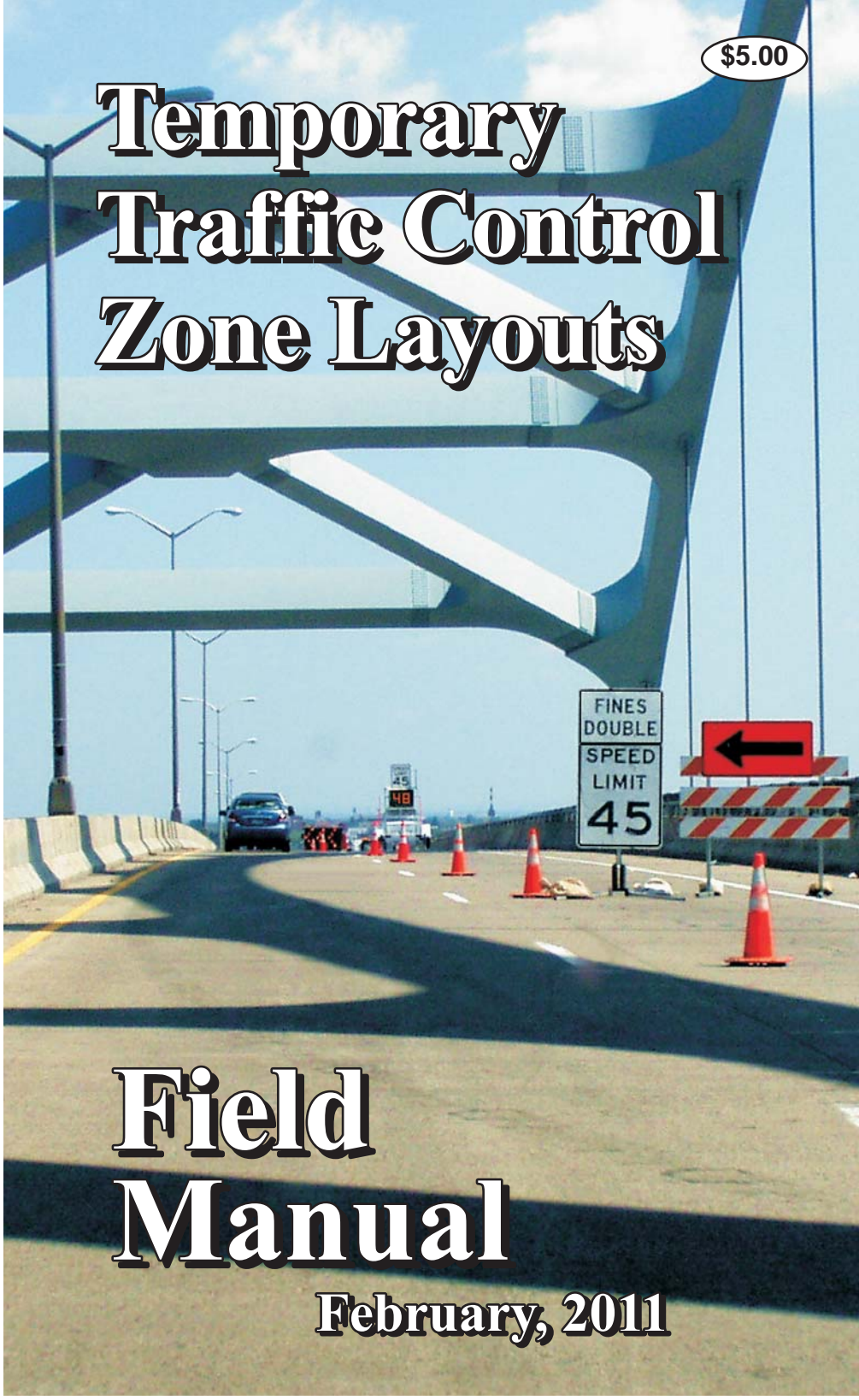


\$5.00

Temporary Traffic Control Zone Layouts



Field Manual

February, 2011

Standards & Specifications
Two-Lane Two-Way
Multi-Lane Undivided
Multi-Lane Divided
Miscellaneous Layouts
Quality Standards
Flagging Handbook

K. The Field Manual

Index

	Pages
Introduction .....	.6K-i
Definitions .....	.6K-ii
Temporary Traffic Control General Guidelines .....	.6K-viii
Checklist for Establishing a Temporary Traffic Control Zone .....	.6K-xii
Temporary Traffic Control Devices .....	.6K-xiii
Work Zone Signing .....	.6K-xiv
Crashworthy Testing Compliance .....	.6K-xv
Guidelines for Portable Changeable Message Signs .....	.6K-xvi
Standard Abbreviations for Use on	
Portable Changeable Message Signs .....	.6K-xix
Arrow Board Specifications .....	.6K-xx
Longitudinal Drop-off Guidelines .....	.6K-xxi thru 6K-xxiii
Components of a Temporary Traffic Control Zone .....	.6K-xxiv
Sign Codes Quick Reference .....	.6K-xxvi
Sample Project Inspection Checklist .....	.6K-xxviii
Channelizing Devices .....	.6K-xxix
MN TPAR Devices .....	.6K-xxx
Symbols used in Typical Layouts .....	.6K-xxxii
Temporary Traffic Control Distance Charts .....	.6K-xxxiii
*Two-Lane, Two-Way Roads (Layouts 1 - 30) .....	.6K-1thru 6K-30
<i>(A roadway consisting of two opposing lanes of undivided traffic.)</i>	
*Multi-Lane Undivided Roads (Layouts 31 - 43) .....	.6K-31 thru 6K-43
<i>(A roadway with two or more lanes of traffic in the same direction with no physical barrier separating the opposing traffic lanes.)</i>	
*Multi-Lane Divided Road (Layouts 45 - 65) .....	.6K-45 thru 6K-65
<i>(Two separate roadways where opposing traffic is separated by a physical barrier or median.)</i>	
*Miscellaneous Layouts (Layouts 67 - 85) .....	.6K-67 thru 6K-85b
<i>(Layouts for Continuously Moving and Miscellaneous Signing Operations)</i>	
Quality Standards .....	.6K-87 thru 6K-104
Flagging Handbook .....	.6K-105 thru 6K-116
Notes .....	.6K-117
Mn/DOT Telephone Numbers .....	.6K-118 thru 6K-119
Temporary Traffic Control Distance Charts	Inside of the Back Cover

* 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 Mn/DOT, Traffic Engineering website at: <http://www.dot.state.mn.us/trafficeng/>

INTRODUCTION

This Field Manual is a section of the 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 the general Temporary Traffic Control (TTC) standards and 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. When specific TTC plans for a specific operation are not available, any public or private agency whose work affects vehicular and pedestrian traffic should use this Field Manual to provide proper temporary traffic control (TTC).

The typical layouts contained in this manual do not cover all situations encountered. Because all situations differ, engineering judgment should be used to insure proper traffic control. The goal of the temporary traffic control 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 devices shall be folded, covered or removed from the area.

This manual contains typical layouts for temporary traffic control zones ranging from mobile operations to zones which may remain in place overnight for up to three days. If the temporary traffic control 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 governing road authority's Traffic Engineering staff should be consulted and a project specific Temporary Traffic Control Plan prepared. Advance planning is necessary for a successful temporary traffic control zone. A checklist is included on page 6K-xxviii to assist you in planning your temporary traffic control zone.

Prior to starting work on any public roadway right-of-way, permission shall be obtained from the governing road authority. The use of any regulatory temporary traffic control device or sign shall be approved by the governing road authority prior to installation. To assist you on state highways, numbers for the Minnesota Department of Transportation are included in the back of this manual. You may wish to note the number of other road authorities on the NOTES page in the back of this book.

Before beginning work, familiarize yourself with this manual, definitions, the principles and the General Responsibilities contained herein. Qualified individuals who have adequate training in temporary traffic control and have a basic understanding of the MN MUTCD should supervise the selection, placement and maintenance of traffic control devices in temporary traffic control zones.

DEFINITIONS

Activity Area - that part of a TTC zone activity area where the work actually takes place. It consists of the work space, traffic space and one or more buffer spaces.

Advance Warning Area - that part of a TTC zone used to inform the motorist what to expect ahead. This area may contain anywhere from a single sign or a rotating/strobe 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 it's visibility to motorists. Good visibility is achieved where the sight distance is sufficient to meet decision sight distance.

Advance Warning Sign Spacing - the distance between signs or between a sign and some other location or device with the TTC zone. It is determined by the posted speed limit. This will ensure that the motorist has sufficient time 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 and based on the highway design, operating characteristics, and conditions. (See Layout 6K-77).

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

Buffer Space - the space which provides a margin of safety for both the driver and the workers. It is important that the buffer space be free of equipment, workers, material and vehicles.

Crashworthy - is a characteristic of roadside devices that have been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Decision Sight Distance - 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 safety maneuver safely and efficiently.

The decision sight distance is used to determine the minimum advance warning distance to the furthest and/or single sign. When determining minimum sight distance to flaggers and mobile operations, these distances also apply. 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 the median is generally wide enough to place TTC devices. Temporary traffic control for divided multi-lane roads may be also used for one-way roadways.

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 since TTC 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 traffic control devices are typically vehicle-mounted. The work area should change by at least the decision sight distance for it to be considered a change in location.
- **Short Duration** - when an operation stays in one location during daylight conditions from 15 minutes to one hour, such that minimal TTC devices are deployed.
- **Short Term** - when an operation stays in one location during daylight conditions from 15 minutes to twelve hours, such that advance signing and channelizing devices are required.
- **Intermediate Term/Night** - when an operation stays in one location during daylight conditions from 15 minutes to no more than 3 days, or stays in one location during hours of darkness. Advance signing and larger channelizing devices (Type B) are required.
- **Long Term** - when an operation stays in one location for more than 3 days. A project specific Traffic Control Plan is typically required.

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.

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

Following Distance - 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 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. These distance are dependent upon the roadway and traffic conditions. Engineering judgement should be used when selecting distances for specific operations.

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

High Speed Road - a roadway where the posted speed limit is 45 miles per hour or greater.

Lane Closure - a closure of one or more lanes of the roadway to traffic. Generally, a minimum lane width of 10 feet is required for a traffic operation. Work operations that restrict adjacent lane width should consider various lane closure alternatives depending upon volume and speeds on the roadway.

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 the Longitudinal Drop-off Guidelines (pages 6K-xxi thru 6K-xxiii) of this manual for more information.

Longitudinal Buffer Space - 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.

Merging Taper - the taper 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.

Mobile Buffer Space - the distance in a mobile operation between the shadow vehicle and the work vehicle. This distance is dependent on whether the shadow vehicle is being used as an advance warning device or as a blocking/protection device for the work vehicle.

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. 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 a 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.

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 Speed Limit signs. It is used in the charts to determine the spacings of TTC devices and the lengths of various tapers on the TTC Layouts. Typical Posted Speed Limits (**S**) are included in the TTC Distance Charts.

Protection Vehicle - the vehicle that is placed in front 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.

Roll Ahead Distance - the recommended minimum distance between a protection vehicle and 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 - the vehicle placed behind the work space in a mobile operation to provide advance warning to motorists. Because mobile operations generally have all advance warning signing mounted on vehicles, the spacing between vehicle should be the Following Distance (**F**) as included in the TTC Distance Charts.

Shifting Taper - the taper used to move traffic from the traffic lane onto a bypass or shoulder. This traffic maneuver generally requires half the distance than a merging taper. See the TTC Distance Charts for the length of a shifting taper called **L/2**.

Shoulder Closure - a closure of the roadway shoulder for work operations. The shoulder then 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 off to traffic so that shoulder work can be done or equipment can be placed on the shoulder. Since this taper is used to guide errant traffic back to its normal lane path, it does not require a full merge distance. The taper length is reduced to one-third of a merging taper length. See the TTC Distance Charts for the length of a shoulder closure taper called **L/3**.

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-6 and 6K-7, 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 (page 6K-xiii) of this manual.

Transition Area - that part of the TTC zone that moves the 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 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 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 five 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, significant pedestrian traffic, and 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 Speed Limits - a regulatory speed limit in a temporary traffic control zone. This speed limit requires proper documentation to approve and install. See *Work Zone Speed Limit Guidelines* at the following website for details:

<http://www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf>

TEMPORARY TRAFFIC CONTROL GENERAL GUIDELINES

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 governing road authority to protect the work space and safely direct traffic around the temporary traffic control 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 governing road authority when existing traffic signs need to be removed or relocated or any regulatory sign must be installed for construction or maintenance work.
- replacing or reimbursing the governing road authority for any damage to or loss of existing traffic signs.
- keeping all traffic control devices clean and in proper position to insure 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 Traffic Control Plan.

PERMISSION TO WORK WITHIN THE RIGHT-OF-WAY

Prior to starting work permission must be obtained from the governing road authority. All road work must be coordinated to protect the public's interest.

The governing road authority may limit the hours of work. 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.

Before beginning any excavation work, Minnesota Statutes require that you contact Gopher State One Call, 1-800-252-1166 outstate or 612-454-0002 in the Minneapolis/St. Paul Metro area.

SELECTING AN APPROPRIATE TEMPORARY TRAFFIC CONTROL LAYOUT

This Field Manual, which is Temporary Traffic Control Zone Layouts, Part 6K of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD), has been organized such that field personnel should easily be able to determine the proper temporary traffic control layout 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:

- Two-Lane, Two-Way Roads (with and without continuous left-turn lanes). These roads are further divided by traffic volume (low, intermediate, high),
- Multi-Lane Undivided Roads (with and without continuous left-turn lanes), and
- 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 of the road, or a turn lane 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.

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 the Checklist for Establishing a TTC Zone on page 6K-xii.

All distances shown on the layouts and charts are approximate. In general, all chart distances vary based upon the posted speed limit. Adjustments in these distances should be made based on traffic entry points and decision sight distance. As stated previously, not all situations could be addressed and engineering judgment should be exercised. Features from 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 a crosswalk closure.

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 the manual for unique operations and special signing conditions. These layouts may have special restrictions and guidelines contained within their notes.

ENHANCEMENT OF THE 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 Devices:
 - a. more signs
 - b. "flashing" arrow board
 - c. more channelizing devices at close spacing
 - d. temporary raised pavement markers
 - e. high-level warning devices
 - f. portable changeable message signs
 - g. portable traffic signals
 - h. portable barriers
 - i. impact attenuator crash cushions
 - j. glare screens
 - k. rumble strips
 - l. more delineation
2. 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
 - e. temporary traffic barriers in place of channelizing devices
3. Improved Geometrics at Diversions or Crossovers
4. Increased Distances
 - a. longer advance warning area
 - b. longer tapers
5. Lighting
 - a. temporary roadway lighting
 - b. steady burn lights used with channelizing devices
 - c. flashing lights for isolated hazards
 - d. illuminated signs
 - e. floodlights

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 lanes, 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.

The devices should be removed as soon as the work is completed and are no longer needed. Devices should be removed in the opposite order from which they were installed. Devices which the driver sees last should be removed first.

A clear lane at least 10 feet wide shall be maintained at all times. After the temporary traffic control zone is in place, it should be inspected by driving through the zone. Motorists' actions and reactions should be noted and if any problems are encountered, they should be quickly corrected. Any modifications to the Traffic Control Plan or standard layouts and the reasons for the modifications should be documented.

During the life of a temporary traffic control zone, maintenance of devices is frequently needed. On short term operations, vehicles may knock over cones which then need to be placed upright. If problems are encountered, they should be corrected immediately and documented.

CHECKLIST FOR ESTABLISHING A TEMPORARY TRAFFIC CONTROL ZONE

COMPLETED	ITEM
<input type="checkbox"/>	Obtain permit from governing road authority.
<input type="checkbox"/>	Determine the type of roadway
<input type="checkbox"/>	Determine the type of work space
<input type="checkbox"/>	Determine the duration of work.
<input type="checkbox"/>	Select hours of work to avoid peak periods.
<input type="checkbox"/>	Select the appropriate layout(s) using type of roadway, type of work, duration, traffic volume, and speed. (See the appropriate Index Chart at the start of each section)
<input type="checkbox"/>	Determine any modifications to typical layout(s). (See the Enhancement of the TTC Layouts on page 6K-x)
<input type="checkbox"/>	Check decision sight distance.
<input type="checkbox"/>	Advance signing distance.
<input type="checkbox"/>	Intersection/driveways
<input type="checkbox"/>	Allow for buffer space free of obstructions.
<input type="checkbox"/>	Contact the proper road authority if the work zone interferes with normal signal operation in the area.
<input type="checkbox"/>	Check the condition of devices. (See the Quality Standards on pages 6K-87 thru 6K-104)
<input type="checkbox"/>	Install devices beginning with the first device the driver will see.
<input type="checkbox"/>	Conduct a drive thru to check for problems. (See the Enhancement of the TTC Layouts on page 6K-x)
<input type="checkbox"/>	Document temporary traffic control zone, problems and major modifications to the layouts.
<input type="checkbox"/>	Traffic should be observed to see if the taper is working correctly.
<input type="checkbox"/>	Complete the work.
<input type="checkbox"/>	Remove the devices as soon as work is completed, beginning with the last device seen by the motorist.

Figure 6K-1

TEMPORARY TRAFFIC CONTROL DEVICES

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 the "Longitudinal Drop-off Guidelines" on pages 6K-xxi thru 6K-xxiii 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 based upon the nighttime visibility of the device. Their visibility is determined upon the total amount of reflective area of the device. Devices with less than 270 sq. in. are classified as Type A Channelizing devices and devices with more than 270 sq. in. of reflective area are Type B 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 overnight 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 at sight or space restricted locations as approved by the road authority. When used, the spacing of the devices should be reduced by up to 50 percent. Figure 6K-11 shows a breakdown of devices by Channelizer Type (drawn to approximate scale). See the MN MUTCD, Part 6F for additional details on application restrictions.

Flashing Warning Lights

Flashing warning lights shall supplement all road, ramp and sidewalk closure signing, and may be added to 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.

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 that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear" (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure.

Work Zone Signing

Advance warning 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.

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 the "TTC Distance Charts" for the advance warning sign spacing distance called **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. 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.

Signs shall not be mounted on existing traffic sign, posts or other utility structures without permission from the proper authority. All signs shall be mounted longitudinally perpendicular to the roadway surface and vertically plumb in accordance with the Quality Standards starting on page 6K- 87. The bottom of signs mounted on barricades or temporary supports shall be no less than one 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.

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

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:

- A.) Reduce the left side signs sizes, or
- B.) 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.

Optional Signs

Several signs are shown on the TTC layouts as optional or have factors that may make them optional. Some advance warning signs may be omitted for low speed roads and/or if the duration will be less than an hour. Read the associated notes on each layout for options. 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 compliment 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.

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

Crashworthy Testing Compliance

All 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. FHWA policy requires that all roadside appurtenances, including temporary traffic control devices, have been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features".

GUIDELINES FOR THE USE OF 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.

Important items when using a Portable Changeable Message Sign are:

General

- A PCMS should be used to supplement conventional signs, pavement marking and lighting.
- If a PCMS is used as an arrow panel, it shall meet all of the requirements of an arrow panel, and shall be used solely as an arrow panel.
- Performance specifications can be found in the current version of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD), Part 6, Section 6F.

Messages

- Each display should contain a single thought.
- The entire display should be readable twice at the posted speed limit prior to work starting.
- 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 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 the list of standard abbreviations on Pages 6K-xxvii and xix).
- Displays shall not scroll horizontally or vertically across the face of the sign.

Requirements

The specifications for use of a PCMS are in the following table.

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 Mgmt.	Advance Warning	Advance Warning & Advance Notice
Legibility Distance Requirements	Legible at 350 feet	Legible at 750 feet	Legible at 900 feet
Minimum Character Height	10 inches	14 inches	18 inches
Maximum No. of Displays	1	2	* 40 mph or less = 3 * 45 mph or more = 2
Message Cycle	Constant	at least 2 seconds per display	at least 2 seconds per display
Minimum Sign Panel Height	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.

Table 6F-2

Abbreviations That Shall be Used Only on Portable Changeable Message Signs

Word Message	Standard Abbreviation	Prompt Word That Should Precede the Abbreviation	Prompt Word That Should Precede the Abbreviation
Access	ACCS	---	---
Ahead	AHD	Fog	---
Blocked	BLKD	Lane	---
Bridge	BR*	(Name)	---
Cannot	CANT	---	---
Center	CNTR	---	Lane
Chemical	CHEM	---	Spill
Condition	COND	Traffic	---
Congested	CONG	Traffic	---
Construction	CONST	---	Ahead
Crossing	XING	---	---
Do Not	DONT	---	---
Downtown	DWNTN	---	Traffic
Eastbound	E-BND	---	---
Emergency	EMER	---	---
Entrance, Enter	ENT	---	---
Exit	EX	Next	---
Express	EXP	---	Lane
Frontage	FRNTG	---	Road
Hazardous	HAZ	---	Driving
Highway-Rail Grade Crossing	RR XING	---	---
Interstate	I-*	---	(Number)
It is	ITS	---	---
Lane	LN	(Roadway Name)*, Right, Left, Center	---
Left	LFT	---	---
Local	LOC	---	Traffic
Lower	LWR	---	Level
Maintenance	MAINT	---	---
Major	MAJ	---	Accident
Minor	MNR	---	Accident
Normal	NORM	---	---
Northbound	N-BND	---	---
Oversized	OVRSZ	---	Load
Parking	PKING	---	---
Pavement	PVMT	Wet	---
Prepare	PREP	---	To Stop
Quality	QLTY	Air	---
Right	RT	Keep, Next	---
Right	RT	---	Lane
Roadwork	RDWK	---	Ahead, (Distance)

* This abbreviation, when accompanied by the prompt word, may be used on traffic control other than portable changeable message signs.

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

Table 6F-3 (sheet 1 of 2)

Abbreviations That Shall be Used Only on Portable Changeable Message Signs

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








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

Table 6F-3 (sheet 2 of 2)

Unacceptable Abbreviations

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

Table 6F-4
6K-xix

Operating Mode	Panel Display *
1. At least one of the following two 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

* Element layout for Type C panel shown

Arrow Stick

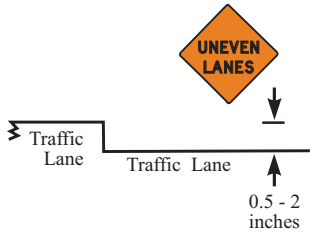
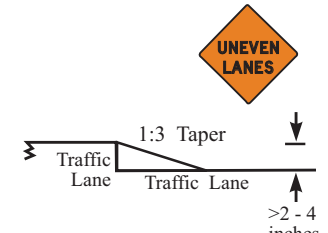
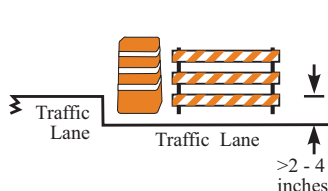
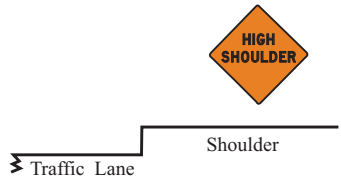


Arrow Sticks may supplement other TTC devices, but shall not be used in place of arrow boards

Advance Warning Arrow Board Specifications

Figure 6K-2

6K-xx

DROP OFF	UNEVEN LANES											
0.5 - 2 inches without taper		<p>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 highway work zones. The best way to increase traffic safety is to make every attempt to minimize exposure to uneven lanes, milled edges, and edge drop-offs. Only when uneven lanes, milled edges, and edge drop-offs are deemed necessary, shall the appropriate portion(s) of these guideline be applied to enhance traffic safety.</p> <p>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.</p>										
Greater than 2 - 4 inches with 1:3 taper		<p>Drop-offs of 0.5-4 inches, at least 8 feet from from the edge of traffic carrying lanes do not require any traffic control treatments.</p> <p>Drop-offs of greater than 4 - 12 inches adjacent to traffic carrying lanes are permitted without tapers or portable concrete barriers for:</p> <ol style="list-style-type: none"> Projects within an urban area when the speed limit is 30 mph or less; or Short term (3 calendar days or less) repair, less than 50 feet in length when the speed limit is greater than 30 mph. 										
Greater than 2 - 4 inches without taper		<p>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.</p> <p>Tapered slopes shall be adequately compacted to provide a firm driving surface.</p> <p>Appropriate uneven lane warning signs or shoulder warning signs shall be repeated after each intersection.</p>										
Traffic Lane Milled Edge												
 <p>Note: Milled edges greater than 2 inches require tapers and/or delineation as detailed for edge drop-offs in addition to the HIGH SHOULDER signs.</p>		<p>Where space is limited or there is a sight restriction, weighted channelizers may be used in place of drums to delineate longitudinal drop-offs.</p> <p>Maximum spacing of traffic control devices shall be determined based on the posted speed limit and using the following table.</p> <table border="1" data-bbox="883 1159 1166 1411"> <thead> <tr> <th>Traffic Control Device</th> <th>Maximum Spacing of Devices</th> </tr> </thead> <tbody> <tr> <td>Sign</td> <td>low speed = ¼ mile high speed = 1 mile</td> </tr> <tr> <td>Drum</td> <td>2G</td> </tr> <tr> <td>Weighted Channelizer or Tubular Marker</td> <td>G</td> </tr> <tr> <td>Type III Barricade</td> <td>20G</td> </tr> </tbody> </table>	Traffic Control Device	Maximum Spacing of Devices	Sign	low speed = ¼ mile high speed = 1 mile	Drum	2G	Weighted Channelizer or Tubular Marker	G	Type III Barricade	20G
Traffic Control Device	Maximum Spacing of Devices											
Sign	low speed = ¼ mile high speed = 1 mile											
Drum	2G											
Weighted Channelizer or Tubular Marker	G											
Type III Barricade	20G											

Longitudinal Drop-off Guidelines

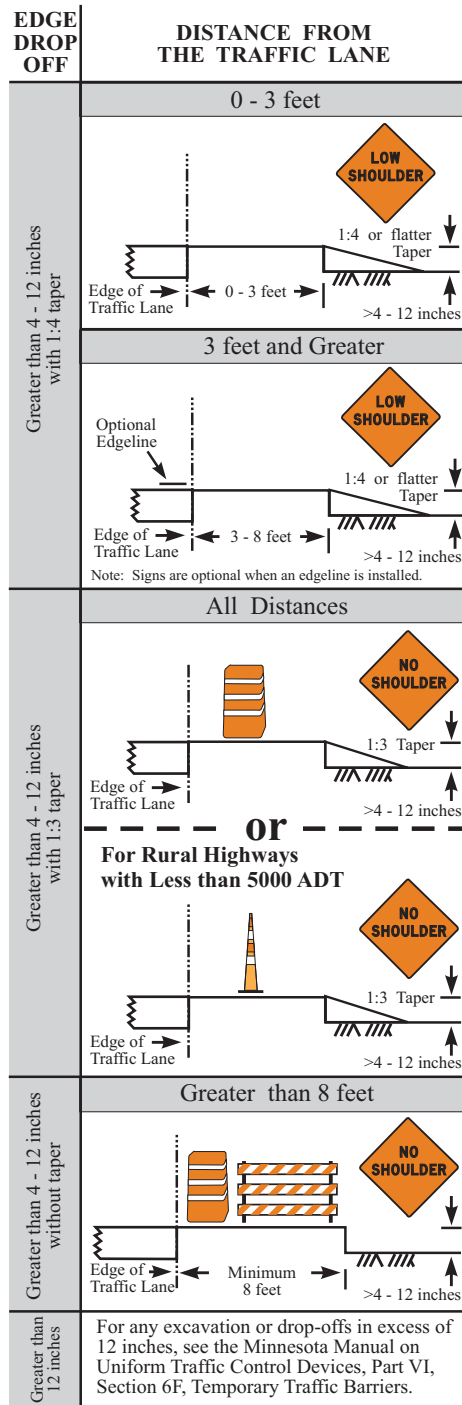
Figure 6K-3

EDGE DROP OFF	DISTANCE FROM THE TRAFFIC LANE	
	0 - 3 feet	3 - 8 feet
0.5 - 2 inches without taper	<p>Edge of Traffic Lane ← 0 - 3 feet →</p> <p>0.5 - 2 inches</p> <p>LOW SHOULDER</p>	<p>Edge of Traffic Lane ← 3 - 8 feet →</p> <p>Optional Edgeline</p> <p>0.5 - 2 inches</p> <p>LOW SHOULDER</p> <p>Note: Signs are optional when an edgeline is installed.</p>
Greater than 2 - 4 inches with 1:3 taper	<p>Edge of Traffic Lane ← 0 - 3 feet →</p> <p>1:3 Taper</p> <p>>2 - 4 inches</p> <p>LOW SHOULDER</p>	<p>Edge of Traffic Lane ← 3 - 8 feet →</p> <p>Optional Edgeline</p> <p>1:3 Taper</p> <p>>2 - 4 inches</p> <p>LOW SHOULDER</p> <p>Note: Signs are optional when an edgeline is installed.</p>
Greater than 2 - 4 inches without taper	<p>Edge of Traffic Lane ← 0 - 3 feet →</p> <p>Alternate Position</p> <p>>2 - 4 inches</p> <p>NO SHOULDER</p>	<p>Edge of Traffic Lane ← 3 - 8 feet →</p> <p>>2 - 4 inches</p> <p>NO SHOULDER</p>
	<p style="text-align: center;">OR</p> <p style="text-align: center;">For Rural Highways with Less than 5000 ADT</p> <p>Edge of Traffic Lane ← 0 - 3 feet →</p> <p>Alternate Position</p> <p>>2 - 4 inches</p> <p>NO SHOULDER</p>	<p style="text-align: center;">OR</p> <p style="text-align: center;">For Rural Highways with Less than 5000 ADT</p> <p>Edge of Traffic Lane ← 3 - 8 feet →</p> <p>Edgeline</p> <p>>2 - 4 inches</p> <p>NO SHOULDER</p>

Longitudinal Drop-off Guidelines

Figure 6K-4

6K-xxii



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 highway work zones. The best way to increase traffic safety is to make every attempt to minimize exposure to uneven lanes, milled edges, and edge drop-offs. Only when uneven lanes, milled edges, and edge drop-offs are deemed necessary, shall the appropriate portion(s) of these guideline 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 - 4 inches, at least 8 feet from from the edge of traffic carrying lanes do not require any traffic control treatments.

Drop-offs of greater than 4 - 12 inches adjacent to traffic carrying lanes are permitted without tapers or portable concrete 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.

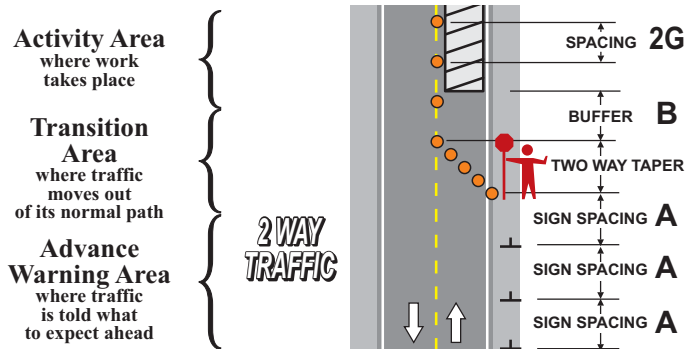
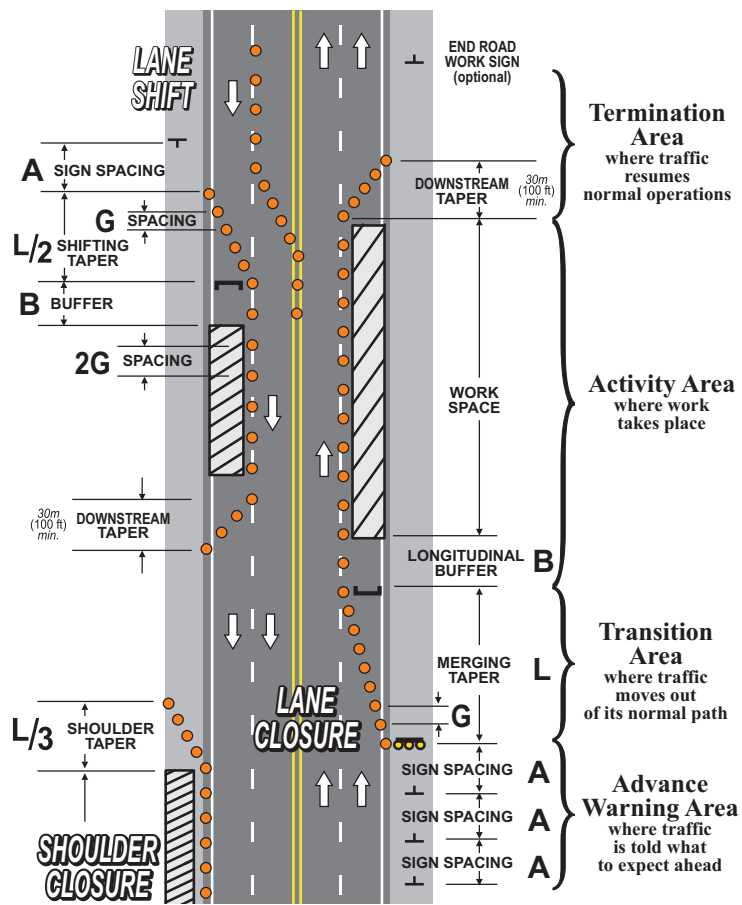
Maximum spacing of traffic control devices shall be determined based on the posted speed limit and using the following table.

Traffic Control Device	Maximum Spacing of Devices
Sign	low speed = ¼ mile high speed = 1 mile
Drum	2G
Weighted Channelizer or Tubular Marker	G
Type III Barricade	20G

Longitudinal Drop-off Guidelines

Figure 6K-5

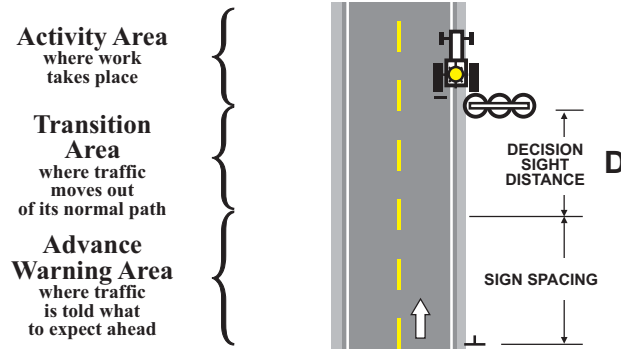
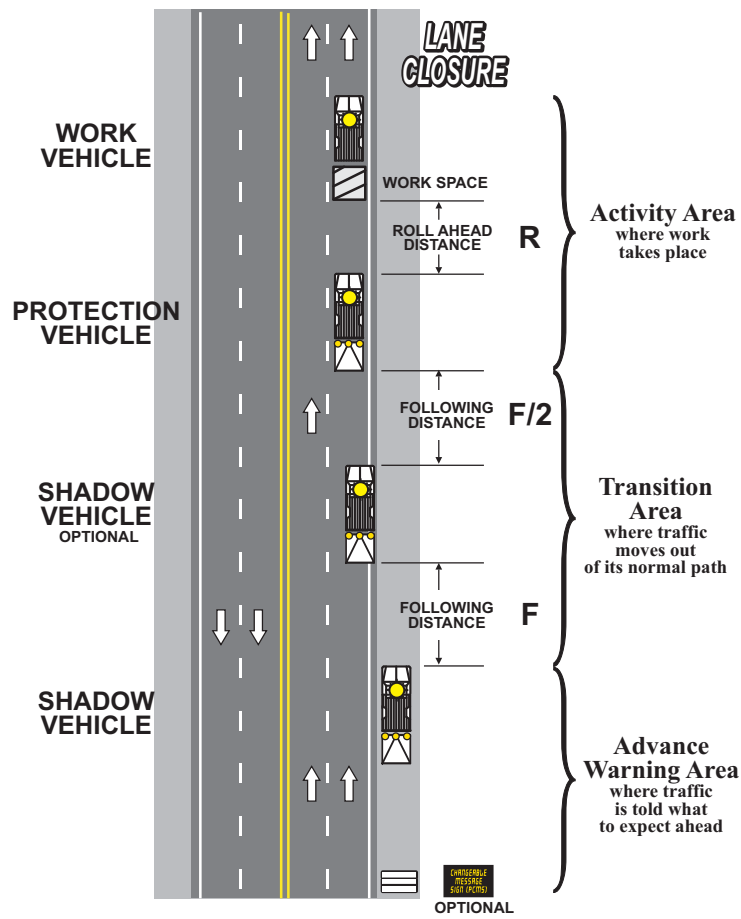
6K-xxiii



Components of a Stationary Temporary Traffic Control Zone

Figure 6K-6






































6K-xxiv



Components of a Mobile Temporary Traffic Control Zone

Figure 6K-7























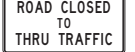

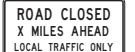











6K-xxv

	W20-1		W20-X16
	W20-4M		W21-X5L W21-X5R
	W20-7		W21-X5A
	W3-4		W21-X9
	W4-2L		W8-9
	W4-2R		W8-23
	W20-X3R		W8-11
	W20-X3L		W20-X18
	W21-W7STOP		W20-X12L
	W21-X7SLOW		W9-3A
	W1-4R		W20-X13R
	W1-4L		W20-X13L
	W21-6A		R10-6L
	W21-1		R10-6R
	W3-3		R1-X3
	R1-1		R4-7
	R1-2		R3-1
	W3-1		R3-2
	W3-2		

SIGN CODES QUICK REFERENCE

Refer to the Standard Signs Manual and the MN MUTCD for additional signs and information on typical sizes and usage.

Figure 6K-8

	G20-X1		G20-X10
	W21-X4AR		G20-X11
	W21-X4AL		G20-X12
	W21-X4ARA		G20-X13
	W21-X4AS		W7-3AP
	G20-4		W20-100P
	W20-1A		W21-X10
	R9-9		W21-X11
	R9-11BR		W21-X12
	R9-11BL		
	R11-2		
	R11-4		W8-1A
	R11-3A		W8-1AR
	W1-6		W8-1AL
	W21-X3L		W8-8
	G20-X7		W13-1P
	G20-X14		W22-1
			W22-2
			W22-3

SIGN CODES QUICK REFERENCE

Refer to the Standard Signs Manual and the MN MUTCD for additional signs and information on typical sizes and usage.

Figure 6K-9

**SAMPLE
PROJECT INSPECTION CHECKLIST**

PROJECT - _____

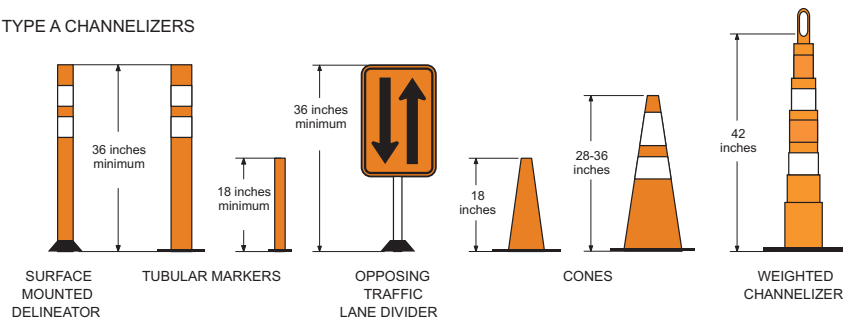
ITEM	YES	NO	HOW MANY?
1. Are any devices missing?	<input type="checkbox"/>	<input type="checkbox"/>	_____
Do any devices need repair?	<input type="checkbox"/>	<input type="checkbox"/>	_____
Were all replaced or repaired?	<input type="checkbox"/>	<input type="checkbox"/>	_____
2. Are any lights (flashers,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

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

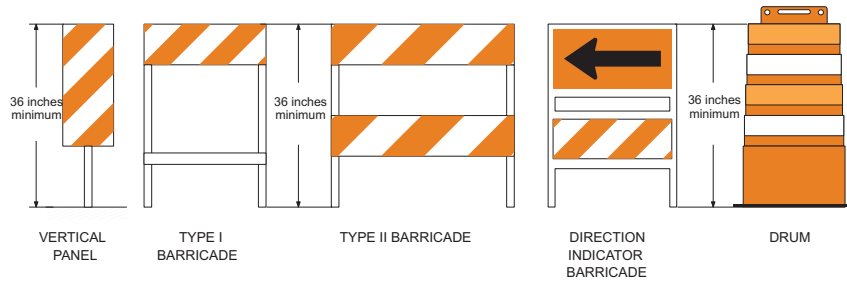
on _____ at _____ a.m. p.m.
(date) (time)

**Figure 6K-10
6K-xxviii**

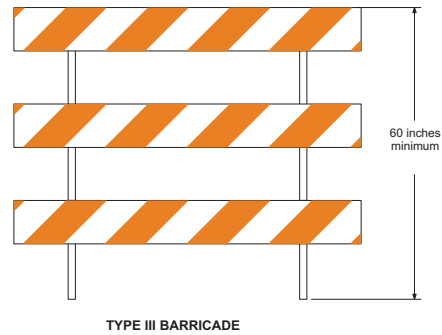
TYPE A CHANNELIZERS



TYPE B CHANNELIZERS

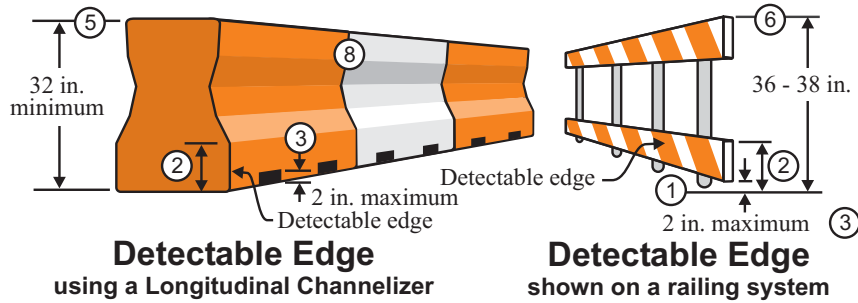


TYPE C CHANNELIZER



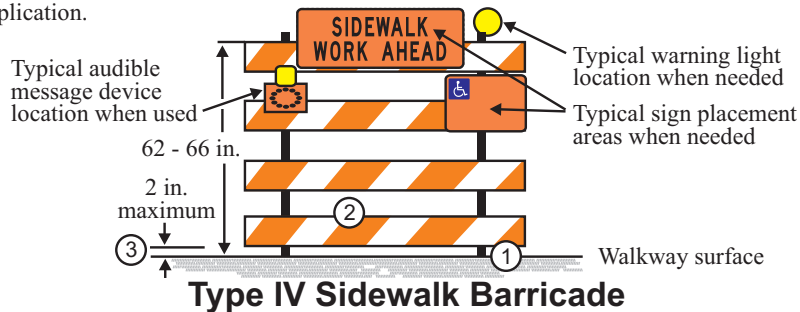
Channelizing Devices

Figure 6K-11
6K-xxix



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 in. minimum walkway clear space and shall have 0.5 in. maximum height above the walkway surface with approved beveling (see note #9 on page 6K-xxx for beveling details).
2. Detectable edges for long canes shall be continuous and 6 in. min high above the walkway surface and have color or markings contrasting with the walkway surface.
3. Devices shall not block water drainage from the walkway. A gap height or opening from the walkway surface up to 2 in. maximum height is allowed for drainage purposes.
4. Railings or other objects may protrude a maximum of 4 in. into the walkway clear space when located 27 in. minimum above the walkway surface.
5. Longitudinal channelizing devices for pedestrians shall be 32 in. high or greater.
6. When hand guidance is required, the top rail or top surface shall:
 - be in a vertical plane perpendicular to the walkway above the detectable edge,
 - be continuous at a height of 36 to 38 in. above the walkway surface, and
 - be 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 of pedestrians.
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.

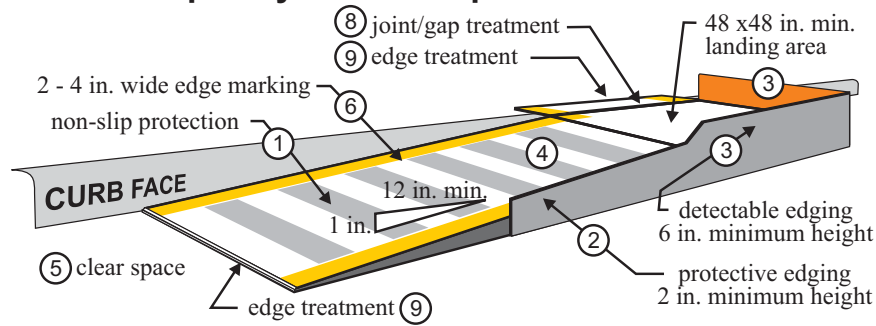


Typical ADA Pedestrian Devices

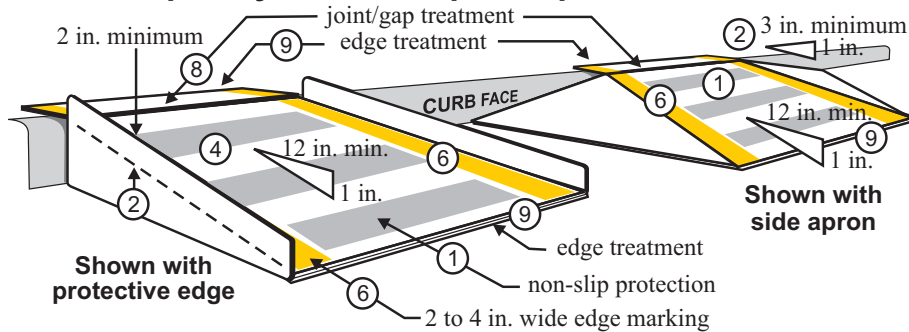
Refer to the Mn/DOT TPAR website for additional standards, guidance, and options for designing temporary pedestrian access routes.
<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>

Figure 6K-12
6K-xxx

Temporary Curb Ramp - Parallel to Curb



Temporary Curb Ramp - Perpendicular to Curb



NOTES:










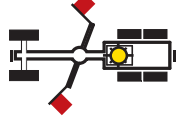









1. Curb ramps shall be 48 in. minimum width with a firm, stable and non-slip surface.
2. Protective edging with a 2 in. minimum height shall be installed when the curb ramp or landing platform has a vertical drop of 6 in. or greater or has a side apron slope steeper than 1:3 (33%). Protective edging should be considered when curb ramps or landing platforms have a vertical drop of 3 in. or more.
3. Detectable edging with 6 in. 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 in. 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 in. 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 in. width.
9. Changes between surface heights should not exceed 0.5 in. Lateral edges should be vertical up to 0.25 in. high, and beveled at 1:2 between 0.25 in. and 0.5 in. height.

Typical ADA Pedestrian Devices

Refer to the Mn/DOT TPAR website for additional standards, guidance, and options for designing temporary pedestrian access routes.
<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>

Figure 6K-13

6K-xxxi

Symbols	Meaning
	Flagger or Operator of Automated Flagging Assistance Device
 AFAD	Automated Flagging Assistance Device (AFAD)
	Flashing Arrow Board
	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.
	A combination of Type A and B channelizing devices
	Direction of Traffic
	See Note; i.e. See Note 6
	Work Space

Symbols Used in Typical Layouts

Figure 6K-14

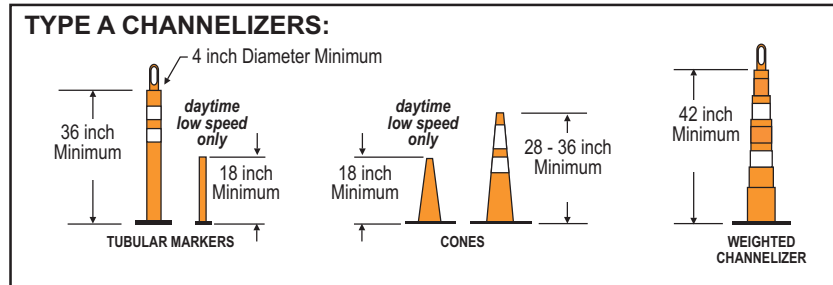
6K-xxxii

Temporary Traffic Control Distance Charts

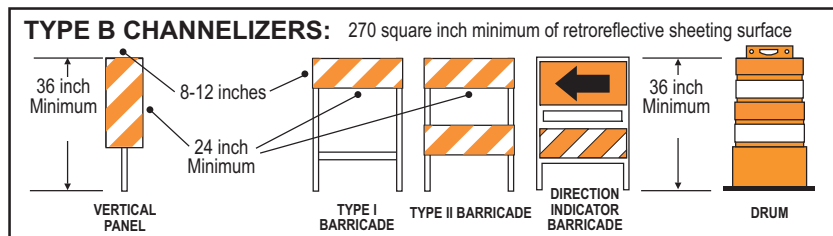
Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (12 ft lane) (L) feet	Shifting Taper (L/2) feet	Typical Shoulder Taper (L/3) feet
0 - 30	G = 25 ft	250	550	200	100	75
35 - 40		325	700	325	175	125
45 - 50	G = 50 ft	600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

Posted Speed Limit Prior to Work Starting (mph)		Buffer Space (B) feet	Shadow Vehicle Following Distance (F) feet	Protection Vehicle Roll-Ahead Buffer Distance (with or without TMA) (R) feet	
				Moving (15 mph max)	Stopped
0 - 30	G = 25 ft	85	250 - 550	100	100
35 - 40		170	325 - 700	100	100
45 - 50	G = 50 ft	280	600 - 900	175	125
55		335	750 - 1200	175	125
60 - 65		485	1000 - 1400	225	175
70 - 75		670	1200 - 1600	225	175

Type A channelizing devices are typically used in attended temporary traffic control zones.*



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 over night.*

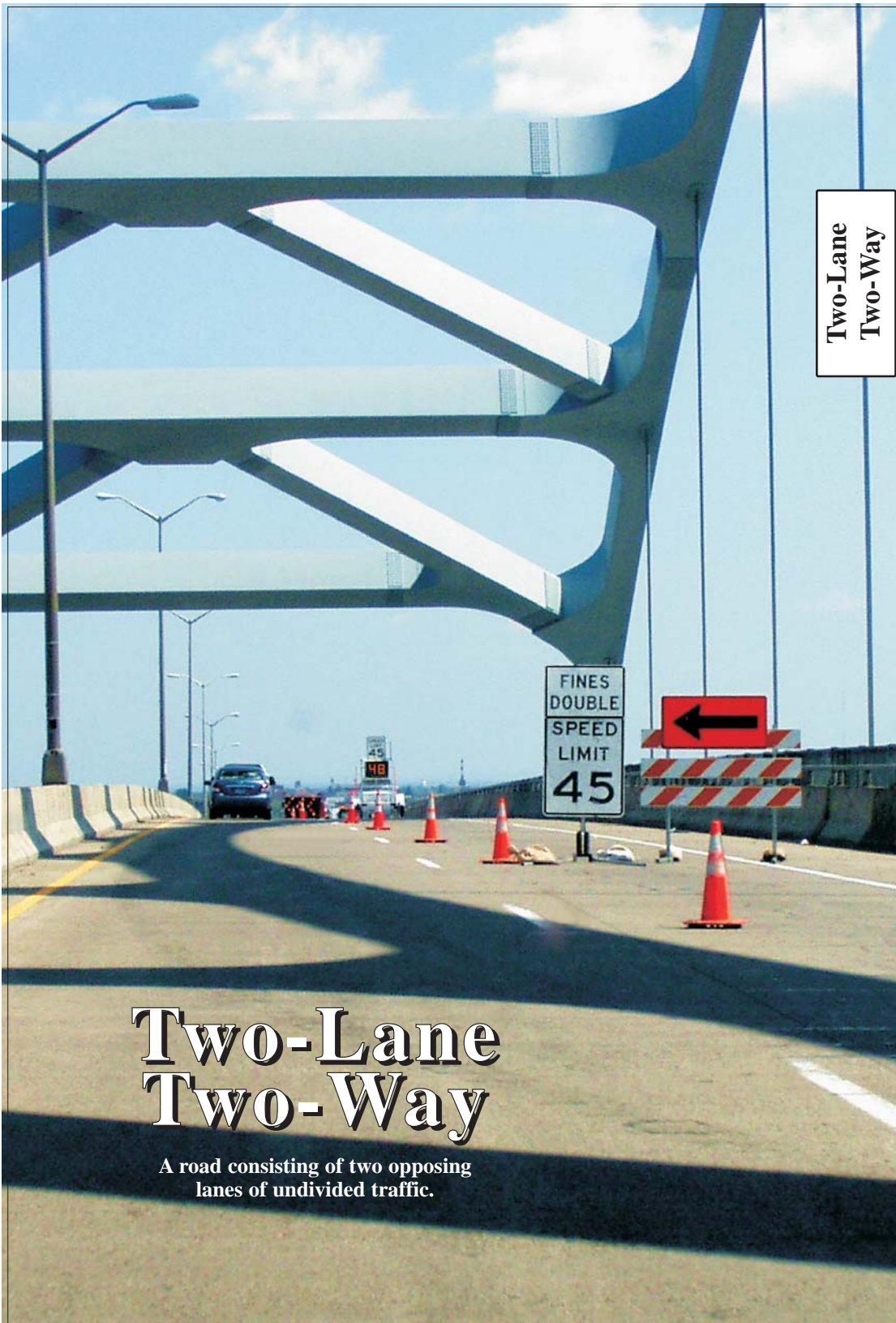


* See the MN MUTCD, Part 6F for more details on application restrictions.

Figure 6K-15

6K-xxxiii

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Two-Lane
Two-Way

Two-Lane Two-Way

A road consisting of two opposing
lanes of undivided traffic.

TWO LANE - TWO WAY ROADS

Low Volume Less than 400 ADT	MOBILE	SHORT DURATION	SHORT TERM	INTERMEDIATE TERM
	15 Minutes or Less	One Hour or Less	12 Hours or Less	3 Days or Less
Lane Closure	5			
Uncontrolled		9		
One Flagger Control		10 *		
Work in Center of Road		22		
Work in Intersection		28 (low speed only)		

Intermediate Volume Up to 1500 ADT	MOBILE	SHORT DURATION	SHORT TERM	INTERMEDIATE TERM
	15 Minutes or Less	One Hour or Less	12 Hours or Less	3 Days or Less
Lane Closure	5			
Flagger Control	8 *		11 *	
AFAD - 1 Operator		12 *		
Work in Center of Road	21 *			

All ADTs	MOBILE	SHORT DURATION	SHORT TERM	INTERMEDIATE TERM
	15 Minutes or Less	One Hour or Less	12 Hours or Less	3 Days or Less
Work on Shoulder	1		2, 4	
Work off Shoulder			2	
Parking Lane Closure			3	
Lane Closure	6, 7 *			
2 Flagger Control		13 *		
Moving Work Spaces		14 *		
Near Intersection		15, 16 *		
Pilot Car Operation		17 *		
Near Railroad Xing		18 *		
Portable Signal Control			19	
STOP Sign Control			20	
Work in Center of Road		22 *		
Lane Shift		24		
Two-Way Left Turn Lanes				
Lane Shift		25		
Center Lane Closure		26		
Turn Lane Closures		42		
Work in Intersection		29 (low speed only)		
Road Closure	81 *		80	
Sidewalk Closure			84, 85	

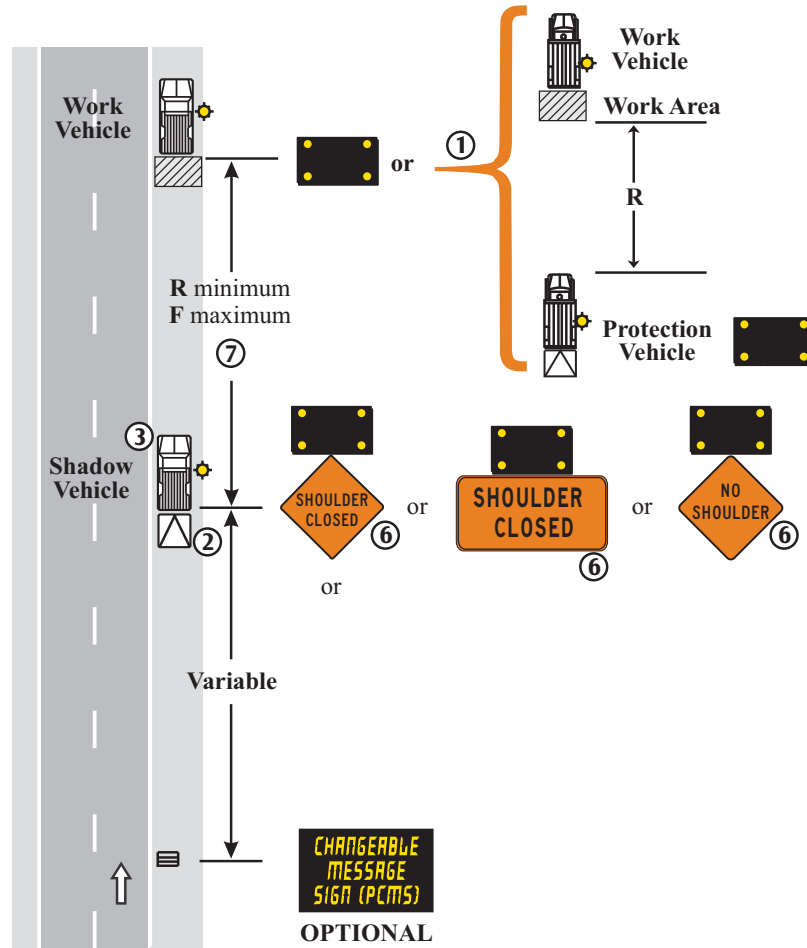
* This layout may be used for night time operations only if the flagging stations are occupied and illuminated with portable lights.

These Layouts as well as the entire Field Manual, the Flagging Handbook and other documents are available on the Mn/DOT, Traffic Engineering website at:

<http://www.dot.state.mn.us/trafficeng/>

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by a protection vehicle at a distance of **R**. The protection vehicle shall be equipped with a flashing arrow panel and should have a truck mounted attenuator.
2. Any shadow vehicle or protection vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The shadow vehicle or protection vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. If the operation does not move at least the Decision Sight Distance every 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.
6. When the PCMS is used, the SHOULDER CLOSED or NO SHOULDER sign becomes optional.
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.



MOBILE SHOULDER CLOSURE

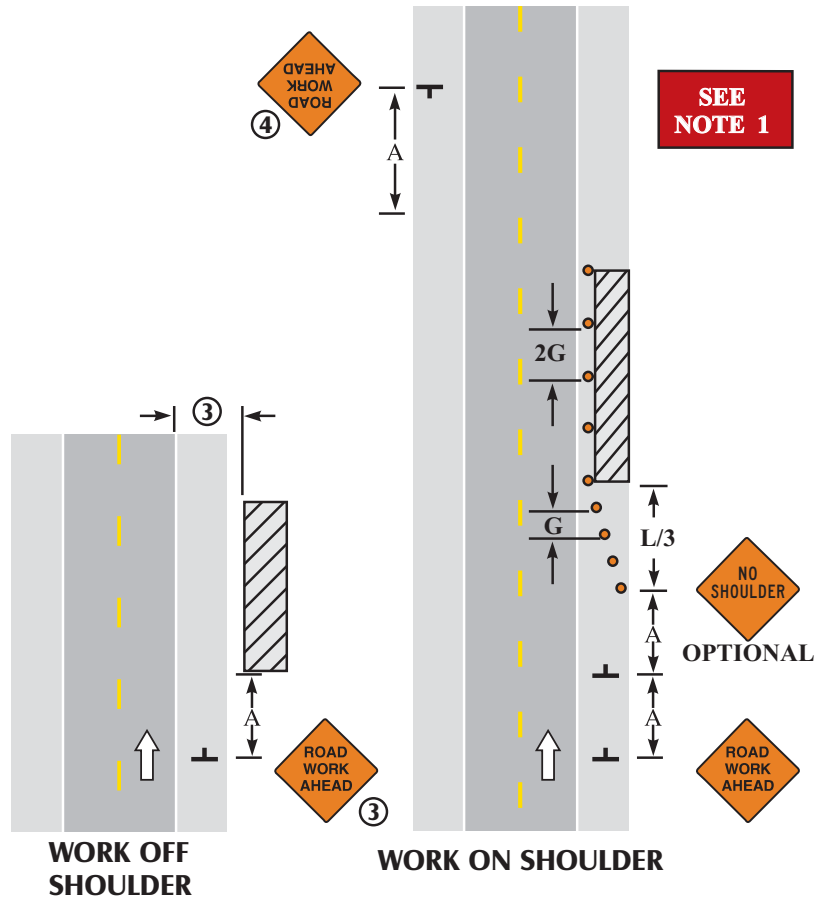
15 MINUTES or LESS

6K-1

LAYOUT 1

NOTES:

1. All signs, barricades and channelizing devices may be omitted when the work occupies an isolated shoulder location for less than one hour and it has little or no interference with traffic.
2. An operation which moves between work spaces that are less than the decision sight distance along the shoulder should use a stationary or mobile shoulder closure.
3. The ROAD WORK AHEAD sign may be omitted for short term daylight operations if:
 - a. the distance from curb face to the 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
 and a vehicle displaying a 360-degree flashing beacon is used.
4. This ROAD WORK AHEAD sign shall be installed on 2-lane, 2-way roads if traffic control devices are installed for a work space in the opposite shoulder.



**SHOULDER CLOSURE
WORK ON OR NEAR SHOULDER**

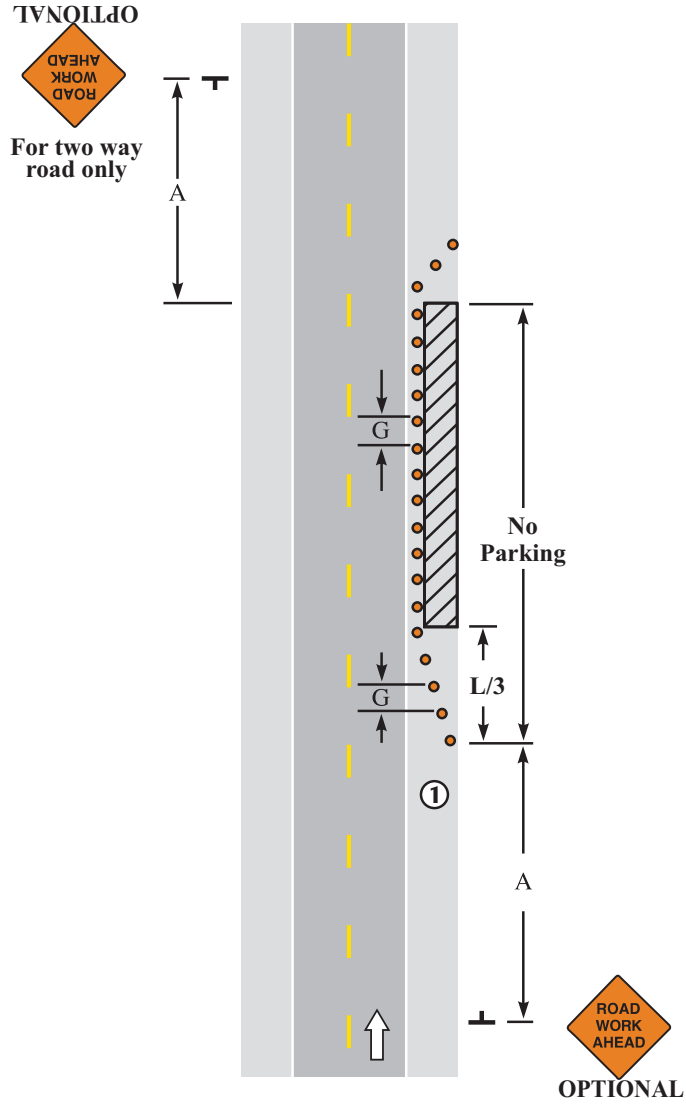
3 DAYS or LESS

6K-2

LAYOUT 2

NOTE:

1. This layout is intended for use where a parking lane is closed. If this parking lane is normally open to vehicle travel during the time of day this closure will be in effect, the lane shall be considered a traveled lane and not a parking lane. The appropriate layout shall then be used to provide traffic control for the lane closure.



PARKING LANE CLOSURE

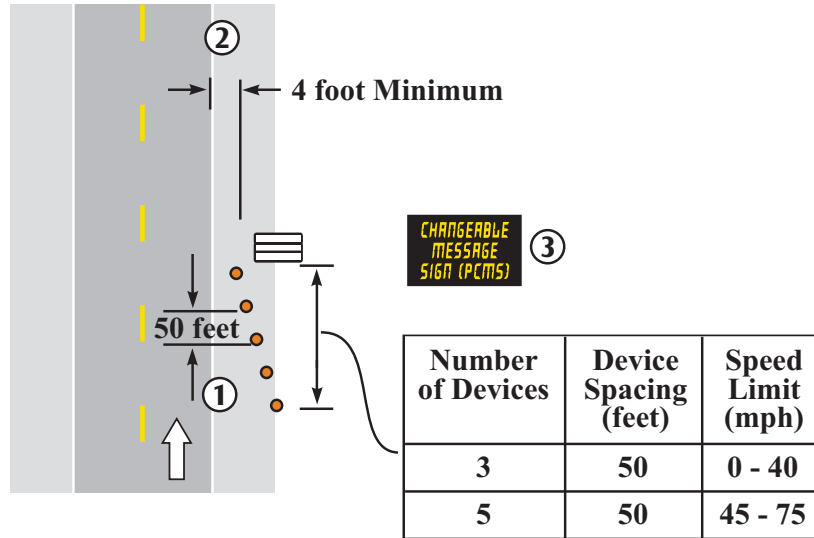
3 DAYS or LESS

6K-3

LAYOUT 3

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 shall be placed at least 4 feet from the edge of the traveled lane. If the 4 feet clearance can not be met, then a full shoulder closure shall be provided.
3. Typical trailer mounted traffic control devices may include flashing arrow boards, automated flagging assistance devices (AFADs), portable signals, portable changeable message signs, portable dynamic speed display signs, communications equipment, or other data collection devices.



**PARTIAL SHOULDER CLOSURE
TRAILER MOUNTED TRAFFIC CONTROL
DEVICES ON SHOULDER**

3 DAYS or LESS

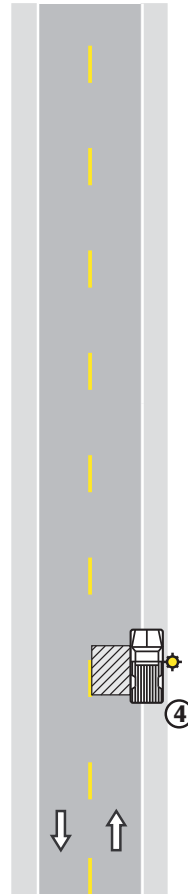
6K-4

LAYOUT 4

NOTES:

1. If the approach sight distance is restricted, a spotter should be used to protect the work area and to warn the driver.
2. If the visibility is poor or the operation does not move at least the Decision Sight Distance 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.

**USE FOR ROADS
LESS THAN
1500 ADT ONLY**



**LANE CLOSURE
TWO-LANE TWO-WAY ROAD**

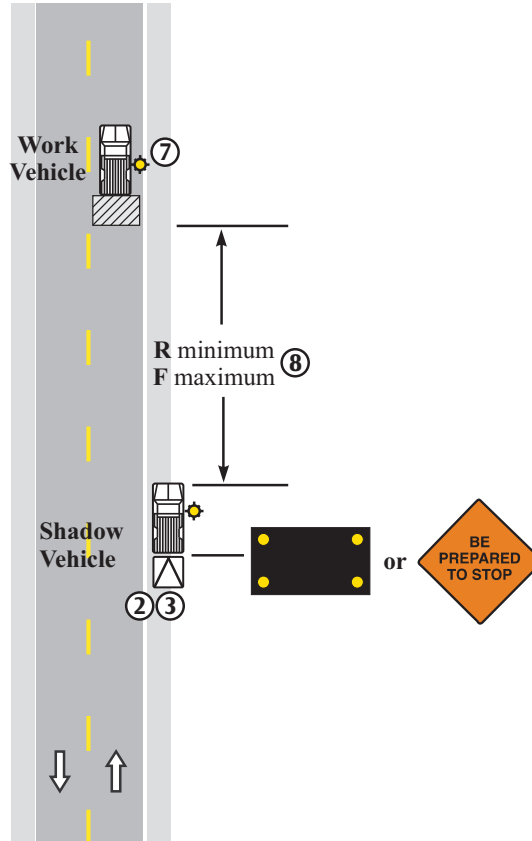
15 MINUTES or LESS

6K-5

LAYOUT 5

NOTES:

1. If the work space is not visible for at least the Decision Sight Distance, the motorists cannot see beyond the work space or traffic volumes do not allow passage, then Layout 7 shall be used.
2. Any shadow vehicle or protection vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The shadow vehicle or protection vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. If the work space does not move at least the Decision Sight Distance every 15 minutes, the appropriate stationary layout should be used.
5. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.
6. For nighttime operations, the flashing arrow board shall be used.
7. The slow moving or stopped work vehicle and shadow vehicle should keep the traffic lane as wide as possible by using the shoulder space whenever practical.
8. The distance between the work area and the 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**

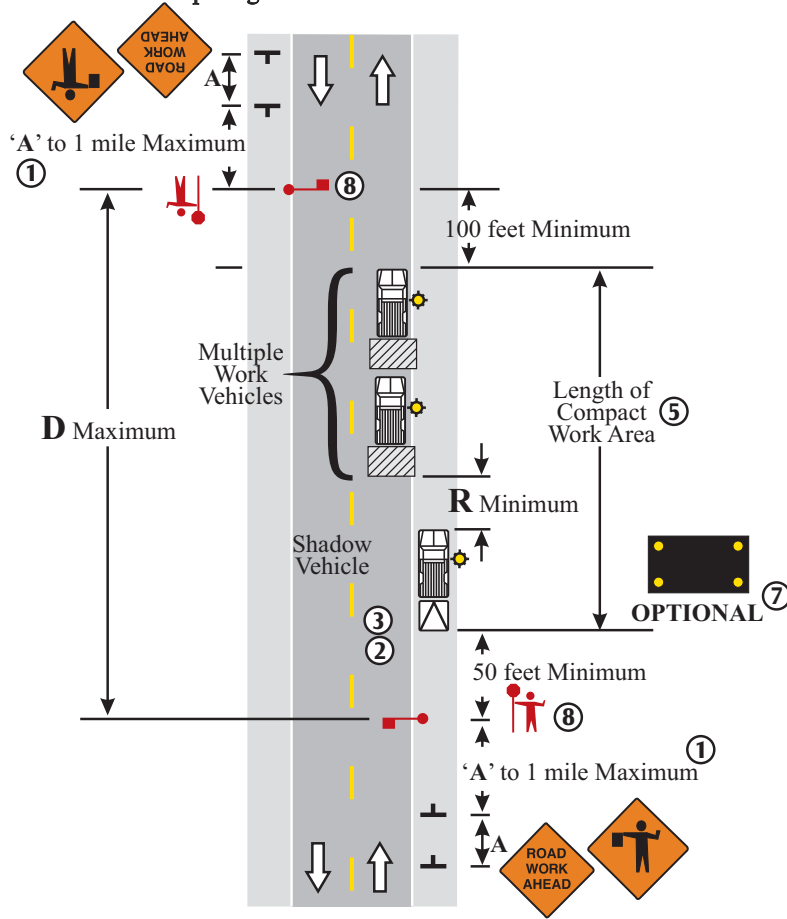
15 MINUTES or LESS

6K-6

LAYOUT 6

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 truck/trailer mounted attenuator.
3. The shadow vehicle or protection vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
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. A compact work area should be maintained with minimum space allowed between work vehicles. When the work area extends beyond 500 feet in total length, other traffic control layouts should be considered.
6. This layout may be used for nighttime operations only in locations where the posted speed limit is 40 mph or less.
7. The flashing arrow board shall be used during nighttime operations.
8. Flaggers shall be used when the approach sight distance is restricted, the motorists can not see beyond the work area, or traffic volumes do not allow safe passage.



**LANE CLOSURE
WITH A MOVING WORK AREA
TWO-LANE TWO-WAY ROAD**

15 MINUTES or LESS

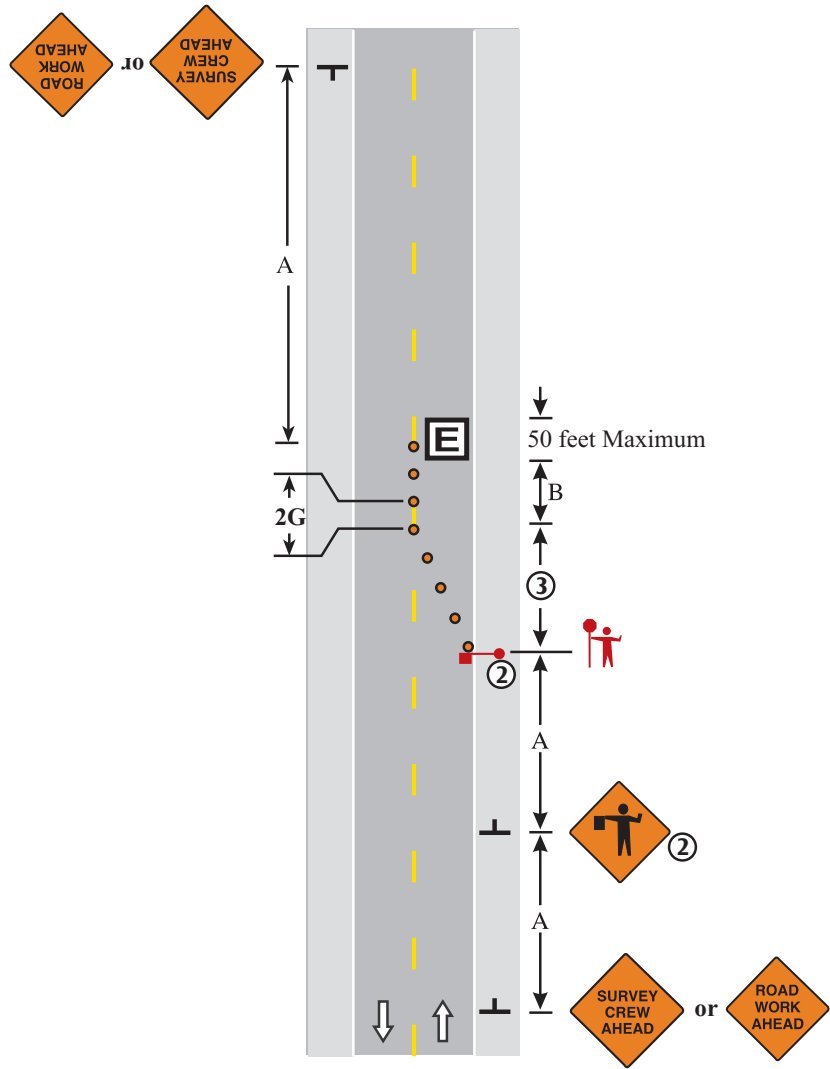
6K-7

LAYOUT 7

NOTES:

1. The work vehicle shall not be parked on the shoulder opposite of the coned area.
2. The flagger and the Flagger Ahead symbol sign may be omitted when traffic volumes do not restrict traffic's ability 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.

**USE FOR ROADS
LESS THAN
1500 ADT ONLY**



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

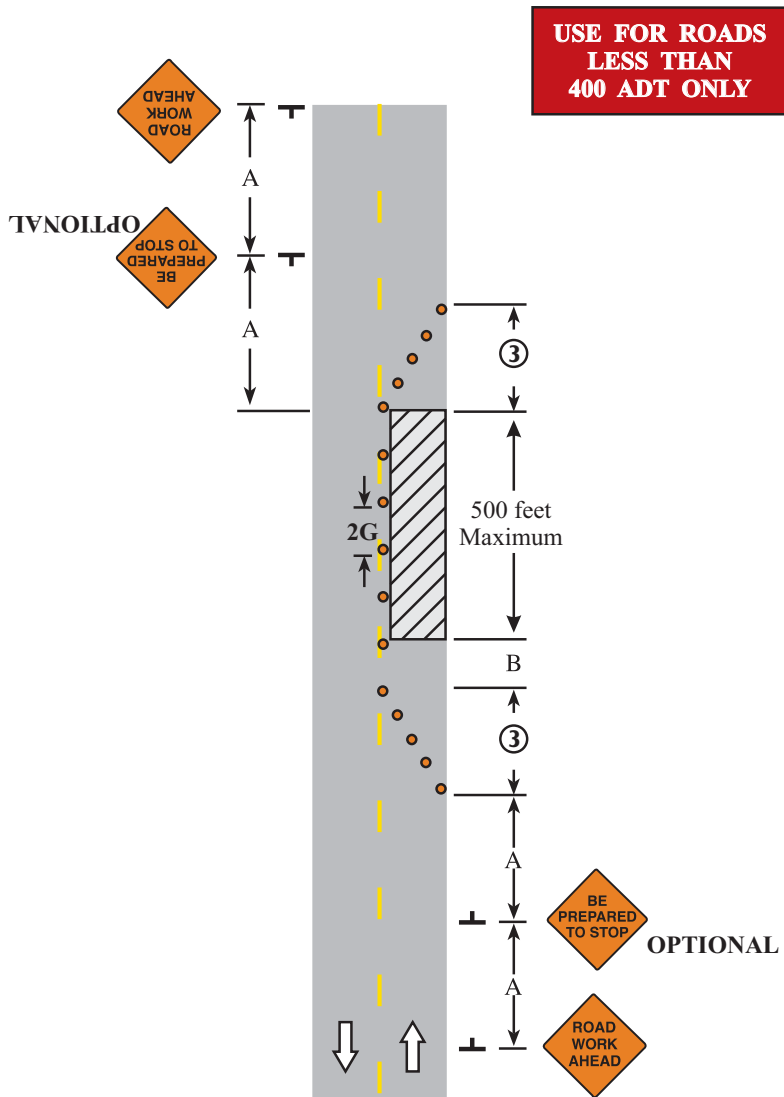
1 HOUR or LESS

6K-8

LAYOUT 8

NOTES:

1. When traffic can not regulate itself through the length of the work space, use Layout 10.
2. STOP signs shall be installed if the work space must be left unattended at night - see Layout 20.
3. The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.



**LANE CLOSURE, NO FLAGGER
TWO-LANE TWO-WAY ROAD**

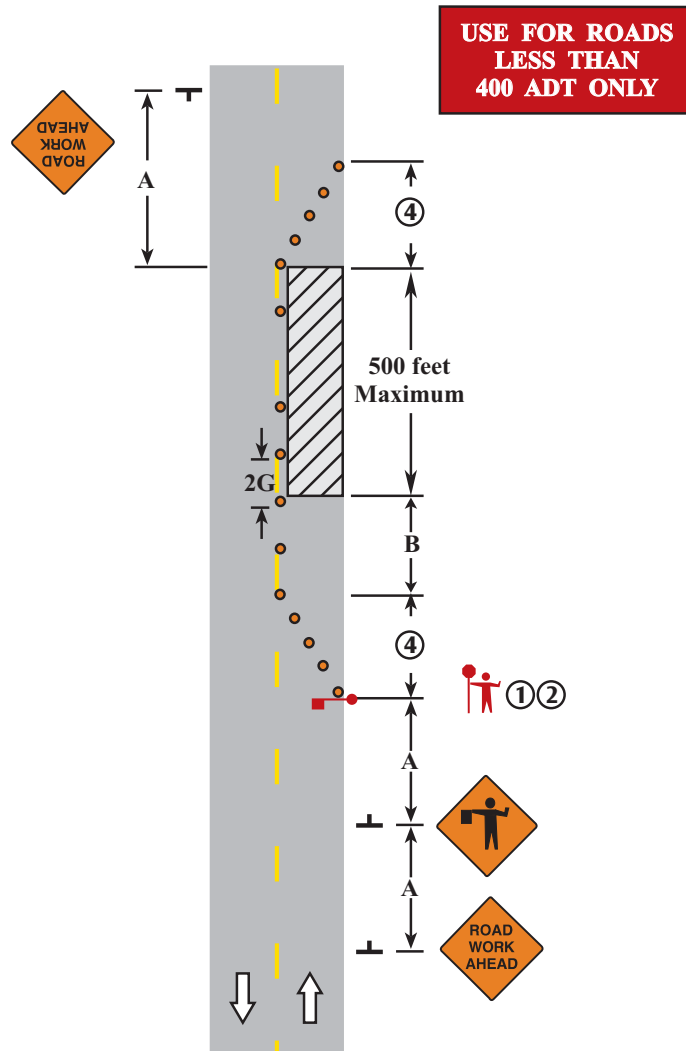
12 HOURS or LESS

6K-9

LAYOUT 9

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
2. If the flagger's ability to see oncoming motorists beyond the work space is less than the Decision Sight Distance, two flaggers shall be used - See Layout 13.
3. STOP signs shall be installed if the work space must be left unattended at night - see Layout 20.
4. The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.



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

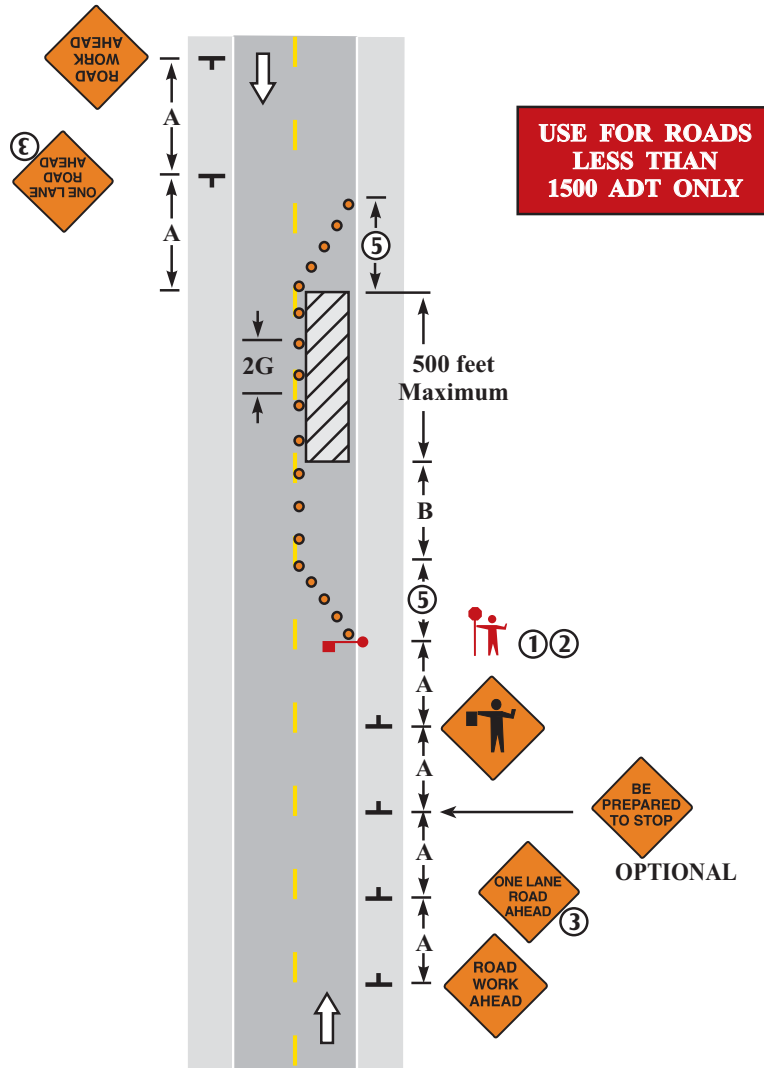
12 HOURS or LESS

6K-10

LAYOUT 10

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
2. If the flagger's ability to see oncoming motorists beyond the work space is less than the Decision Sight Distance, two flaggers shall be used - See Layout 13.
3. The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
4. STOP signs shall be installed if the work space must be left unattended at night, - see Layout 20.
5. The two-way taper should be 50 feet in length and using five equally spaced channelizing devices.



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

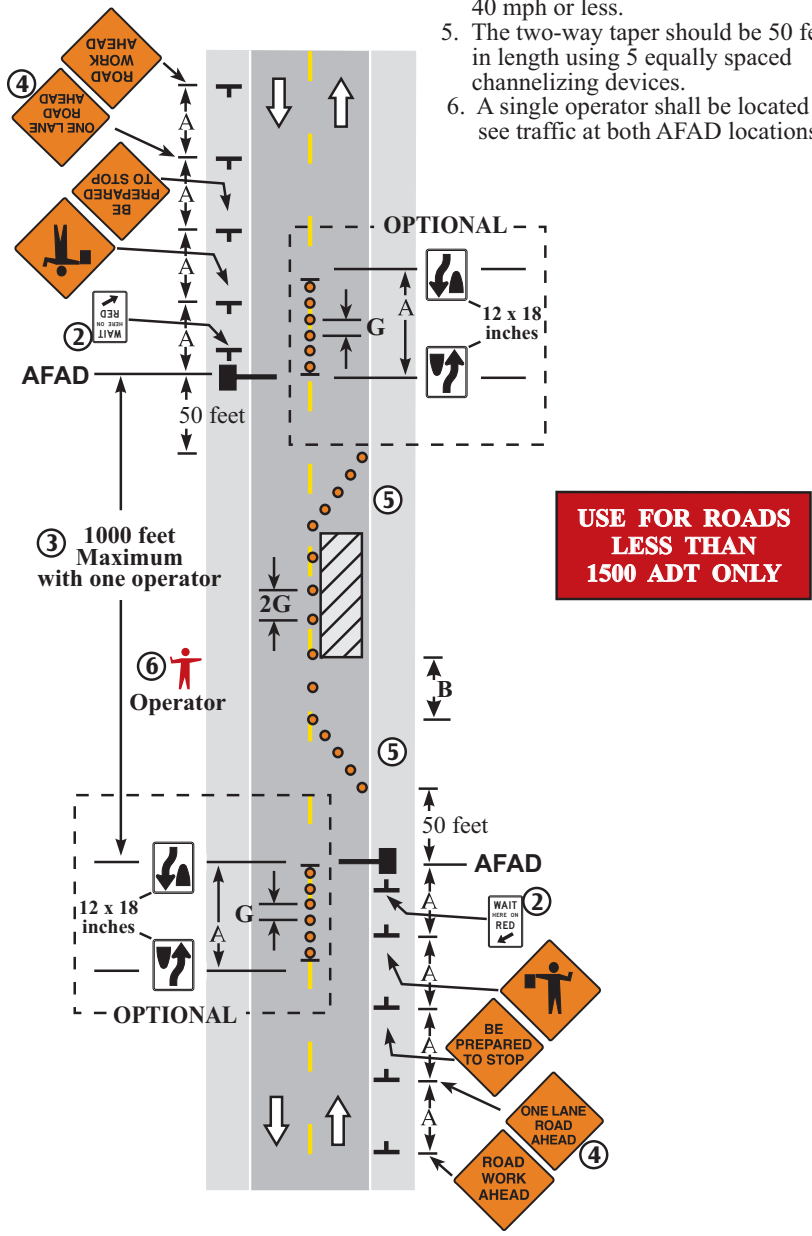
12 HOURS or LESS

6K-11

LAYOUT 11

NOTES:

1. The approach sight distance to the Automated Flagging Assistance Device (AFAD) shall be at least the Decision Sight Distance.
2. The WAIT HERE ON RED sign shall be installed 20 feet in advance of the AFAD.
3. The distance between the AFAD stations may be extended when an operator is placed at each station.
4. The ONE LANE 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.
6. A single operator shall be located to see traffic at both AFAD locations.



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

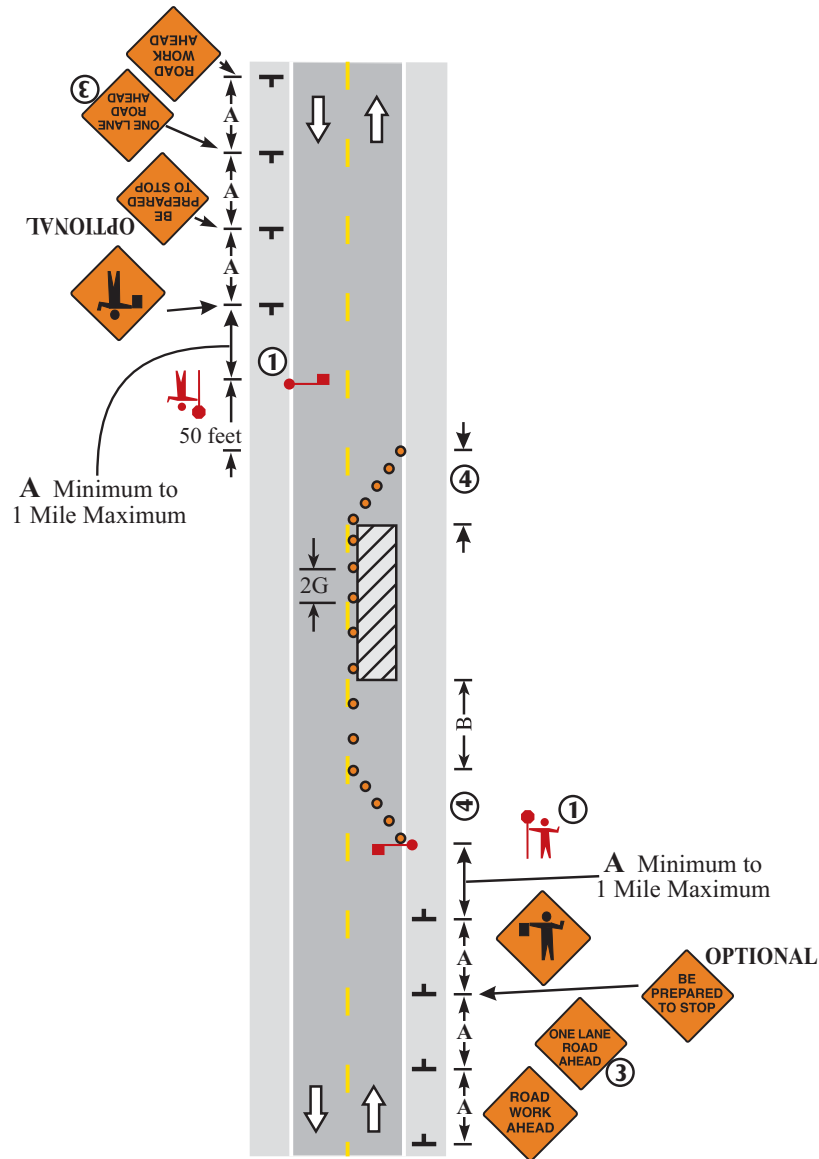
12 HOURS or LESS

6K-12

LAYOUT 12

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
2. During nighttime operations, illuminate both the flaggers and the work space with portable lights.
3. The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
4. The two-way taper should be 50 feet and using five equally spaced channelizing devices.



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

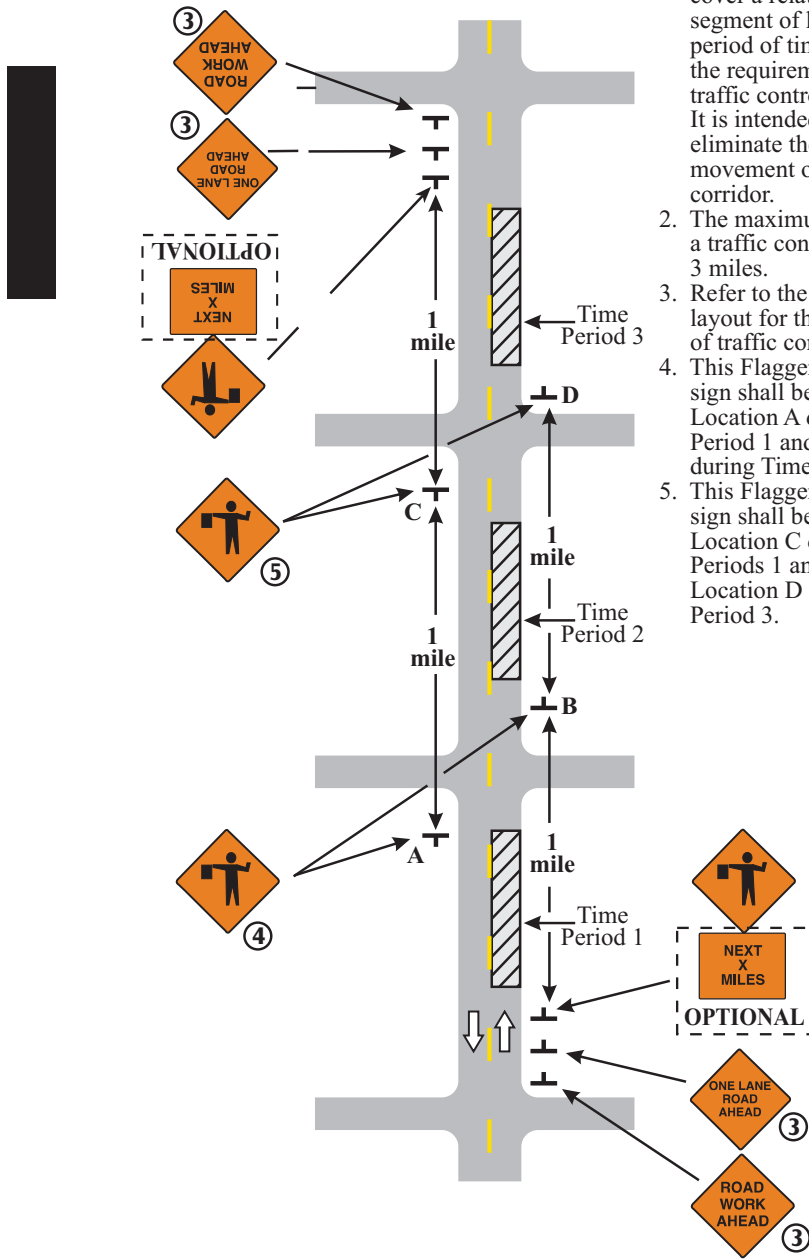
12 HOURS or LESS

6K-13

LAYOUT 13

NOTES:

1. This layout may be used for those short term stationary traffic control zones that cover a relatively long segment of highway in a short period of time but do not meet the requirements for a mobile traffic control zone. It is intended to be used to eliminate the multiple movement of signs along a corridor.
2. The maximum distance for a traffic control zone is 3 miles.
3. Refer to the appropriate layout for the exact location of traffic control devices.
4. This Flagger Ahead symbol sign shall be used at Location A during Time Period 1 and at Location B during Time Periods 2 and 3.
5. This Flagger Ahead symbol sign shall be used at Location C during Time Periods 1 and 2 and at Location D during Time Period 3.



**MOVING WORK SPACES
TRAFFIC CONTROL ZONE**

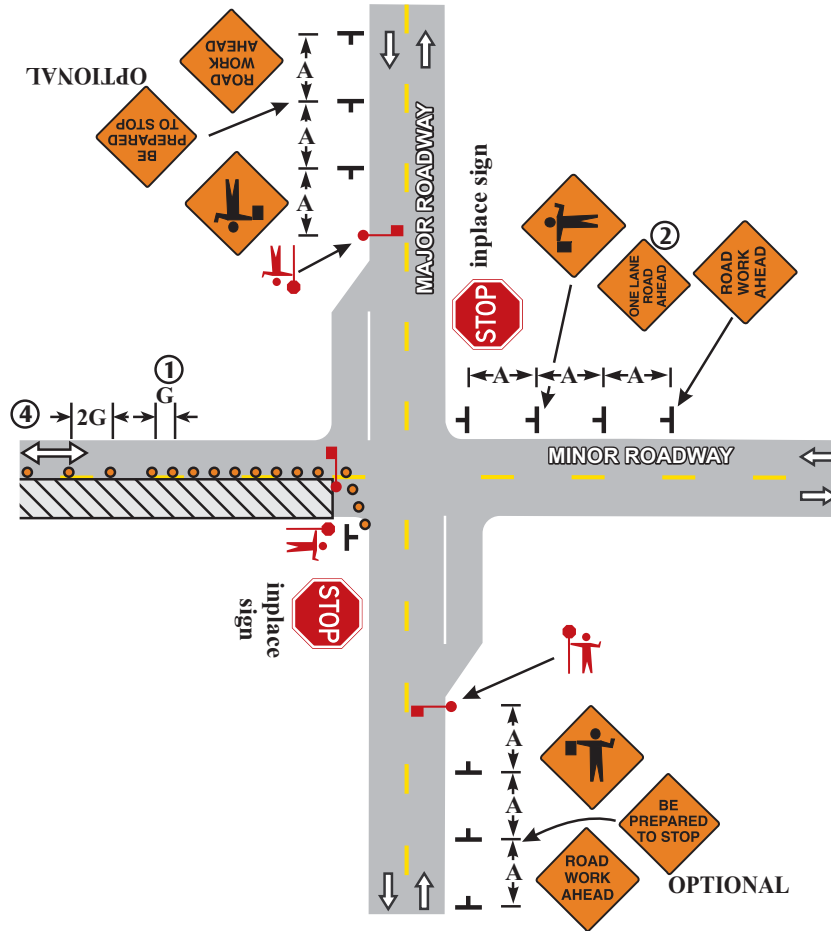
12 HOURS or LESS

6K-14

LAYOUT 14

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 road exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
 - a. Control the traffic at the intersection with a law enforcement officer;
 - b. Restrict vehicle turns from the major roadway with flagging, signing, and/or closing the turn lanes; or
 - c. Completely close a leg of the minor roadway until the work space has left the area near the intersection. (Local traffic only)
4. For other temporary traffic control devices in advance of the work space, see Layouts 10, 11, or 13.



**LANE CLOSURE ON MINOR ROAD
BEFORE INTERSECTION OF MAJOR ROAD
TWO-LANE TWO-WAY ROAD**

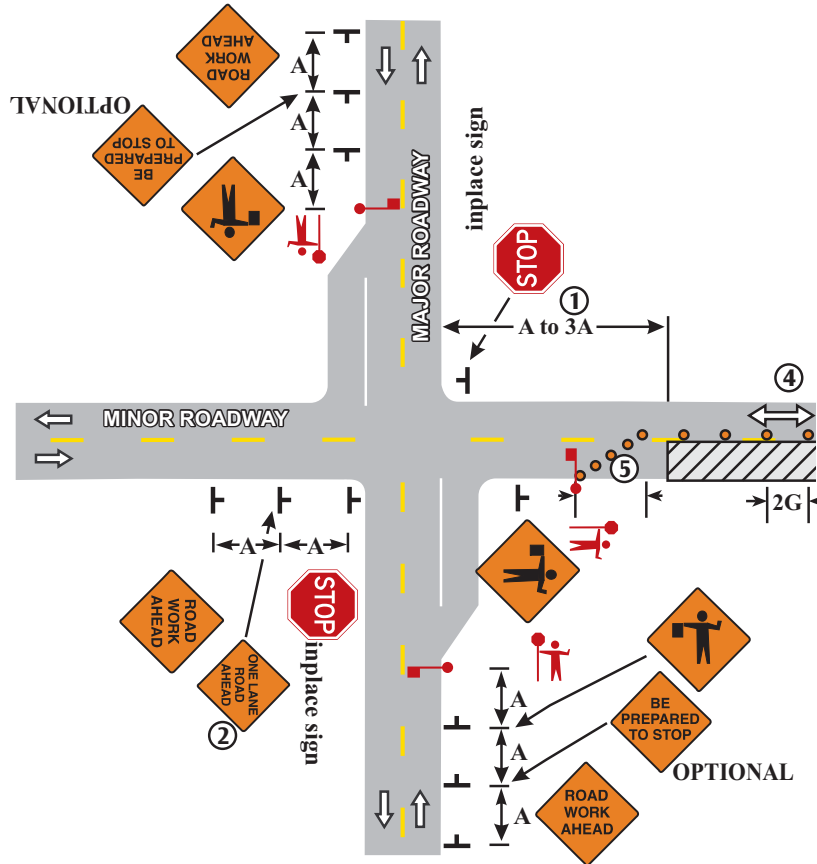
12 HOURS or LESS

6K-15

LAYOUT 15

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 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 road exceeds 1500 ADT or turning movements cause unsafe operations, the following steps should be considered:
 - a. Control the traffic at the intersection with a law enforcement officer;
 - b. Restrict vehicle turns from the major roadway with flagging, signing, and/or closing the turn lanes; or
 - c. Completely close a leg of the minor roadway until the work space has left the area near the intersection. (Local traffic only)
4. For other temporary traffic control devices in advance of the work space, see Layouts 10, 11, or 13.
5. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.



**LANE CLOSURE ON MINOR ROAD
BEYOND INTERSECTION OF MAJOR ROAD
TWO-LANE TWO-WAY ROAD**

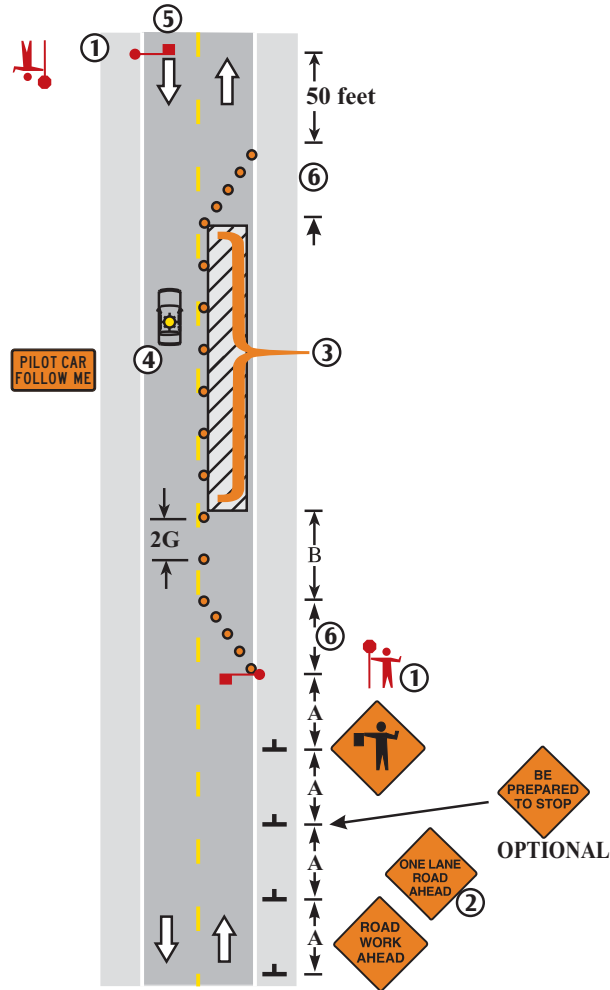
12 HOURS or LESS

6K-16

LAYOUT 16

NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
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:
 - a. Traffic is traveling next to longitudinal drop-offs that are greater than 4 inches, or
 - b. Visibility of the open traveled lane is restricted.
4. Pilot cars should lead traffic through the work zone at a safe speed. See the *Flagger 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 five equally spaced channelizing devices.



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

12 HOURS or LESS

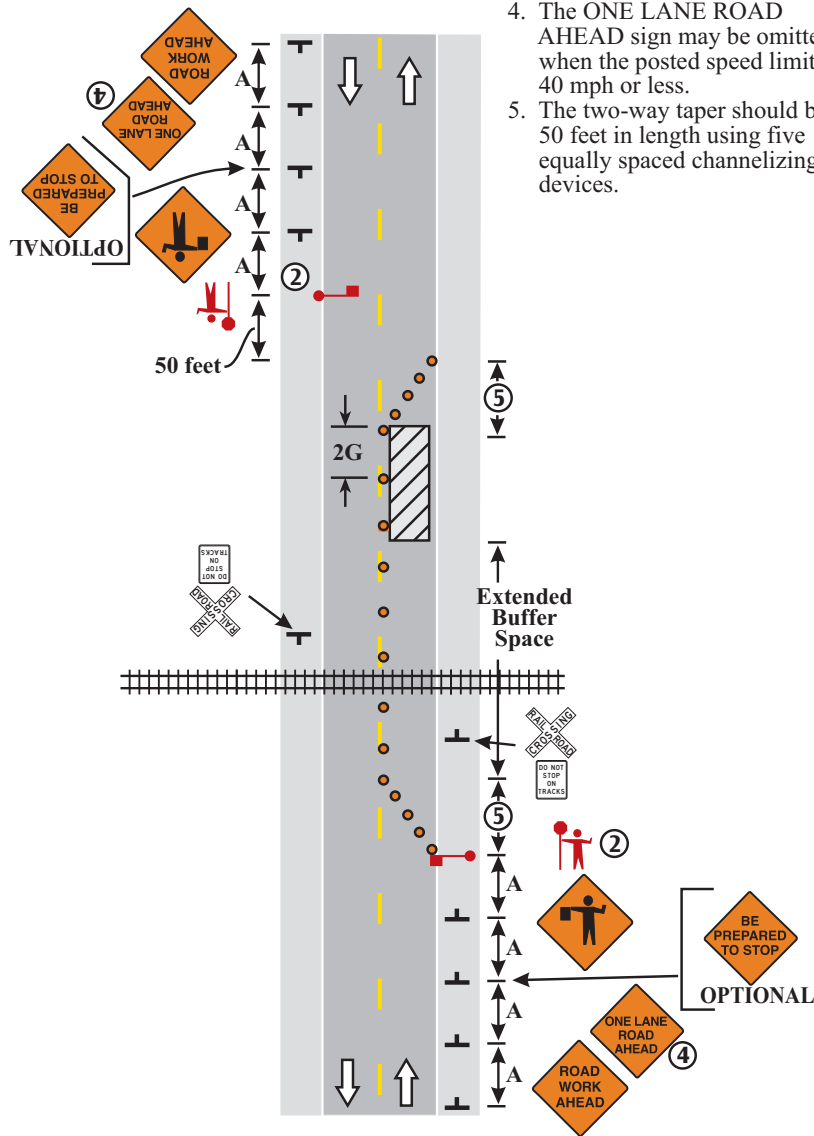
6K-17

LAYOUT 17

NOTES:

1. 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.
2. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
3. The activity area should be extended beyond the railroad crossing so that the backup of traffic created by the flagging operation will not extend across the railroad crossing.

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 five equally spaced channelizing devices.



**LANE CLOSURE NEAR RR CROSSING
TWO-LANE TWO-WAY ROAD**

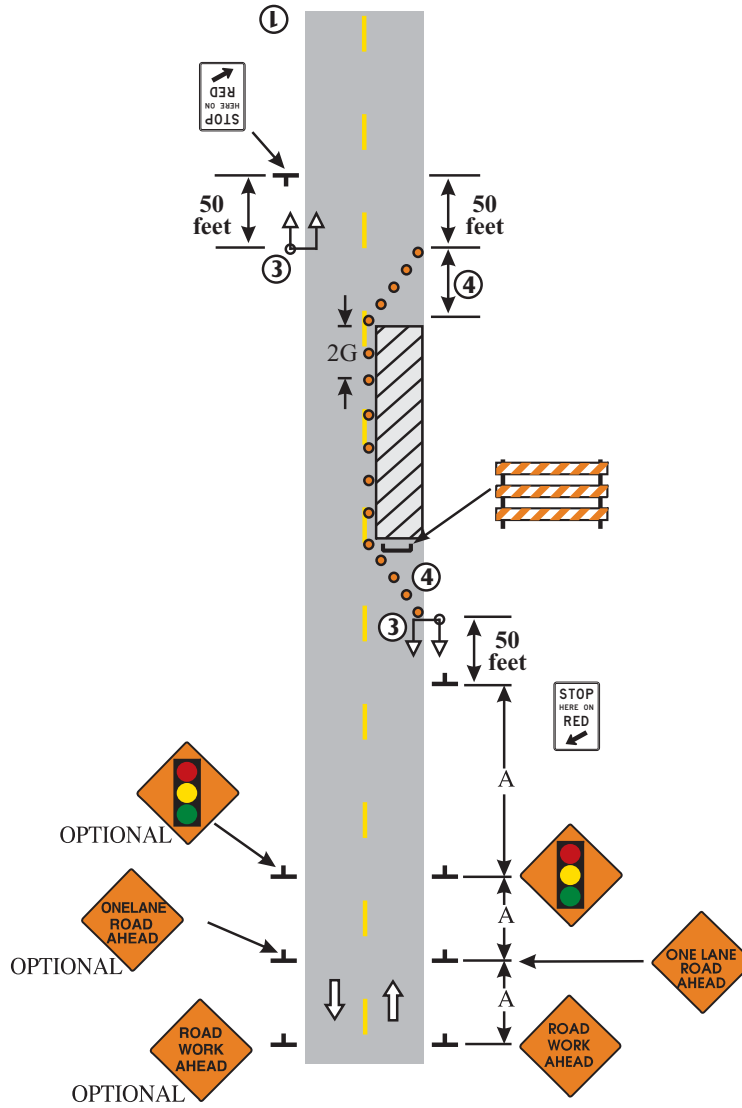
12 HOURS or LESS

6K-18

LAYOUT 18

NOTES:

1. Approach signs are the same in both directions.
2. Signal timing and signal head locations shall be established by qualified personnel.
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 over head on the same structure as the first signal head.
4. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.



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

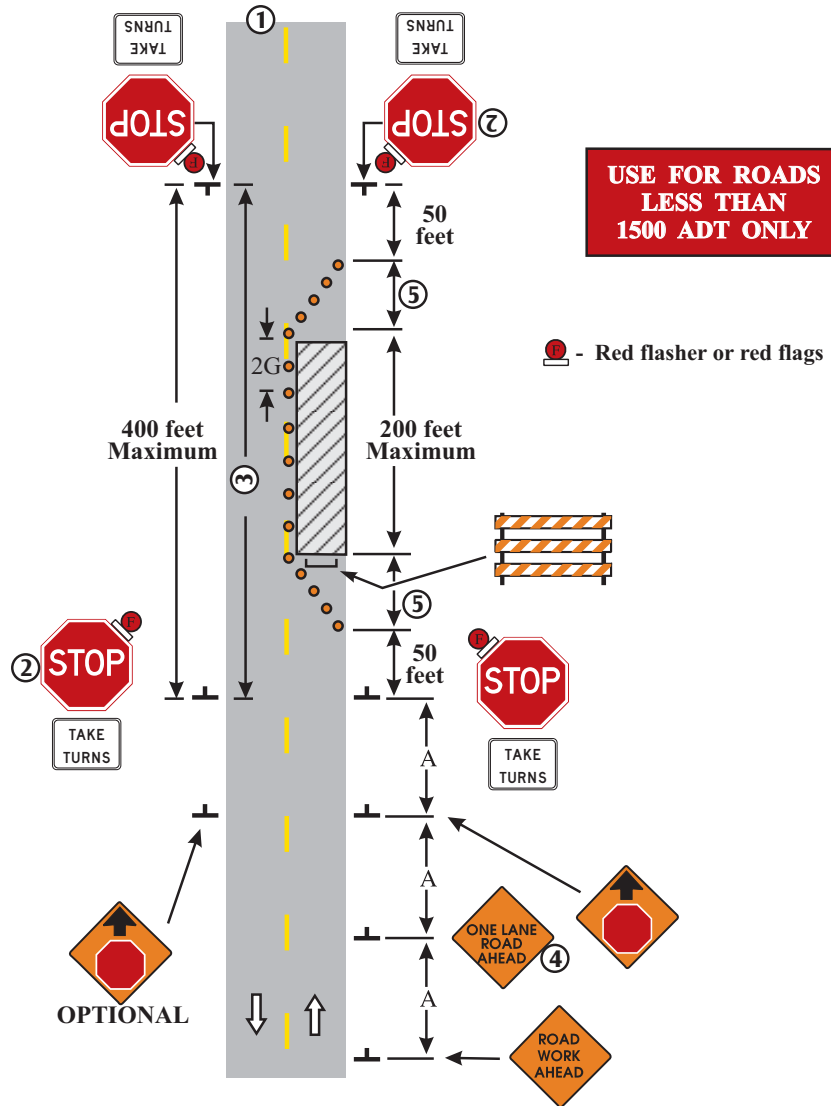
3 DAYS or LESS

6K-19

LAYOUT 19

NOTES:

1. Approach signs are the same in both directions.
2. The left side 48 x 48 inch STOP signs may be replaced with 30 x 30 inch STOP signs.
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 13 or 19.
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 five equally spaced channelizing devices.



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

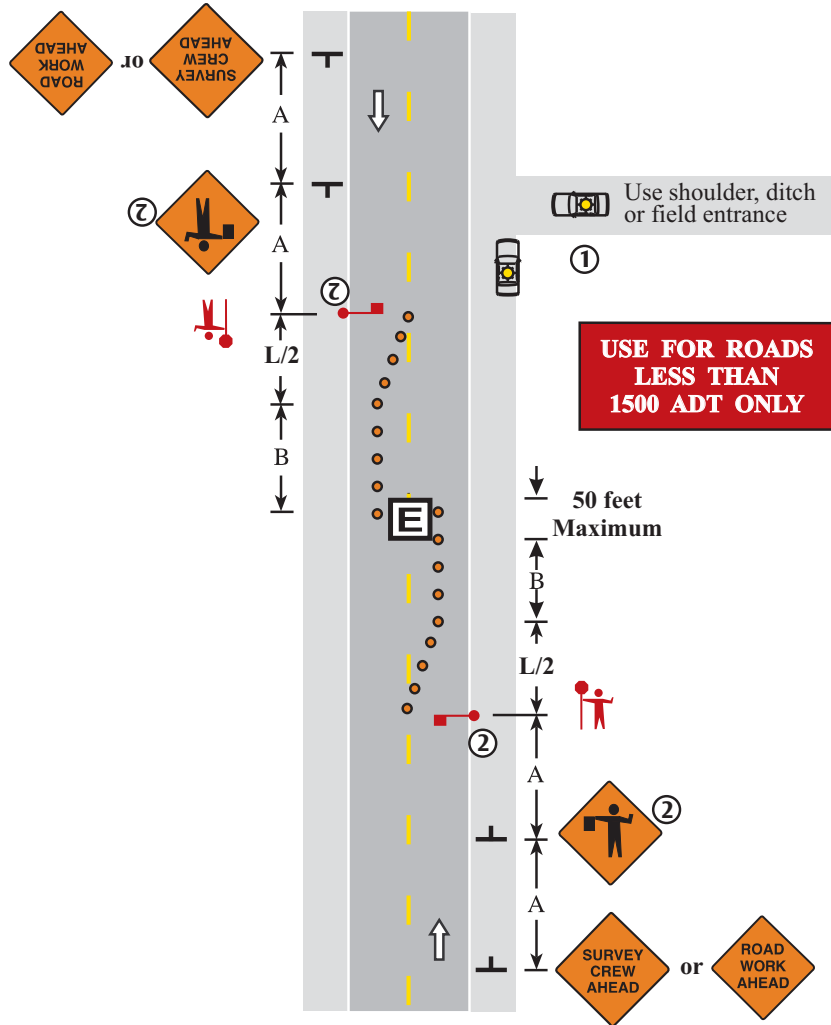
3 DAYS or LESS

6K-20

LAYOUT 20

NOTES:

1. The work vehicle shall be parked off of the roadway.
Do not obstruct the shoulder in the coned areas.
2. The flagger and Flagger Ahead sign may be omitted if there is at least 10 feet of roadway and shoulder available to safely pass the work equipment on the centerline of the roadway.



**EQUIPMENT ON CENTERLINE
TWO-LANE TWO-WAY ROAD**

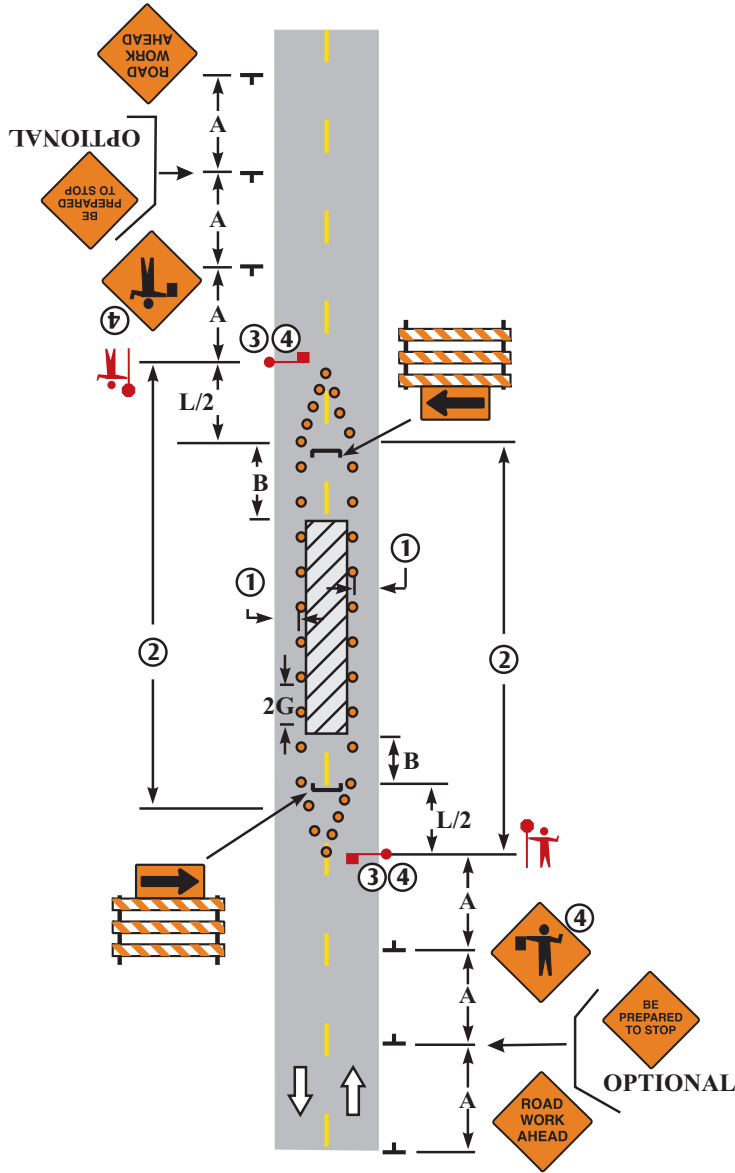
1 HOUR or LESS

6K-21

LAYOUT 21

NOTES:

1. Minimum paved lane width from the channelizing devices to the edge of pavement or outside edge of the shoulder shall be 10 feet.
2. Parking and stopping may be prohibited along the work area and tapers.
3. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
4. The flaggers and Flagger Ahead signs may be omitted if the posted speed limits is 40 mph or less.



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

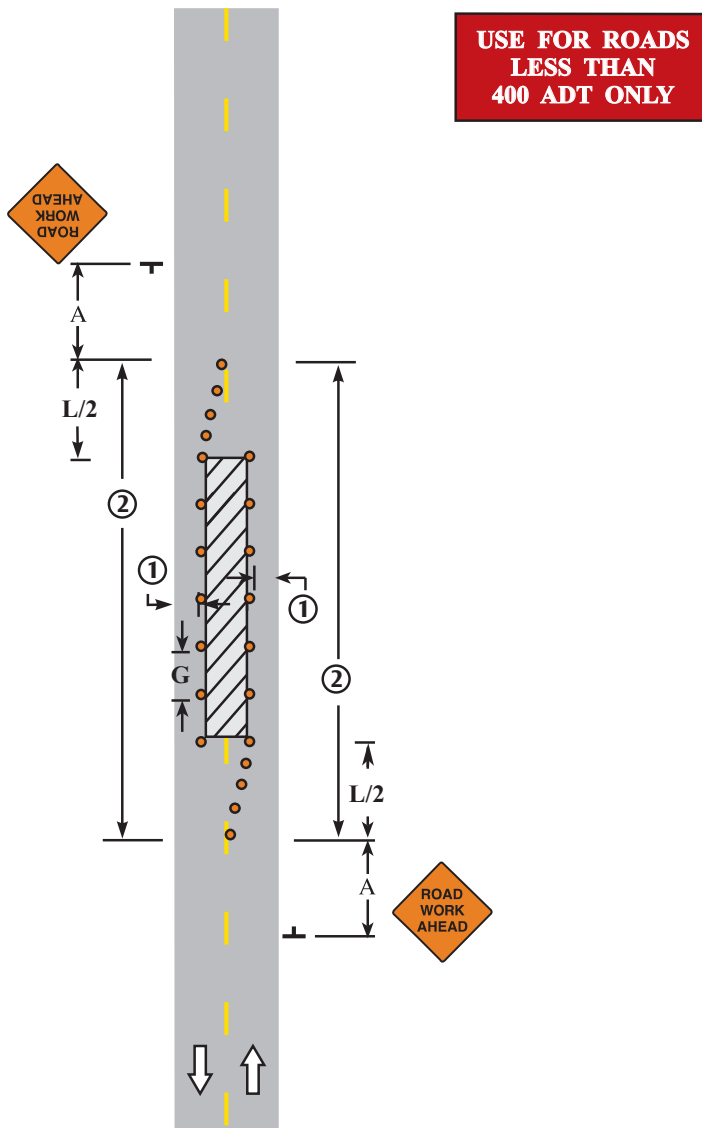
12 HOURS or LESS

6K-22

LAYOUT 22

NOTES:

1. Minimum paved lane width from the channelizing devices to the edge of pavement or outside edge of the shoulder shall be 10 feet.
2. Parking and stopping may be prohibited along the work area and tapers.



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

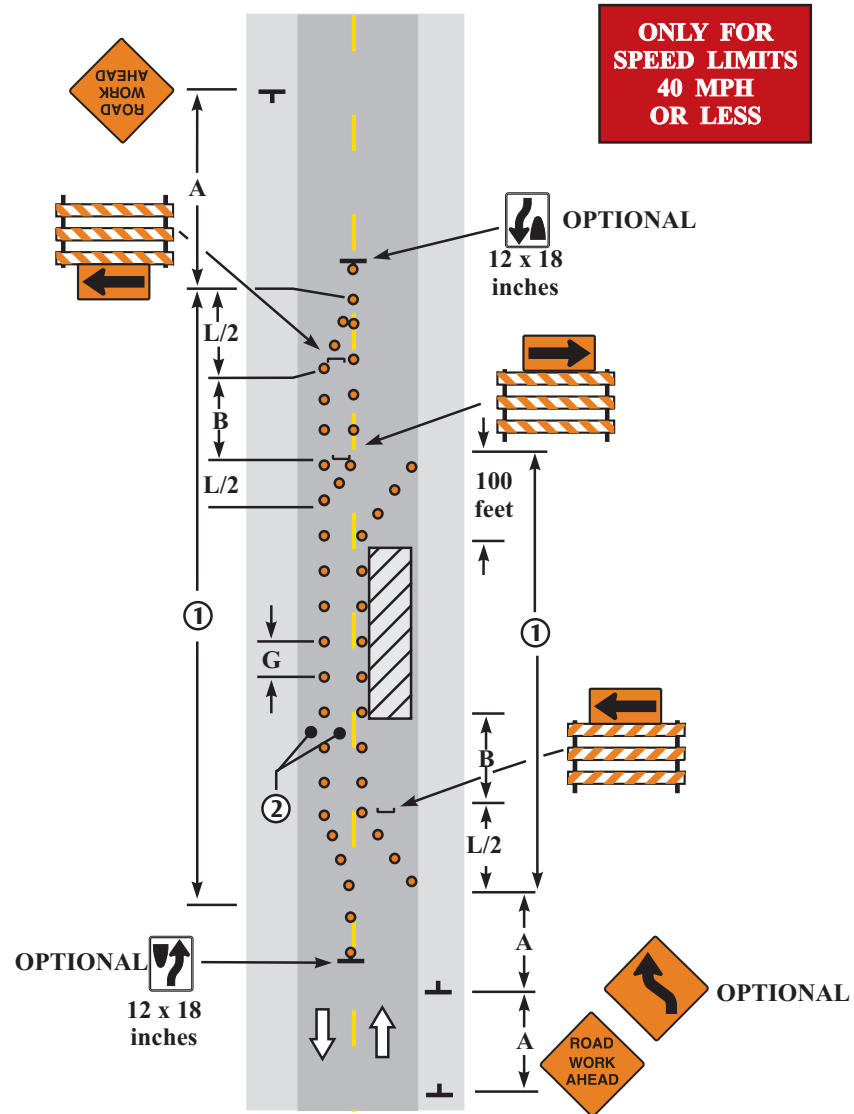
3 DAYS or LESS

6K-23

LAYOUT 23

NOTES:

1. Parking and stopping may be prohibited along the work space and taper.
2. The minimum paved lane width from the channelizing devices to the edge of pavement or outside edge of the shoulder shall be 10 feet.



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

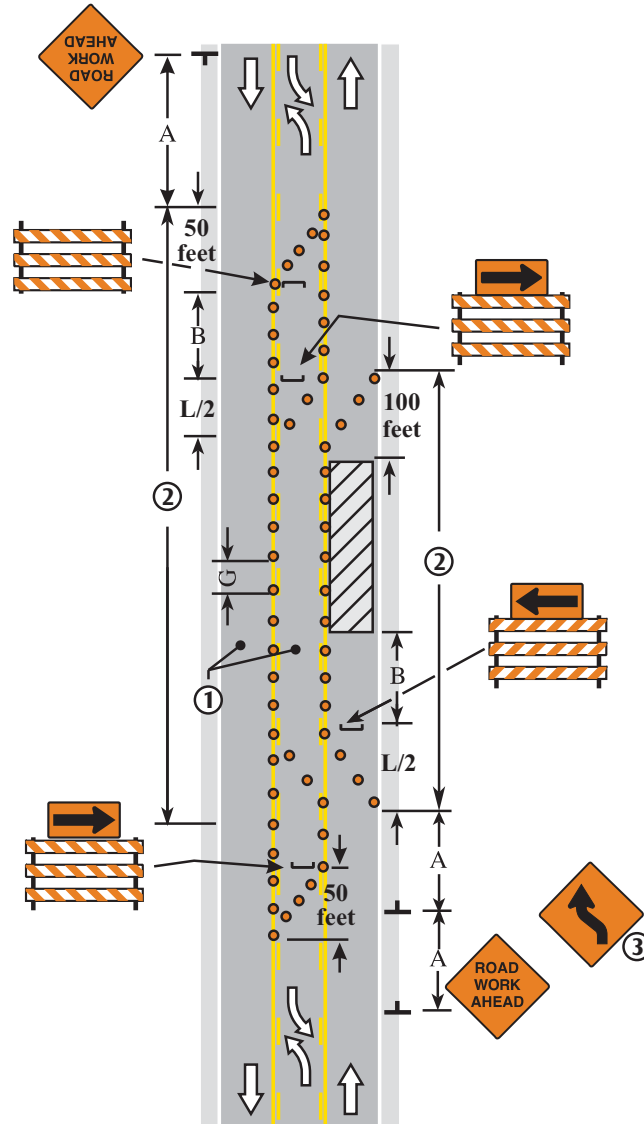
3 DAYS or LESS

6K-24

LAYOUT 24

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.
3. The Lane Shift Symbol sign may be omitted when the posted speed limit is 40 mph or less.



**LANE CLOSURE
TWO-LANE TWO-WAY ROAD
WITH TWO WAY LEFT TURN LANE**

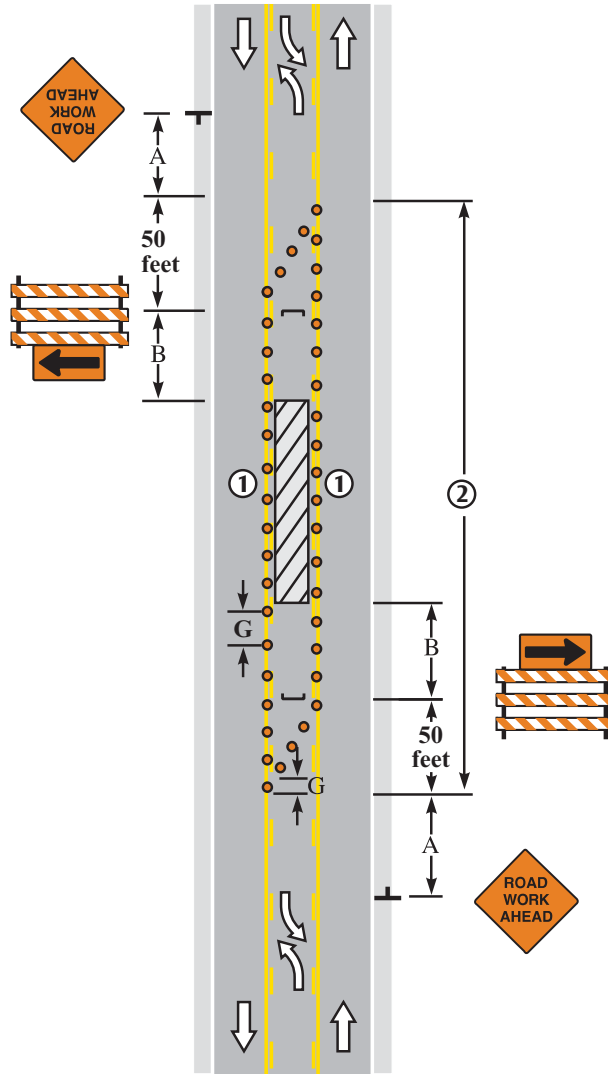
3 DAYS or LESS

6K-25

LAYOUT 25

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.



**TURN LANE CLOSURE
TWO-LANE TWO-WAY ROAD
WITH TWO WAY LEFT TURN LANE**

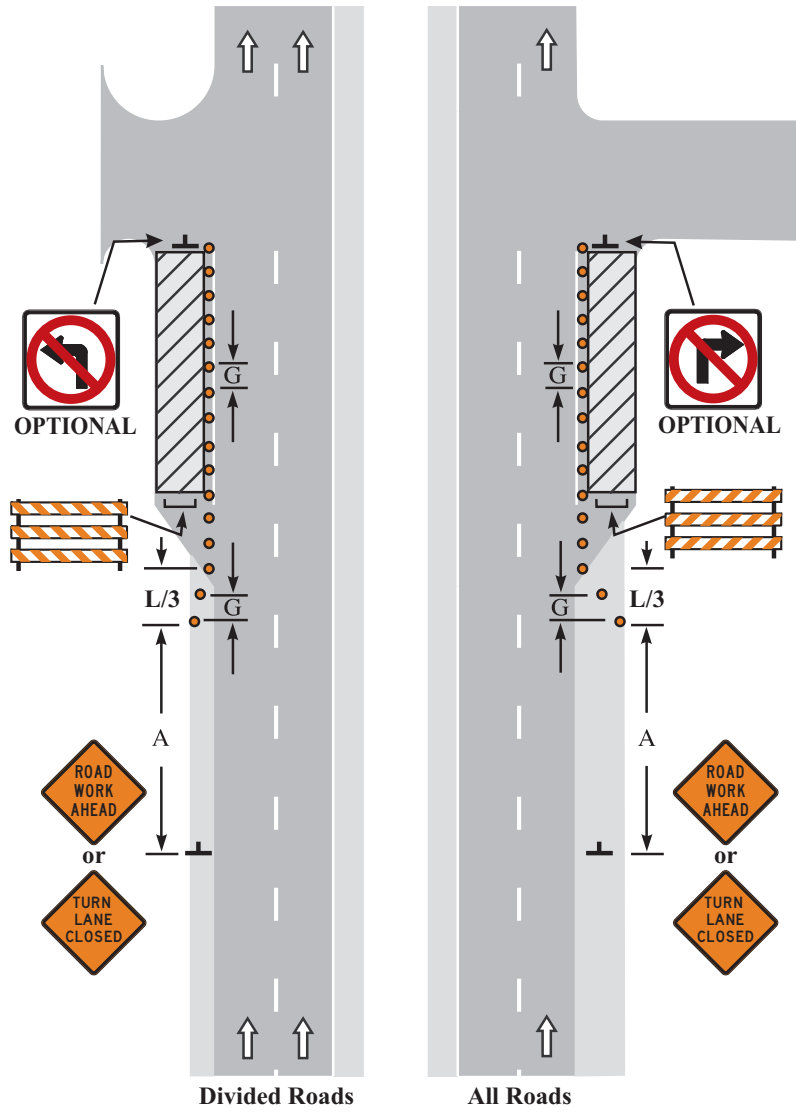
3 DAYS or LESS

6K-26

LAYOUT 26

NOTES:

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



TURN LANE CLOSURES

3 DAYS or LESS

6K-27

LAYOUT 27

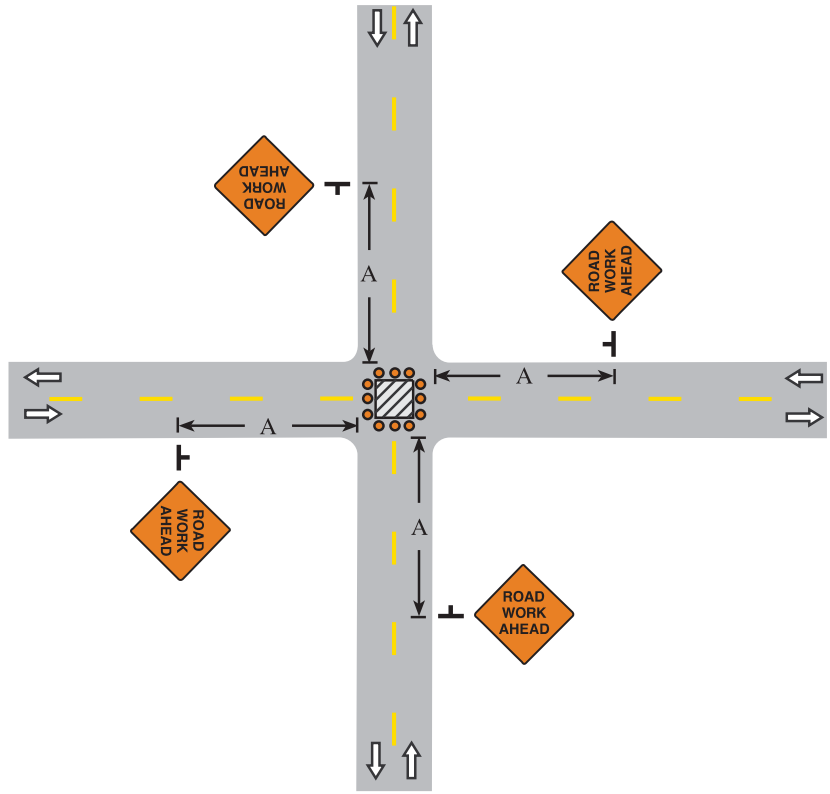
NOTES:

1. The minimum paved lane width from channelizing devices to the edge of the pavement or to the outside edge of the shoulder shall be 10 feet.



**USE FOR ROADS
LESS THAN
400 ADT ONLY**

**ONLY FOR
SPEED LIMITS
40 MPH
OR LESS**



CLOSURE IN CENTER OF INTERSECTION

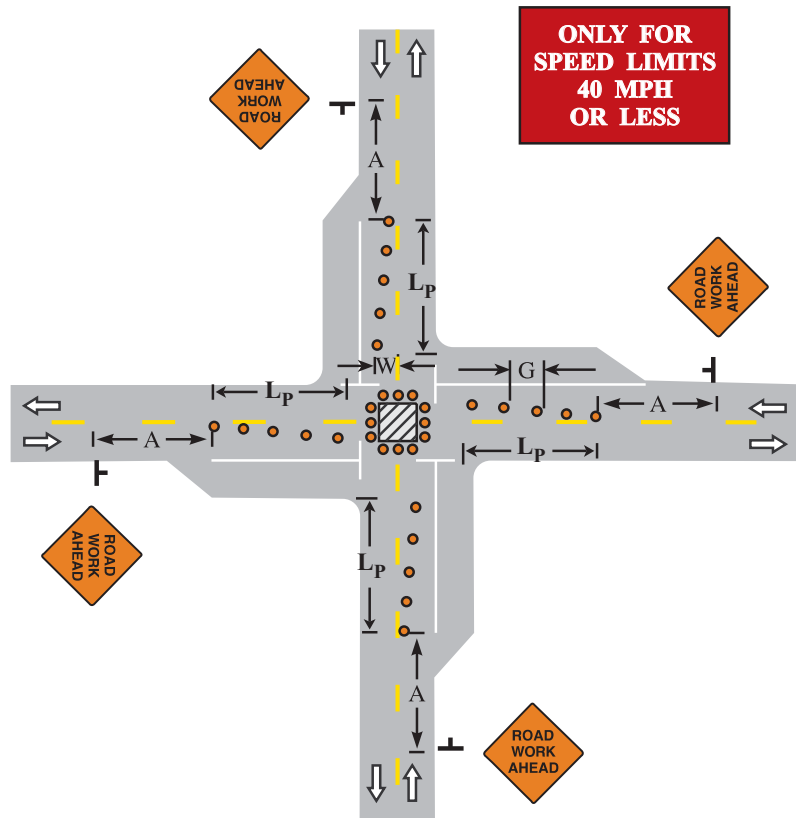
3 DAYS or LESS

6K-28

LAYOUT 28

NOTES:

1. Contact the appropriate road authority for signal timing modifications before beginning work at any signalized intersection.
2. The minimum paved lane width from channelizing devices to the edge of the pavement or to the outside edge of the shoulder shall be 10 feet.



Posted Speed Limit Prior to Work Starting (mph)	
0 - 30	G=25 ft
35 - 40	

Partial Lane Closure Taper Lengths <i>based on encroachment distance into the lane (W)</i> (LP)					
	feet	feet	feet	feet	feet
W	2	4	6	8	10
LP	50	75	100	125	150
	75	100	175	225	300

CLOSURE IN CENTER OF INTERSECTION

3 DAYS or LESS

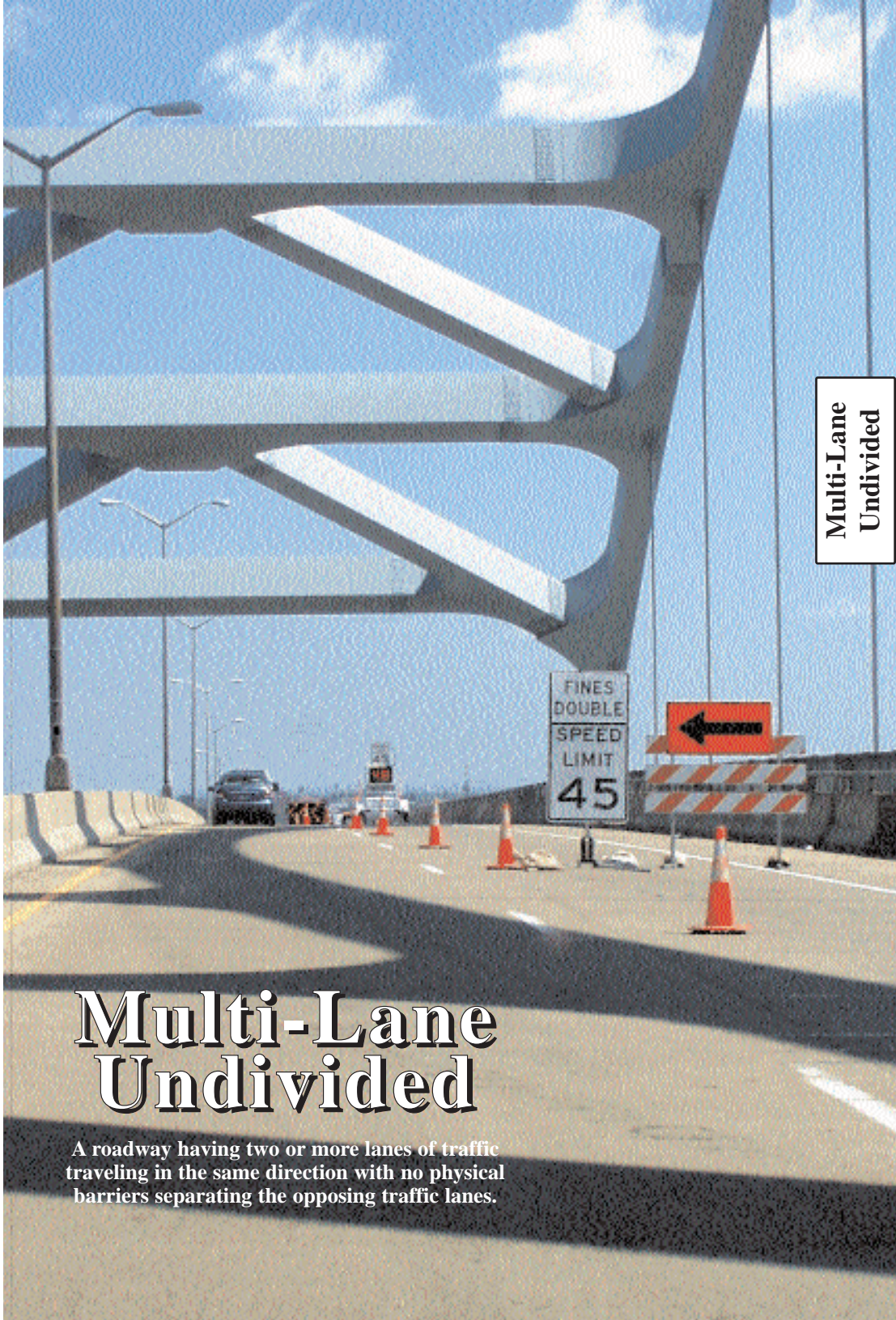
6K-29

LAYOUT 29



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There is no Layout 30.



**Multi-Lane
Undivided**

Multi-Lane Undivided

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

MULTI-LANE UNDIVIDED ROADS

	MOBILE	SHORT DURATION	SHORT TERM	INTERMEDIATE TERM
	15 Minutes or Less	One Hour or Less	12 Hours or Less	3 Days or Less
Work on Shoulder	1	2, 4		
Work off Shoulder	2			
Parking Lane Closure	3			
Lane Closures				
Mobile	31			
Near Intersection	32	26, 36, 40, 42 43		
Left Lane	34, 35, 36			
Right Lane	33*	39, 40		
Turn Lane	26, 43			
Double Lane	41, 42			
Two Way Left Turn Lanes				
Left Lane Closure	37, 38			
Road Closure	82			
Sidewalk Closure	84, 85			

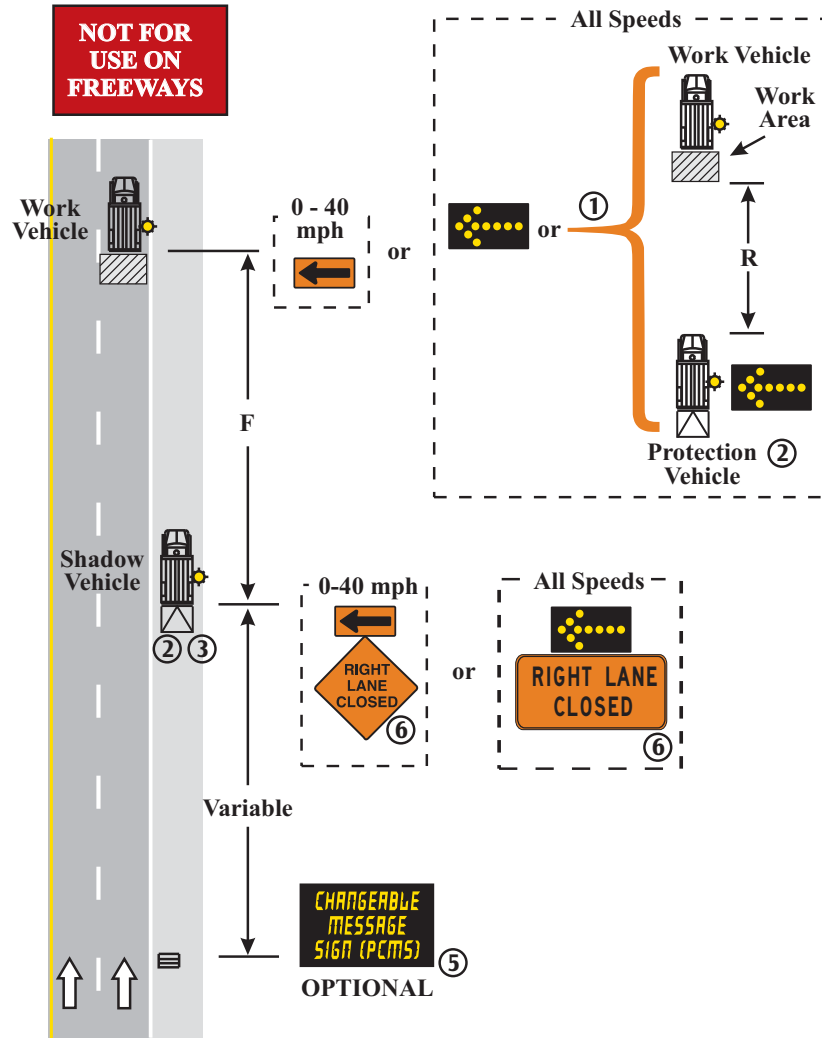
* **NOTE:** Low Speed, Intermediate Volume Roads Only.

These Layouts as well as the entire Field Manual, the Flagging Handbook and other documents are available on the Mn/DOT, Traffic Engineering website at:

<http://www.dot.state.mn.us/trafficeng/>

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by a protection vehicle at a distance of **R**. The protecting vehicle shall be equipped with a flashing arrow board and should have a truck mounted attenuator.
2. Any shadow vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The Shadow Vehicle may encroach into the traffic lane when the shoulder is too narrow to drive on.
4. If the operation does not move at least the Decision Sight Distance every 15 minutes, the appropriate stationary layout should be used.
5. If this layout is used for nighttime operations, the PCMS shall be used.
6. The RIGHT LANE CLOSED sign may be omitted when the PCMS is used.



**MOBILE LANE CLOSURE
MULTI-LANE ROAD**

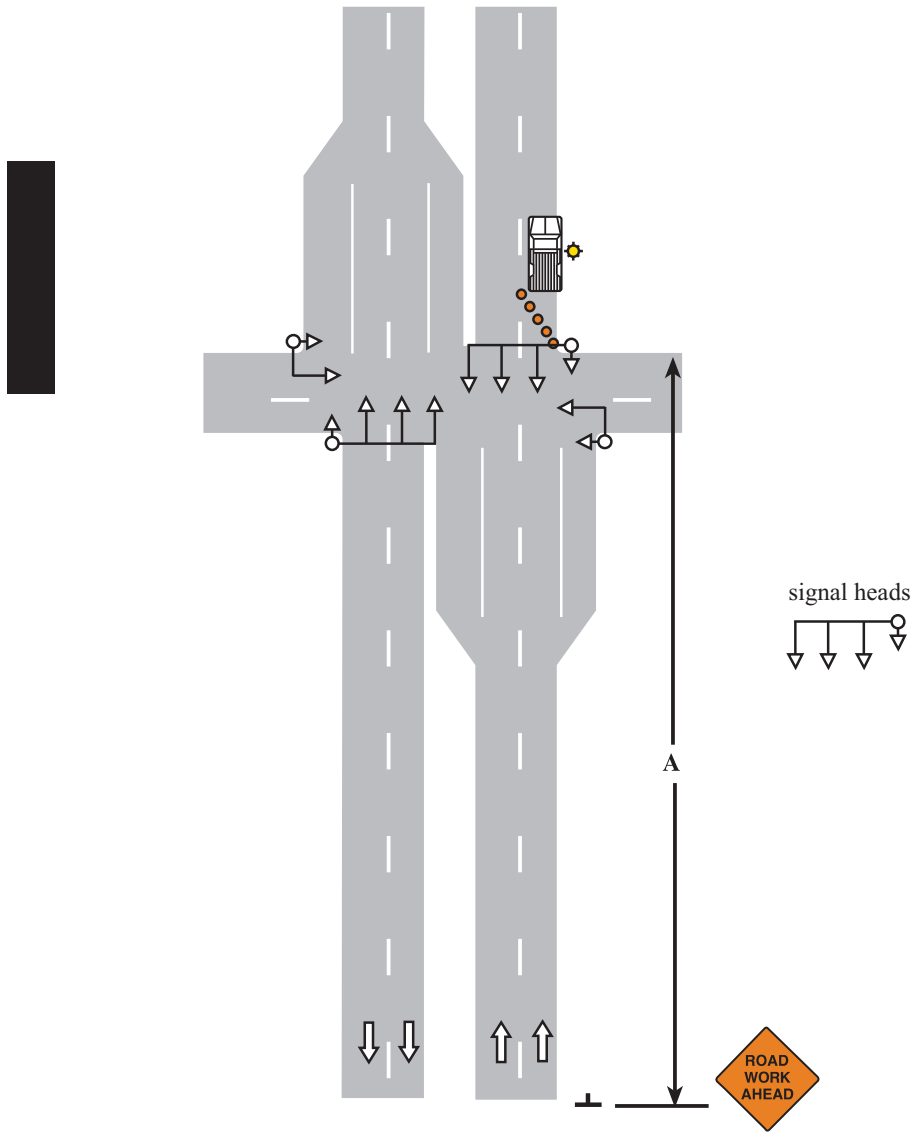
15 MINUTES or LESS

6K-31

LAYOUT 31

NOTES:

1. The operation shall not remain in one location for more than 15 minutes.
2. There should be little or no encroachment into the cross-street traffic path
3. The traffic control signal should be put in an ALL-RED flash mode to facilitate traffic control at the work site. If the intersection flashes YEL-RED, the appropriate stationary layout shall be used.
4. If the work space is not visible for at least the Decision Sight Distance, the appropriate stationary layout shall be used.



**LANE CLOSURE
FAR SIDE OF SIGNALIZED INTERSECTION**

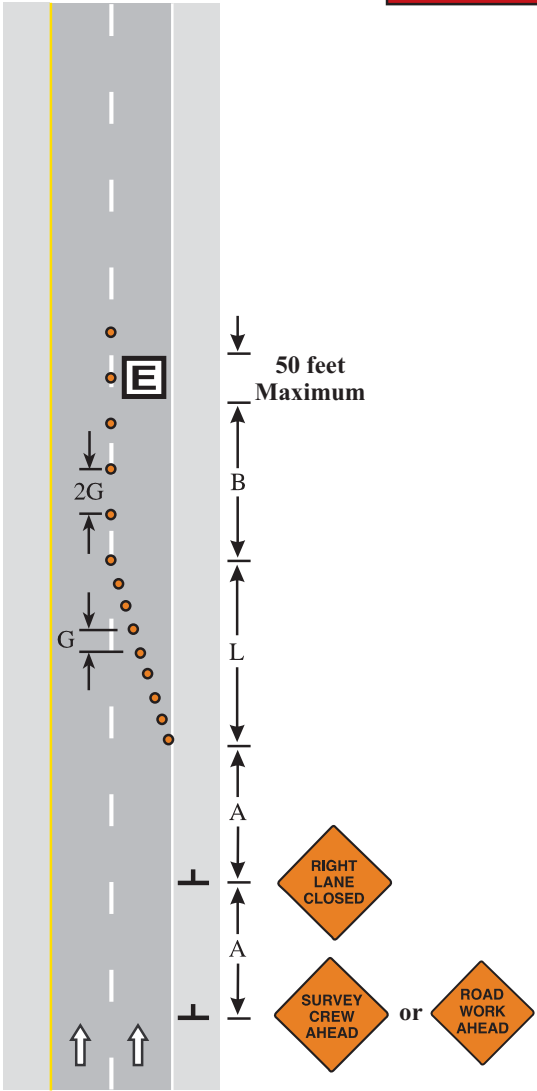
15 MINUTES or LESS

6K-32

LAYOUT 32

**USE FOR ROADS
LESS THAN
1500 ADT ONLY**

**ONLY FOR
SPEED LIMITS
40 MPH
OR LESS**

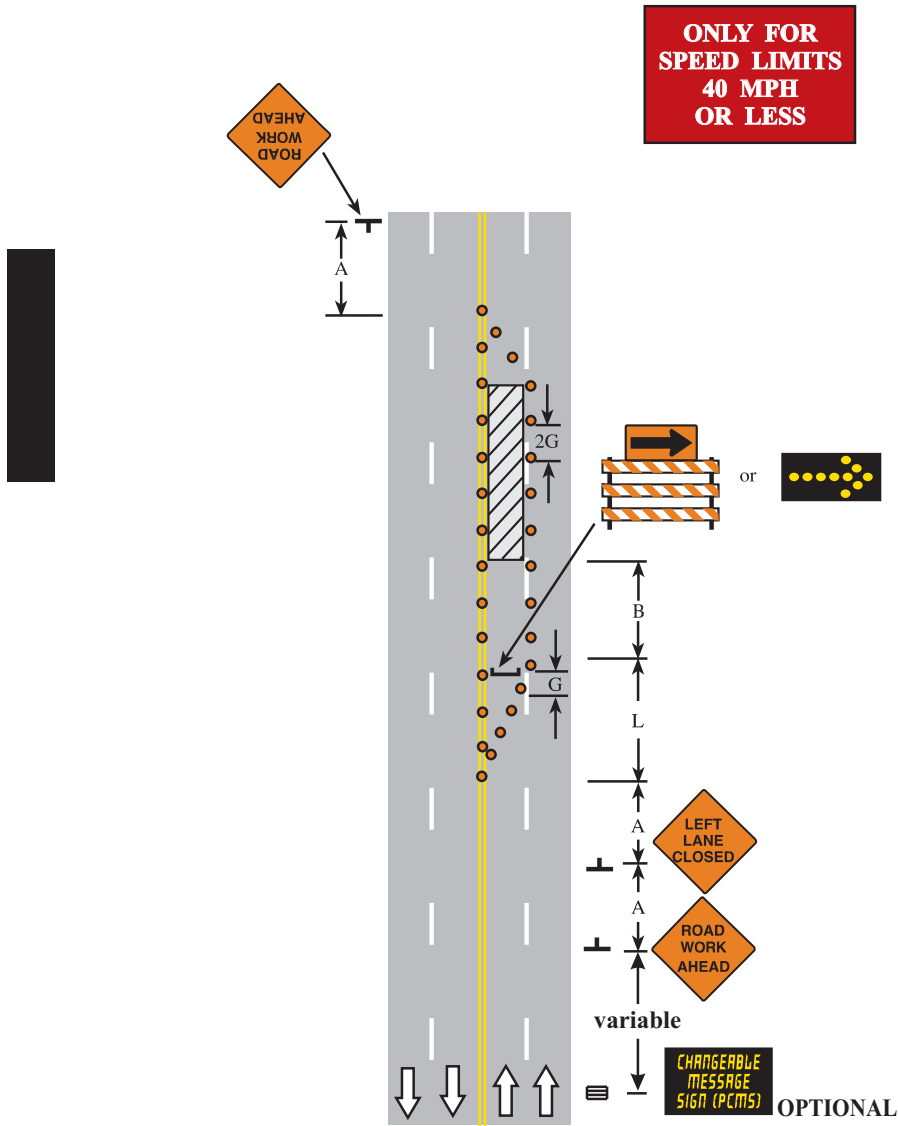


**EQUIPMENT IN TRAFFIC LANE
MULTI-LANE ROAD**

1 HOUR or LESS

6K-33

LAYOUT 33



**LEFT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD**

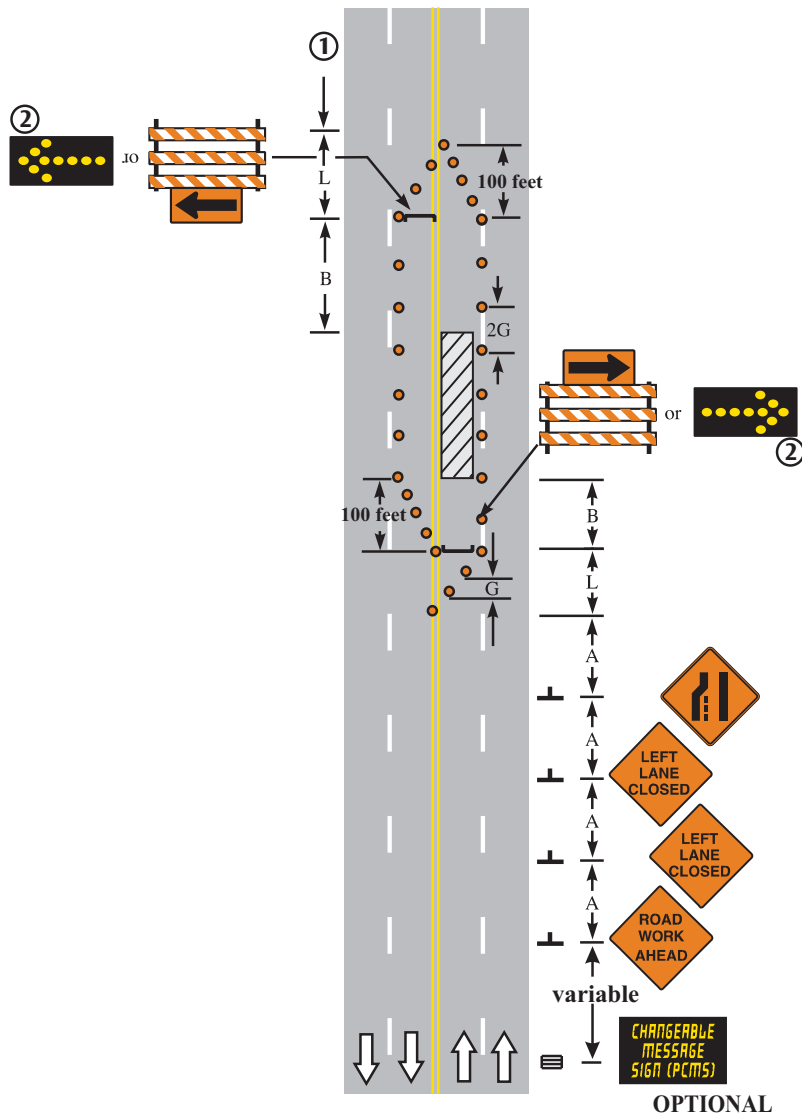
3 DAYS or LESS

6K-34

LAYOUT 34

NOTES:

1. The advance warning sign sequence is shown for one way direction only. Signing from the other direction shall be identical.
2. The flashing arrow panel shall be used where the posted speed limit is 45 mph or greater.



**LEFT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD**

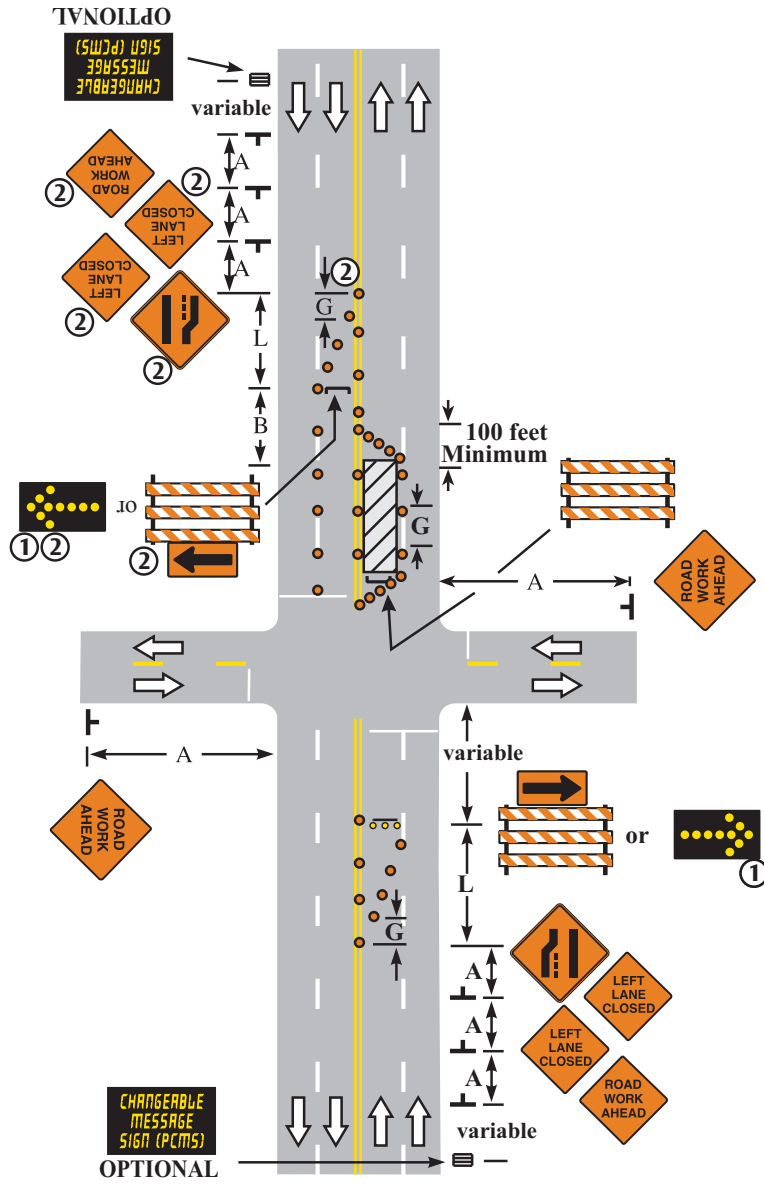
3 DAYS or LESS

6K-35

LAYOUT 35

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. The lane closure may be omitted when the posted speed limit is 40 mph or less, or when the workers are not at the work site.



**LEFT LANE CLOSURE
WORK SPACE AT INTERSECTION
MULTI-LANE UNDIVIDED ROAD**

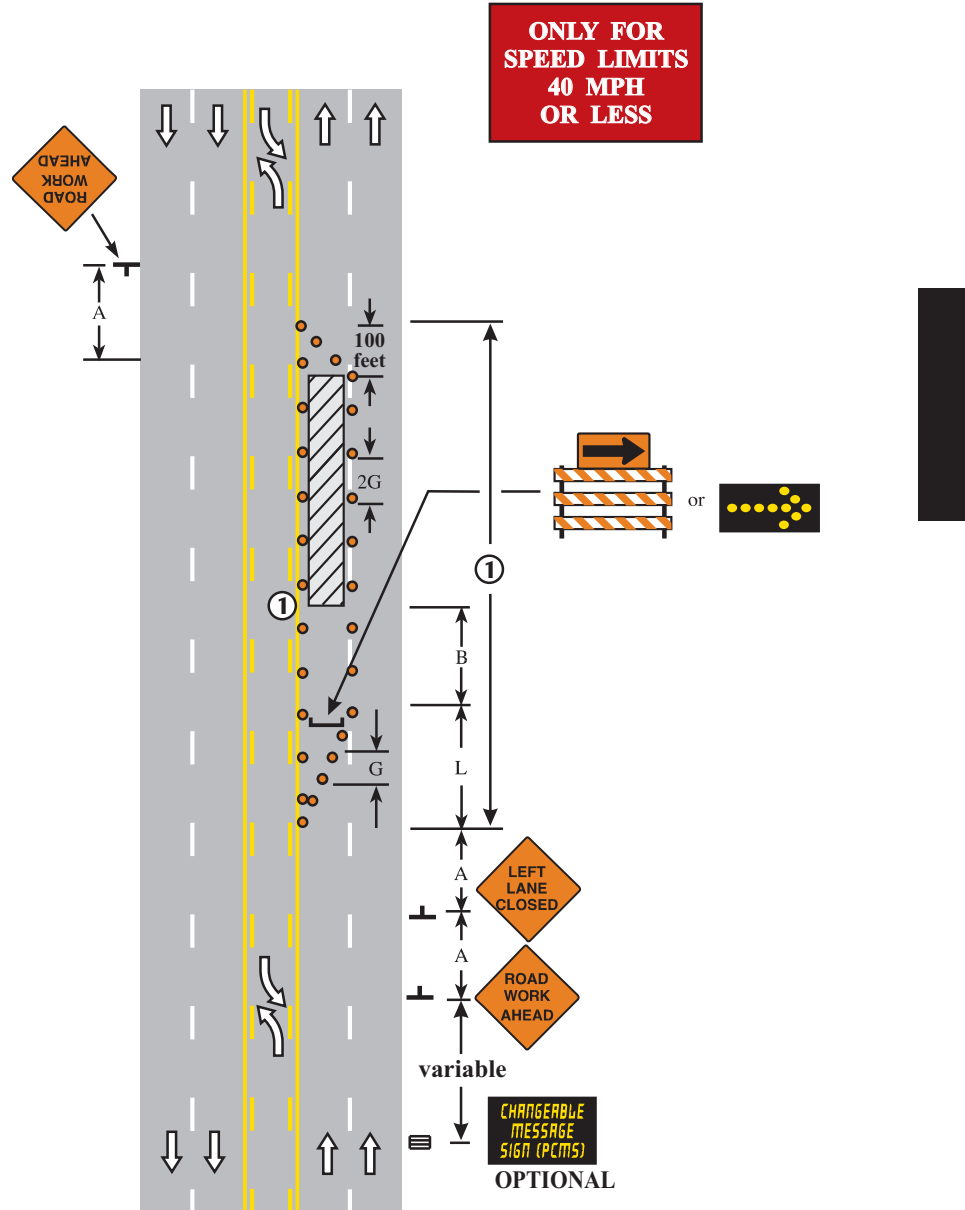
3 DAYS or LESS

6K-36

LAYOUT 36

NOTES:

1. Parking, stopping and left turning vehicles may be prohibited along the work space and taper.



**LEFT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD
WITH TWO-LANE TWO-WAY LEFT TURN LANE**

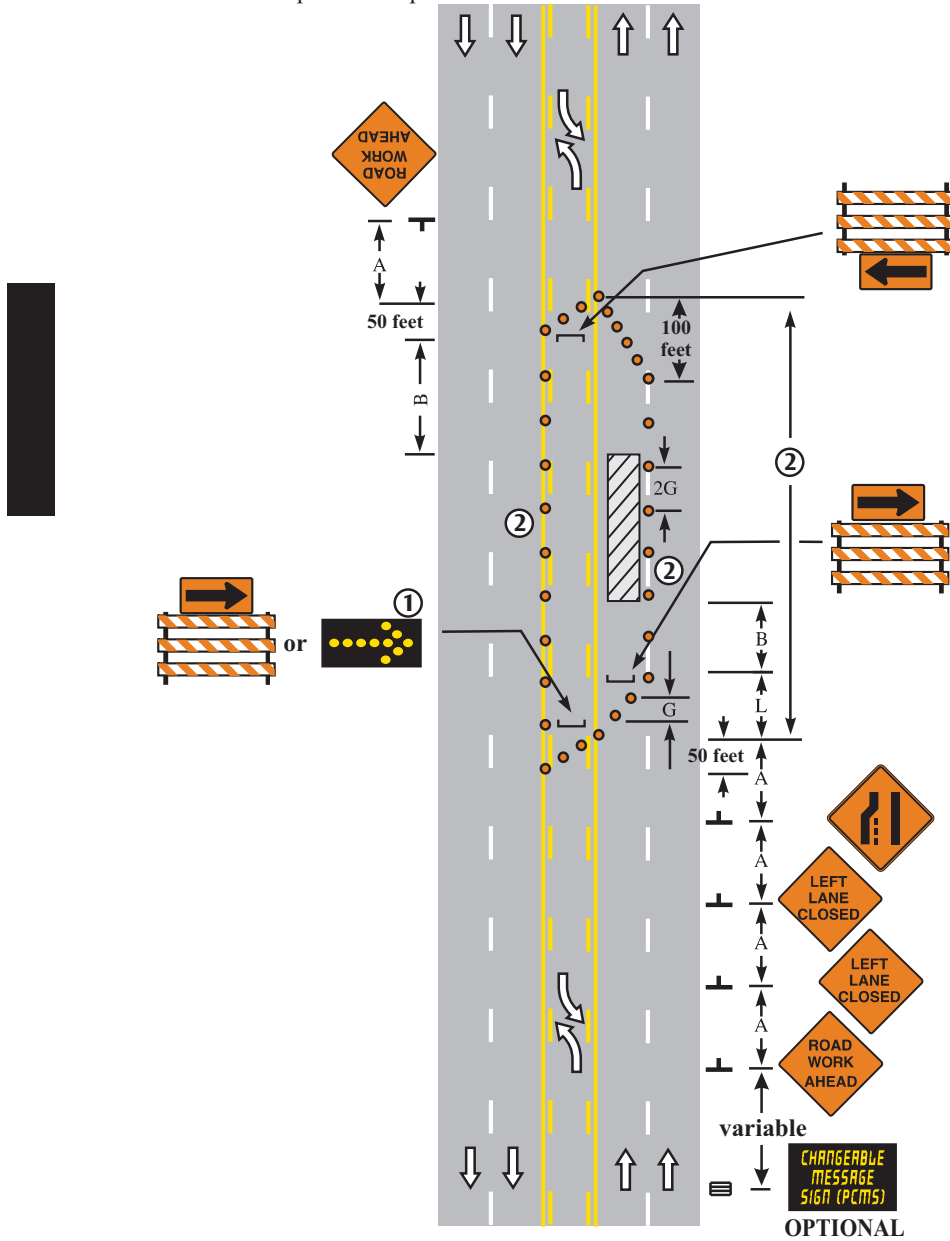
3 DAYS or LESS

6K-37

LAYOUT 37

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. Parking, stopping and left turning vehicles may be prohibited along the work space and taper.



**LEFT LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD
WITH TWO-LANE TWO-WAY LEFT TURN LANE**

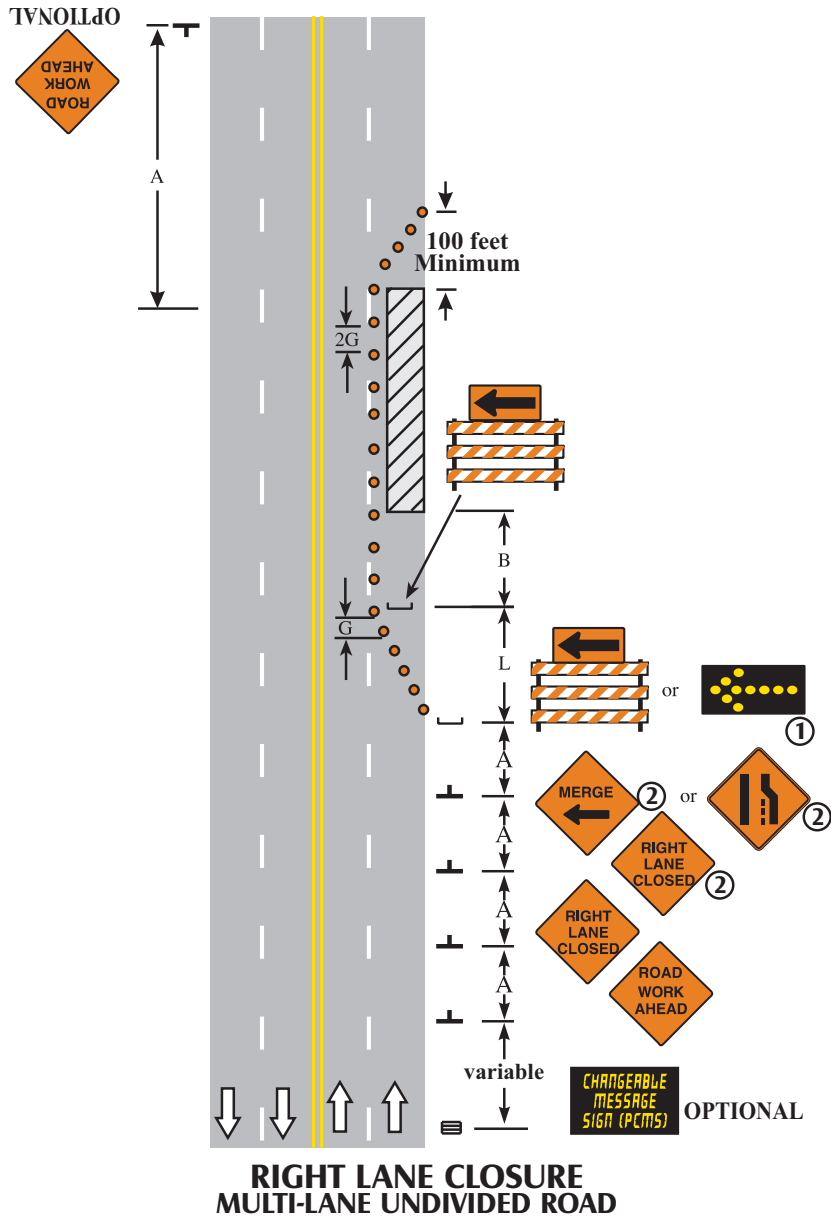
3 DAYS or LESS

6K-38

LAYOUT 38

NOTES:

1. The flashing arrow board shall be used where the posted speed limit is 45 mph or greater.
2. The RIGHT LANE CLOSED sign and the MERGE with arrow sign or Lane Drop sign, may be omitted when the posted speed limit is 40 mph or less.



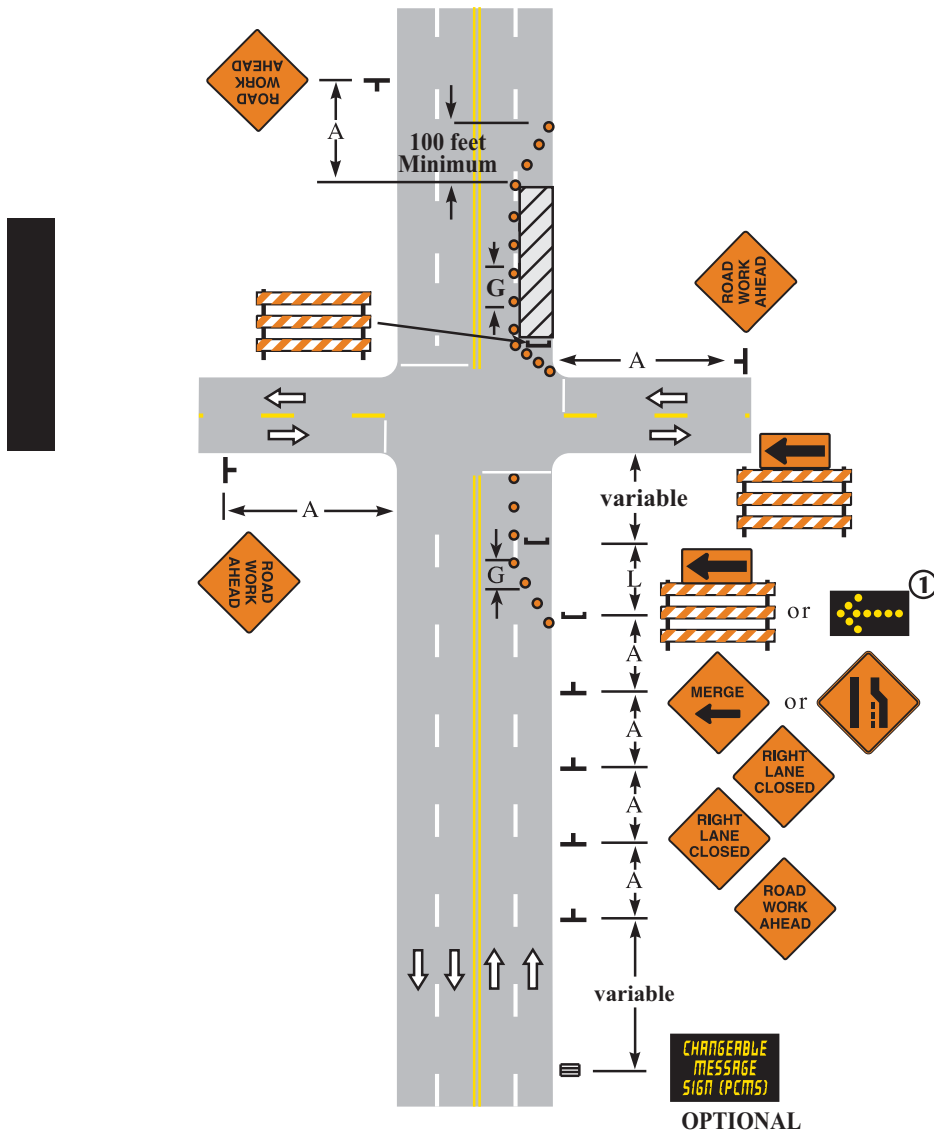
3 DAYS or LESS

6K-39

LAYOUT 39

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45mph or greater.



**RIGHT LANE CLOSURE
WORK SPACE AT INTERSECTION
MULTI-LANE UNDIVIDED ROAD**

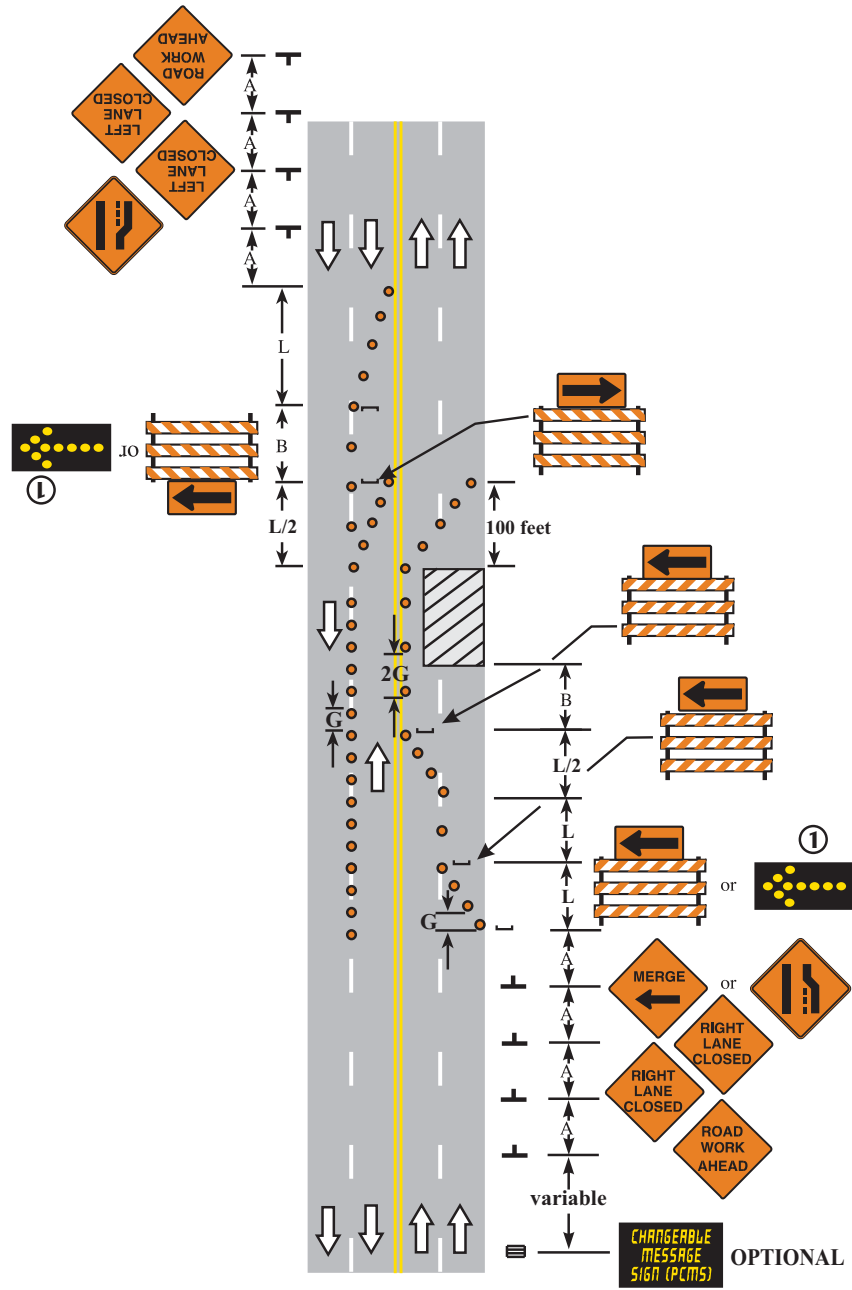
3 DAYS or LESS

6K-40

LAYOUT 40

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.



**DOUBLE LANE CLOSURE
MULTI-LANE UNDIVIDED ROAD**

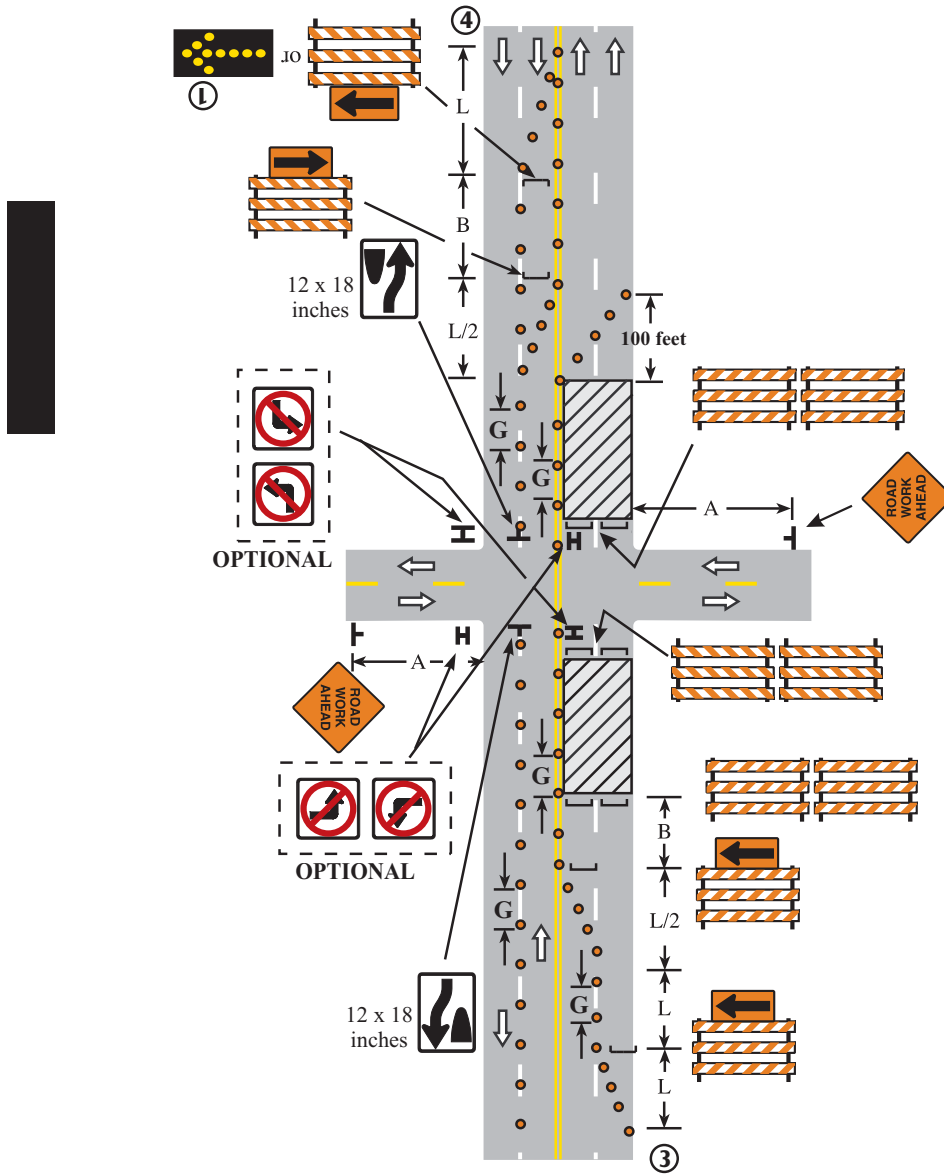
3 DAYS or LESS

6K-41

LAYOUT 41

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. Contact the appropriate road authority for the placement of temporary STOP signs or signal timing modifications before beginning work at any signalized intersection.
3. For the placement of advance warning signs, see Layout 41.
4. For the placement of advance warning signs, see Layout 34 or 35.



**DOUBLE LANE CLOSURE AT INTERSECTION
MULTI-LANE UNDIVIDED ROAD**

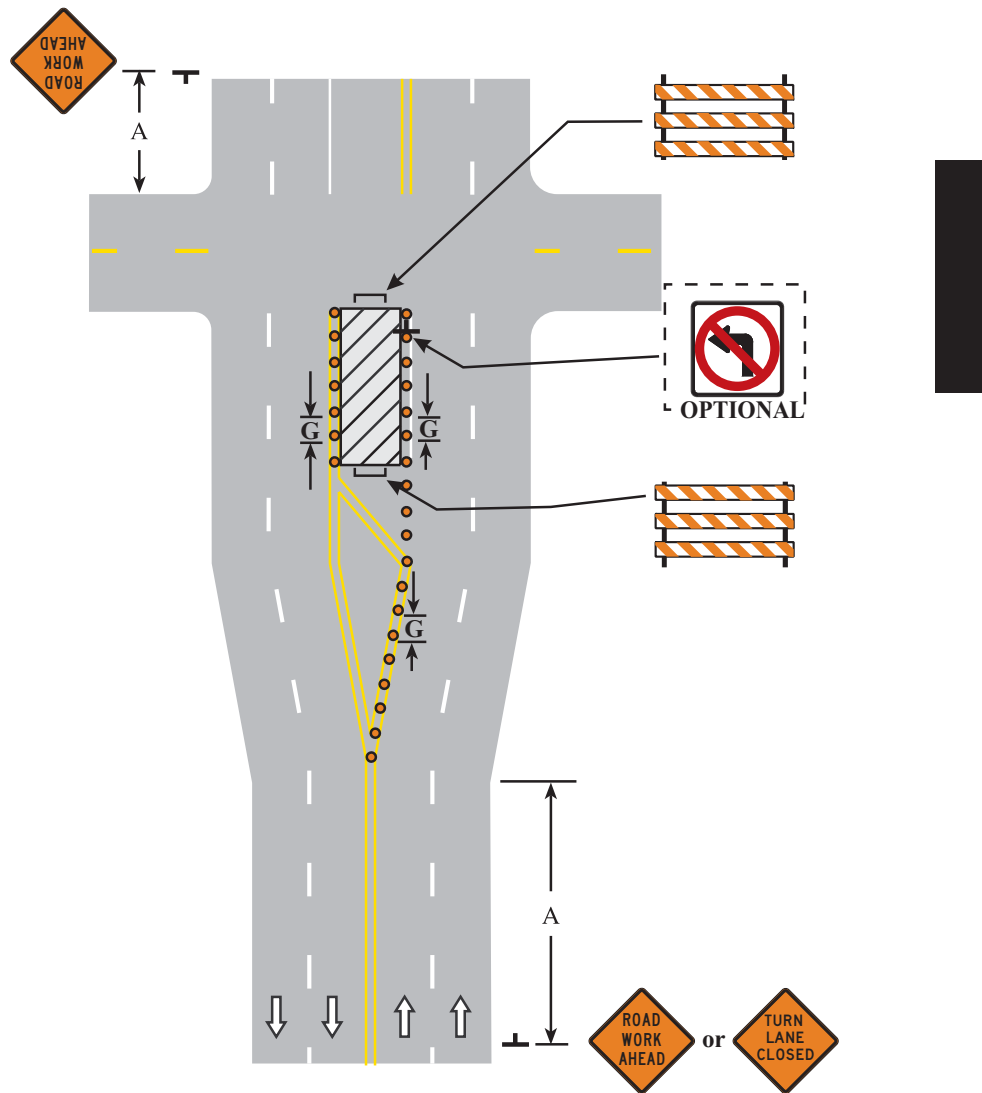
3 DAYS or LESS

6K-42

LAYOUT 42

NOTES:

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



LEFT TURN LANE CLOSURE

3 DAYS or LESS

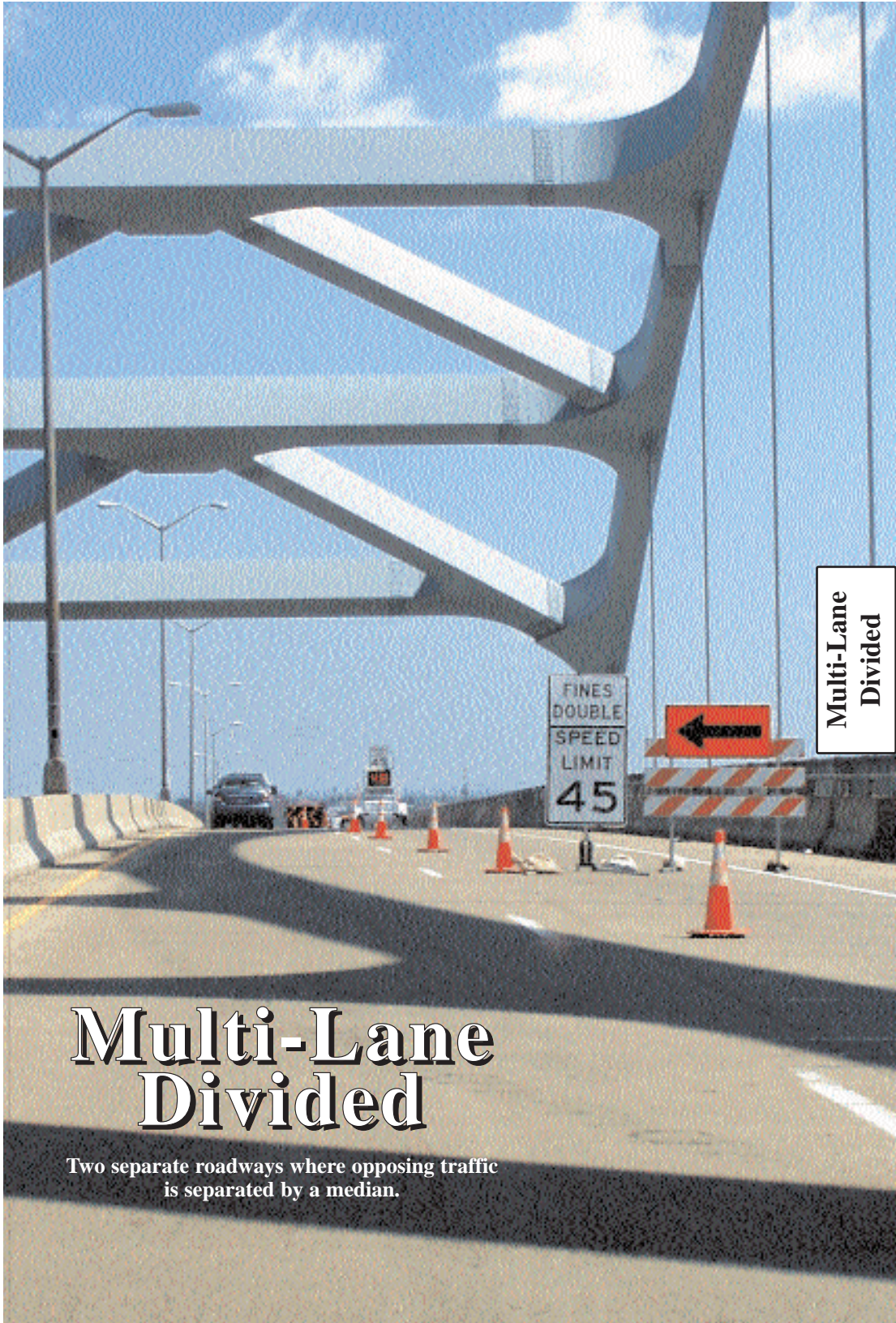
6K-43

LAYOUT 43



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There is no Layout 44.



Multi-Lane
Divided

Multi-Lane Divided

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

MULTI-LANE DIVIDED ROADS

	MOBILE	SHORT DURATION	SHORT TERM	INTERMEDIATE TERM
	15 Minutes or Less	One Hour or Less	12 Hours or Less	3 Days or Less
Work on Shoulder	1	2, 4		
Work off Shoulder	2			
Parking Lane Closure	3			
Lane Closures				
Mobile	45, 46			
Nighttime	50			
Center Lane	51			
Left Lane	52, 53, 54, 55,			
Right Lane	33*			
Turn Lane	27			
Double Lane	56, 57			
Extended Lane	58			
Lane Shift	59			
Near Ramp	60, 61, 62			
Partial Ramp Closure	63			
Ramp Closure	47, 48, 49	64, 65		
Work near Intersection	32	27, 54, 55		
Road Closure	83			
Sidewalk Closure	84, 85			

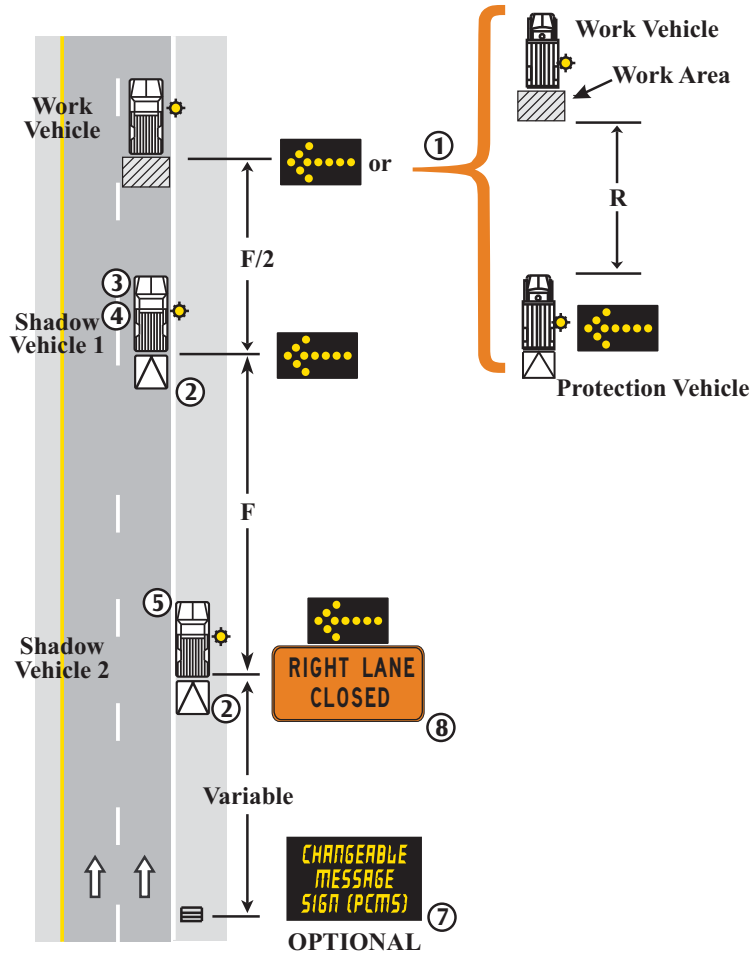
* **NOTE:** Low Speed, Intermediate Volume Roads Only.

These Layouts as well as the entire Field Manual, the Flagging Handbook and other documents are available on the Mn/DOT, Traffic Engineering website at:

<http://www.dot.state.mn.us/trafficeng/>

NOTES:

1. A work vehicle without a flashing arrow board shall be followed by a protection vehicle at a distance of **R**. The protecting vehicle shall be equipped with a flashing arrow board and should have a truck mounted attenuator.
2. All shadow vehicles operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The lateral placement of shadow vehicle 1 may be adjusted to create a taper when a Protection Vehicle is used.
4. Shadow Vehicle 1 may be omitted on non-freeway design roadways.
5. Shadow Vehicle 2 may encroach into the traffic lane when the shoulder is too narrow to drive on.
6. If the operation does not move at least the Decision Sight Distance every 15 minutes, the appropriate stationary layout should be used.
7. The PCMS shall be used for nighttime operations.
8. When the PCMS is used, the RIGHT LANE CLOSED sign becomes optional.



**MOBILE LANE CLOSURE
MULTI-LANE ROAD**

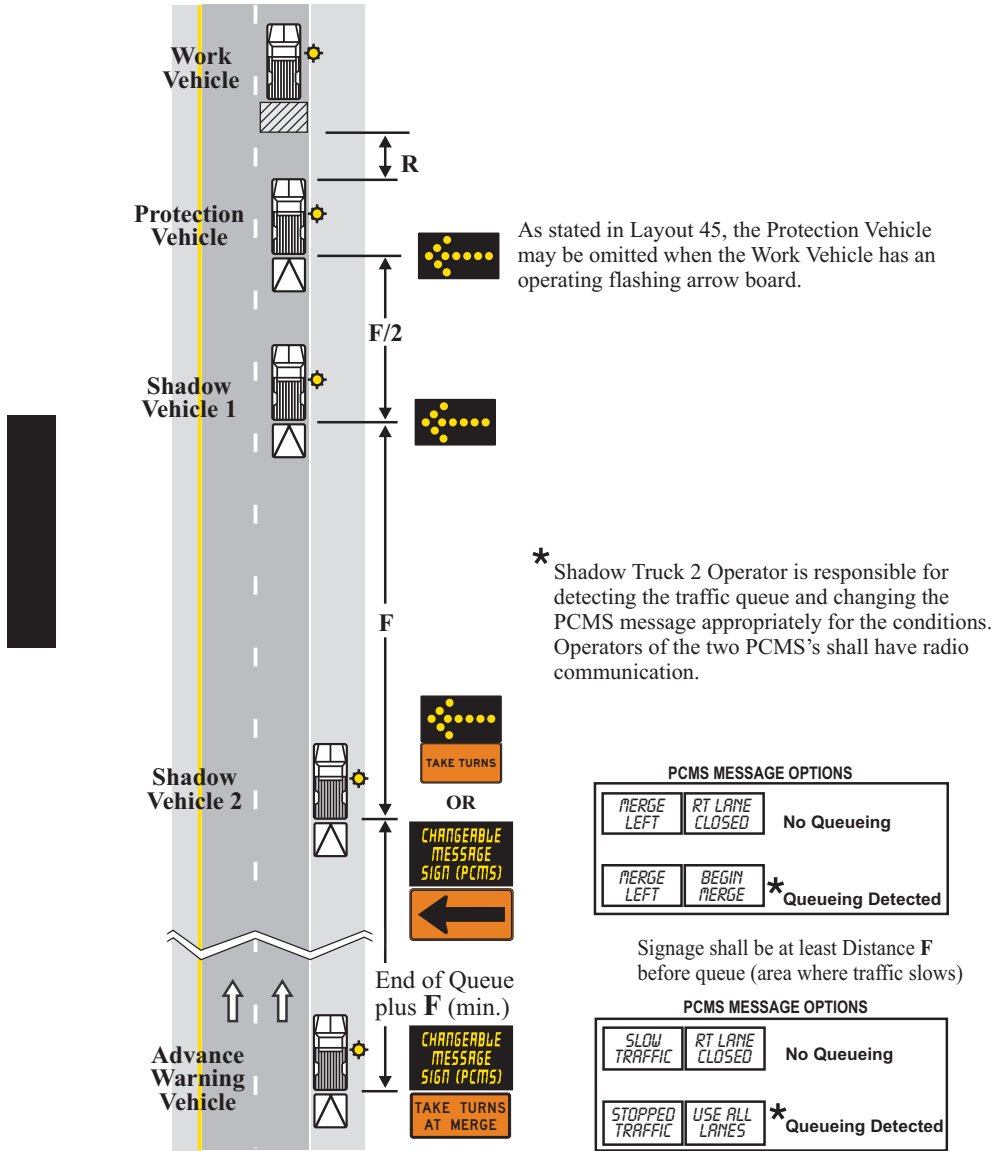
15 MINUTES or LESS

6K-45

LAYOUT 45

NOTES:

1. All shadow vehicles operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
2. The lateral placement of shadow vehicle 1 may be adjusted to create a taper when a Protection Vehicle is used.
3. Shadow Vehicle 1 may be omitted on non-freeway design roadways.
4. Shadow Vehicle 2 may encroach into the traffic lane when the shoulder is too narrow to drive on.



**MOBILE LANE CLOSURE
WITH LATE MERGE
MULTI-LANE ROAD**

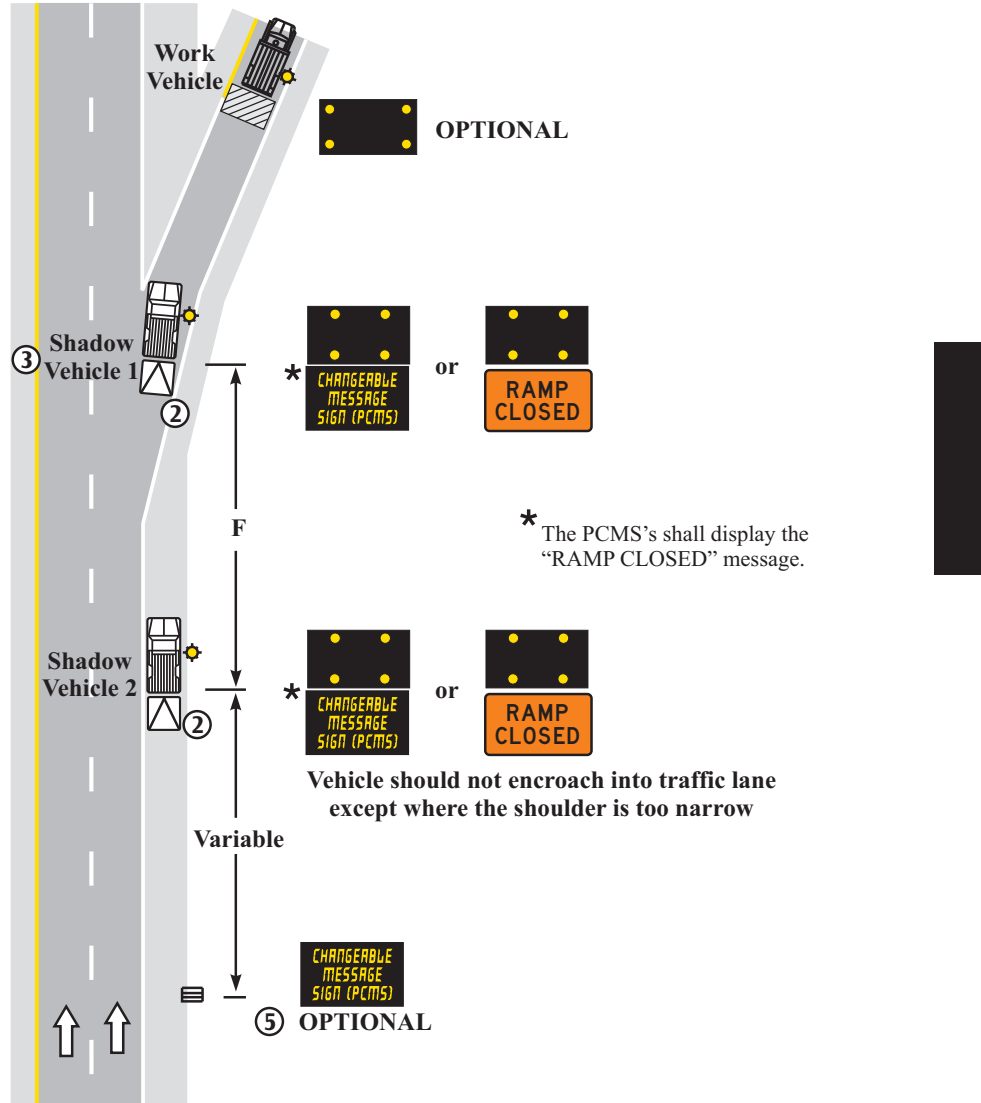
15 MINUTES or LESS

6K-46

LAYOUT 46

NOTES:

1. The protection vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If a protection vehicle follows the work vehicle up the ramp, then it shall remain a minimum distance **R** from the work area.
2. Any shadow or protection vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic.
4. If the ramp can not be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.



**MOBILE RAMP CLOSURE
EXPRESSWAY/FREEWAY**

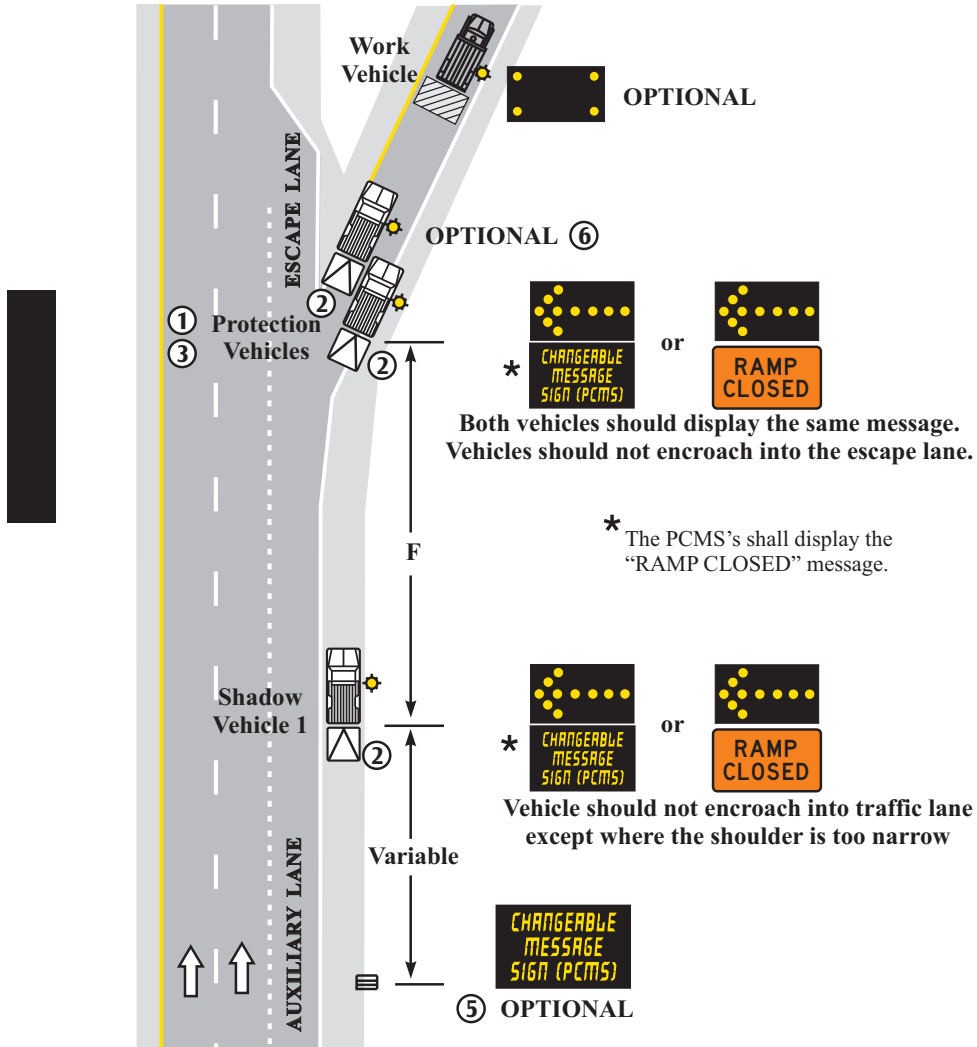
15 MINUTES or LESS

6K-47

LAYOUT 47

NOTES:

1. The protection vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If the operation requires one protection vehicle to follow the work vehicle up the ramp, then it shall remain a minimum distance **R** from the work area.
2. Any shadow or protection vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic and should allow traffic to use the escape lane.
4. If the ramp can not be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS's shall be used for nighttime operations.
6. The optional second protection vehicle may be needed to block wider exit ramps.



**MOBILE RAMP CLOSURE with ESCAPE LANE
EXPRESSWAY/FREEWAY**

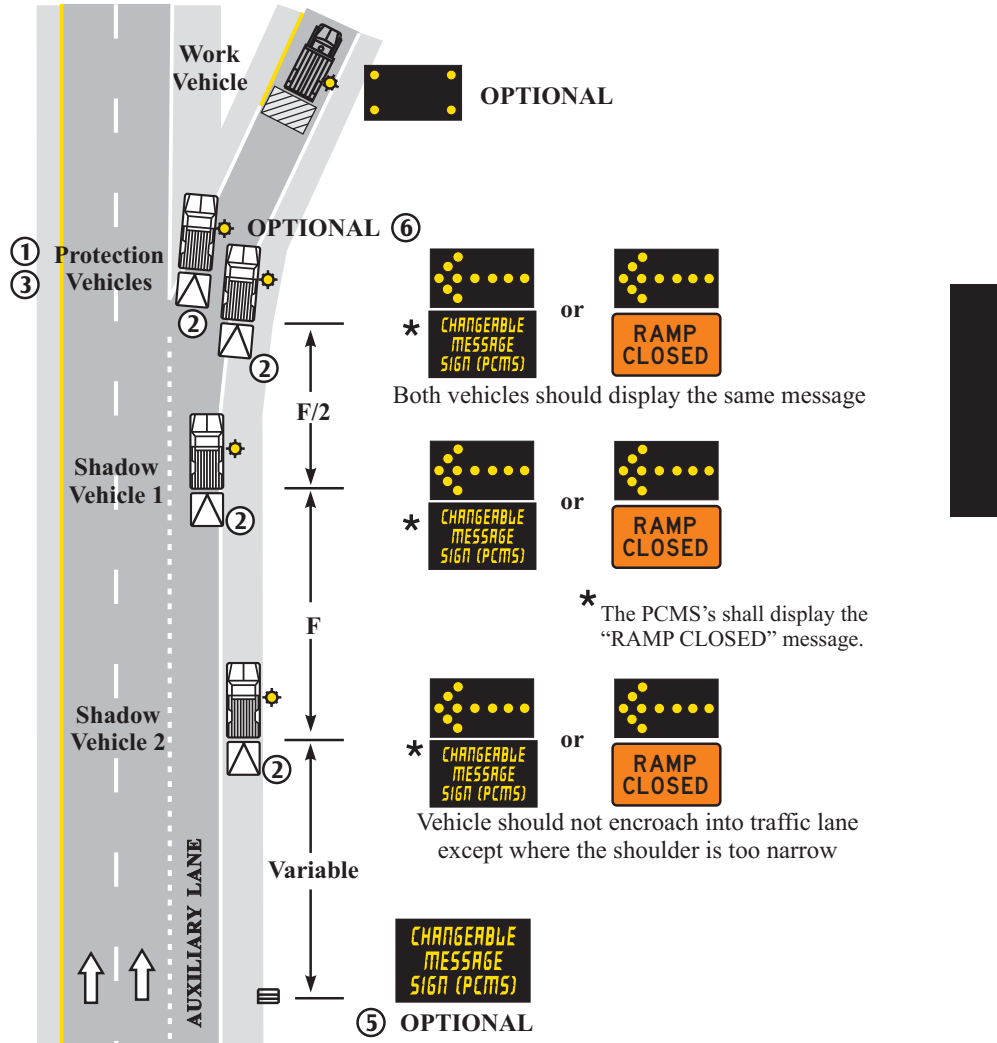
15 MINUTES or LESS

6K-48

LAYOUT 48

NOTES:

1. The protection vehicle should remain positioned near the ramp gore to prevent traffic from using the exit ramp. If a protection vehicle follows the work vehicle up the ramp, then the flashing arrow display shall change to the caution mode shall remain a minimum distance **R** from the work area.
2. Any shadow or protection vehicle operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.
3. The vehicles blocking the exit ramp should not encroach into lanes open to traffic.
4. If the ramp can not be reopened within 15 minutes, the appropriate stationary layout should be used.
5. The PCMS shall be used for nighttime operations.
6. The optional second protection vehicle may be needed to block wider exit ramps.



**MOBILE RAMP CLOSURE with LANE DROP
EXPRESSWAY/FREEWAY**

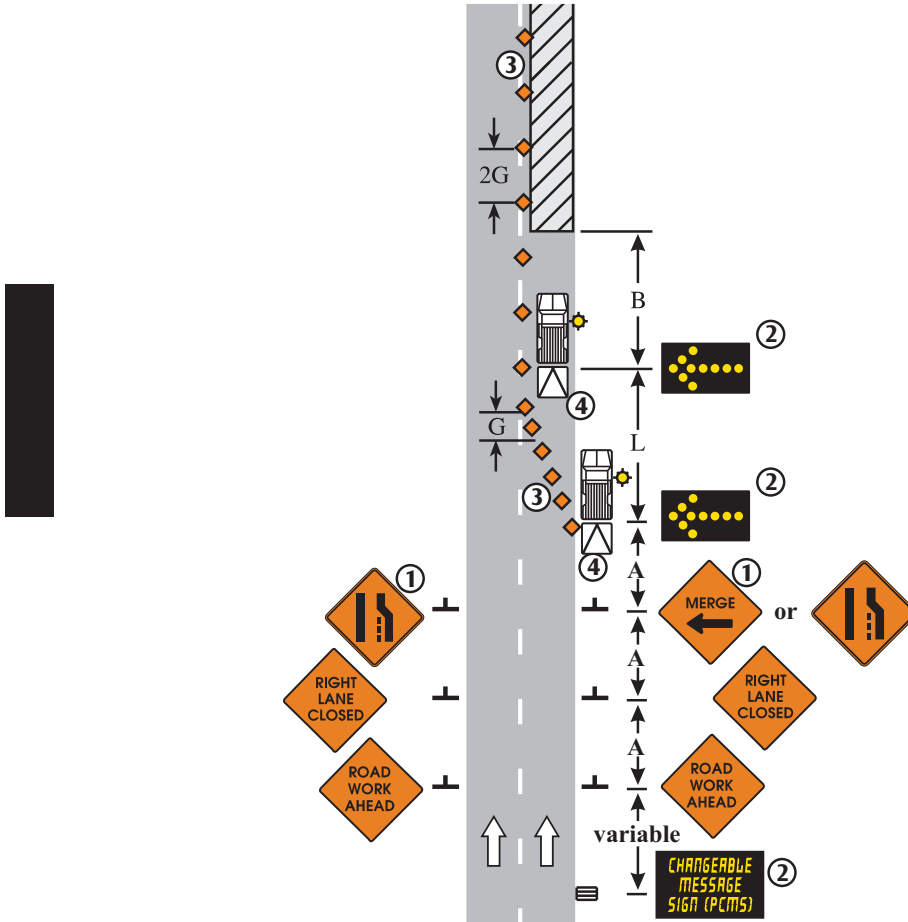
15 MINUTES or LESS

6K-49

LAYOUT 49

NOTES:

1. The Lane Reduction sign and the MERGE sign may be omitted when the posted speed limit is 40 mph or less.
2. In order to use this layout, two flashing arrow boards, at least one PCMS, and advance warning signs shall be used. If these devices are not available, either Layout 52 shall be used.
3. When using a combination of cones (28 inch minimum height) and Direction Indicator Barricades every third device in the merge taper and every tenth device in the tangent area shall be a Directional Indicator Barricade.
4. All shadow vehicles operating totally or partially in a traffic lane should be equipped with a truck mounted attenuator.



**LANE CLOSURE
OCCUPIED NIGHTTIME WORK SPACE
MULTI-LANE DIVIDED ROAD**

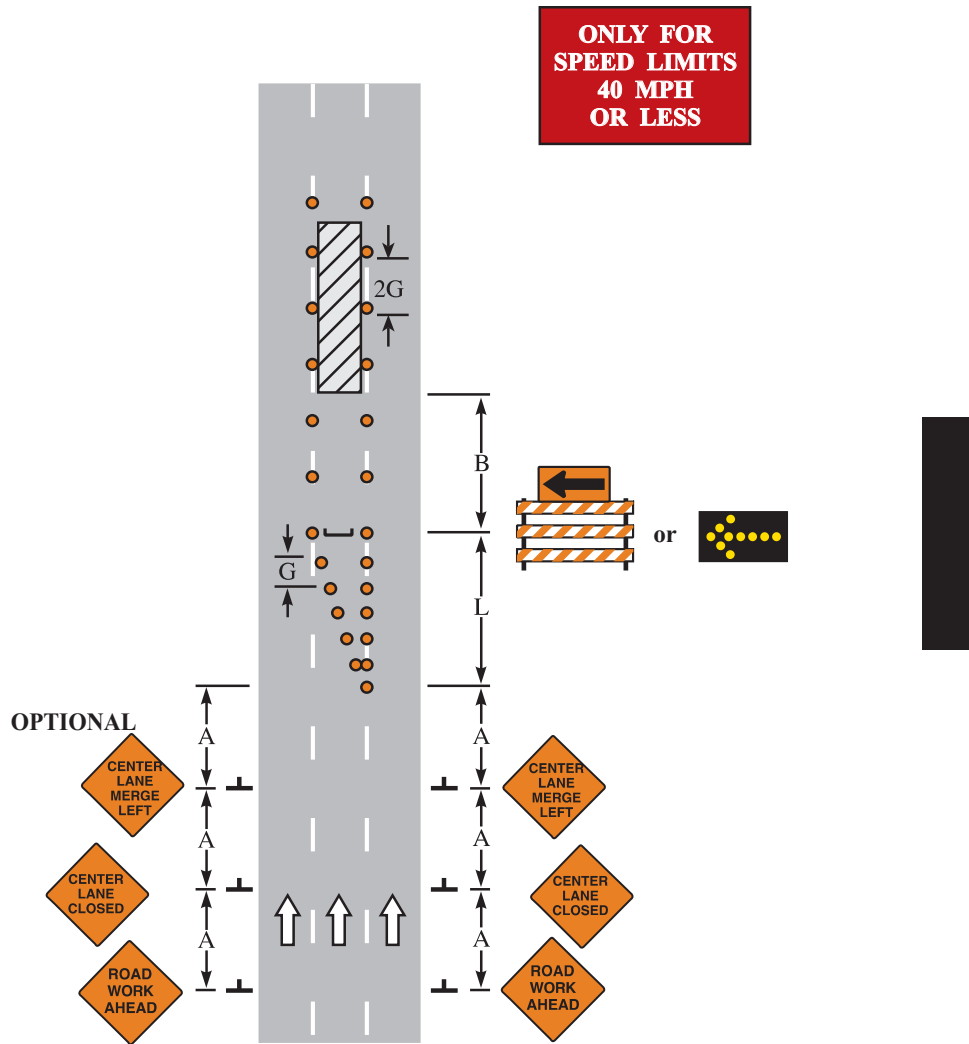
12 HOURS or LESS

6K-50

LAYOUT 50

NOTE:

1. If traffic volumes are low, a double lane closure is preferred.



**CENTER LANE CLOSURE
MULTI-LANE DIVIDED OR ONE WAY ROAD**

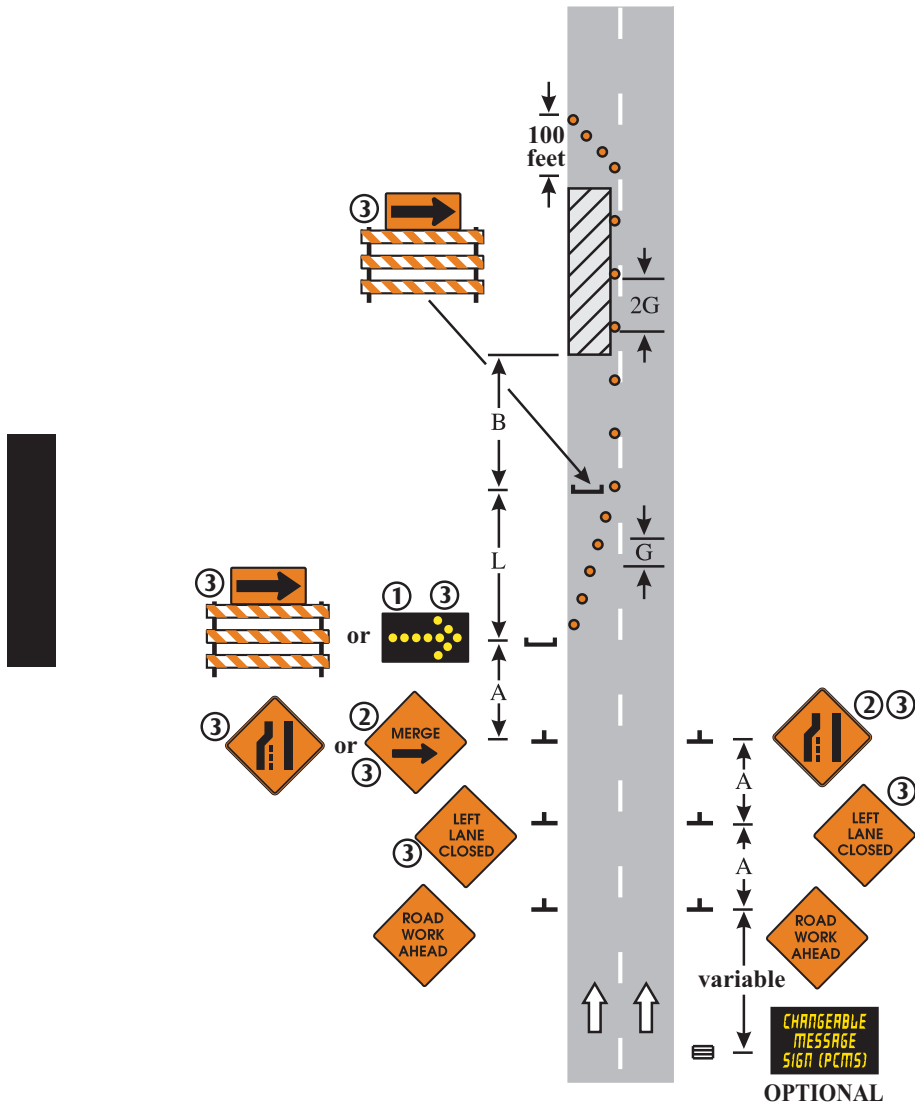
3 DAYS or LESS

6K-51

LAYOUT 51

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. The Lane Drop symbol sign and the Merge with arrow 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**

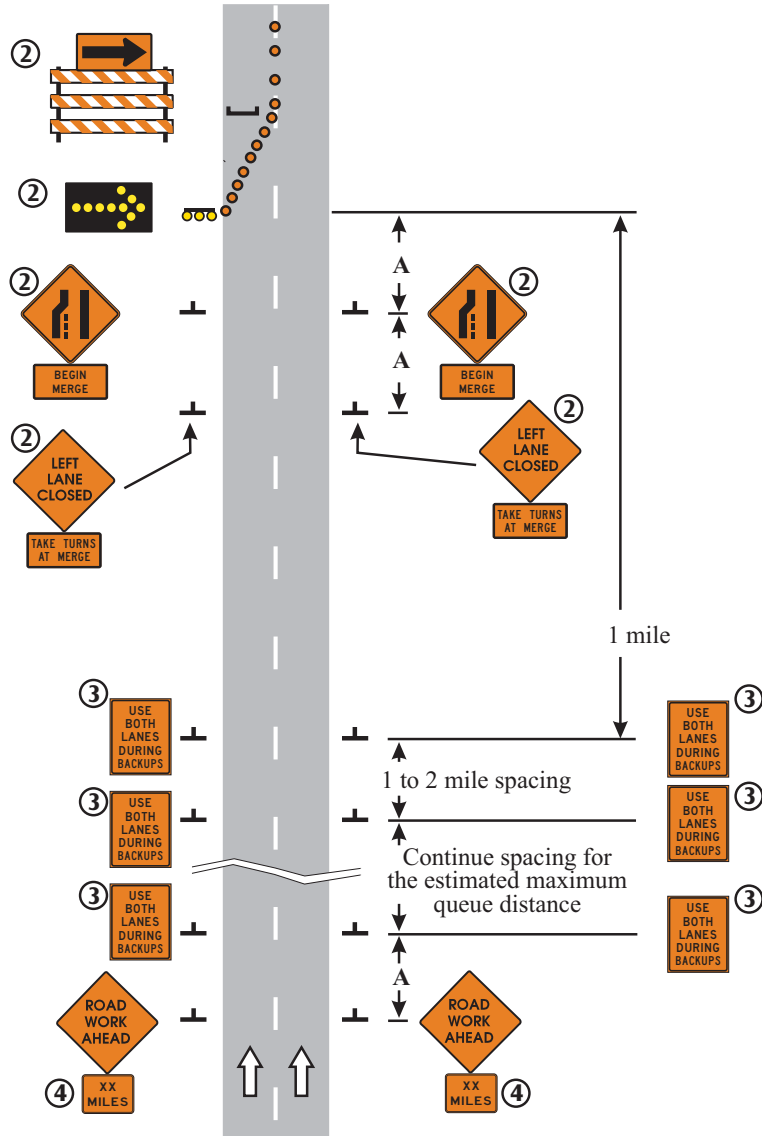
3 DAYS or LESS

6K-52

LAYOUT 52

NOTES:

1. This layout should be used on high speed roadways where traffic queues may extend at least 0.5 mile upstream of the taper. If little or no queuing is anticipated, use the typical lane closure Layout 52.
2. Use the appropriate traffic control devices for a right lane closure.
3. A PCMS may be used in place of a pair of USE BOTH LANES DURING BACKUPS signs.
4. Distance plaques are recommended when the distance is 2 miles or more.



**LANE CLOSURE WITH LATE MERGE
MULTI-LANE DIVIDED ROAD**

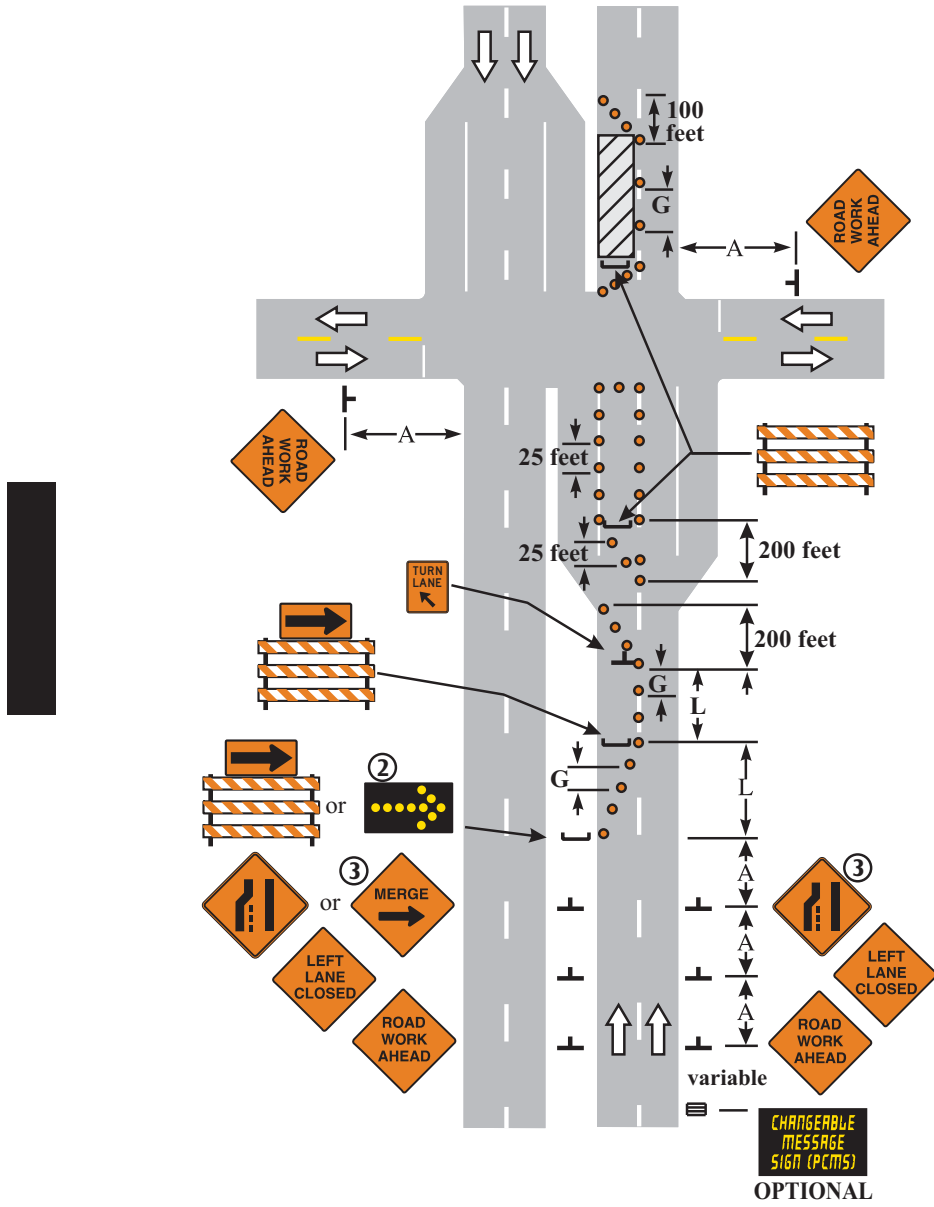
3 DAYS or LESS

6K-53

LAYOUT 53

NOTES:

1. Use the appropriate advance warning sign spacing for the speed on the cross road.
2. The flashing arrow board shall be used when the posted speed limit is 45 or greater.
3. The Lane Drop symbol sign and the MERGE with Arrow 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**

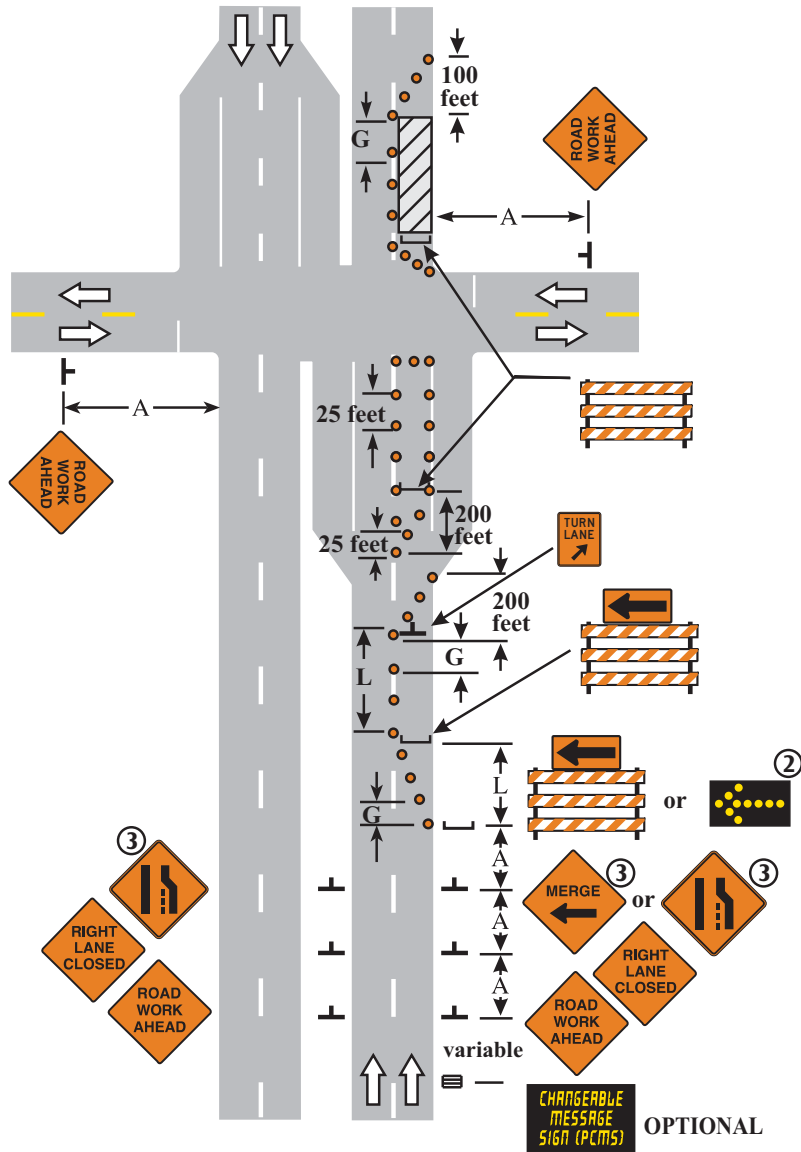
3 DAYS or LESS

6K-54

LAYOUT 54

NOTES:

1. Use the appropriate advance warning sign spacing for the speed on the cross road.
2. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
3. The Lane Drop symbol sign and the MERGE with Arrow 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**

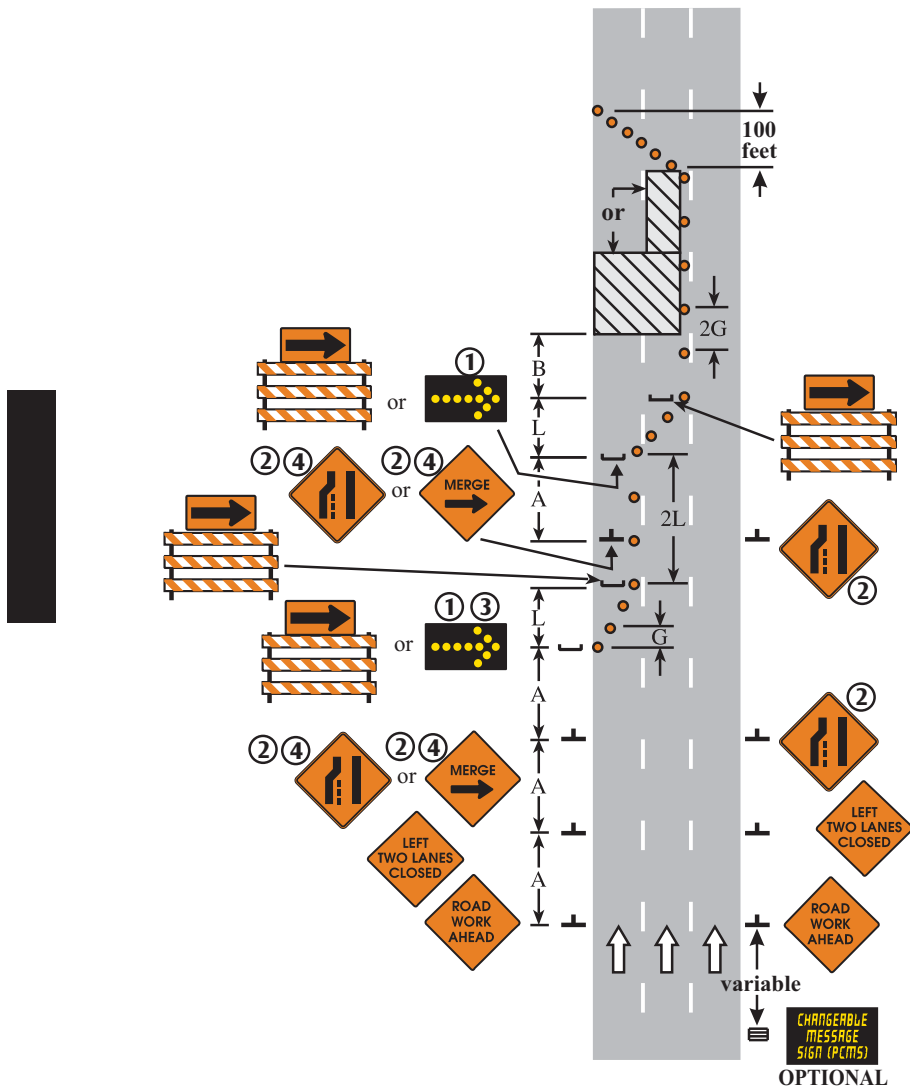
3 DAYS or LESS

6K-55

LAYOUT 55

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. The Lane Drop symbol signs, the Merge with arrow signs, and the arrow board may be omitted when the posted speed limit is 40 mph or less.
3. If the flashing arrow board will not fit entirely on the left shoulder, it should be placed behind the taper, encroaching on the lane as little as possible.
4. When the Lane Drop symbol sign or the MERGE with arrow sign is used, the same sign shall be used for both lane closures in each direction.



**LEFT TWO LANES CLOSED
MULTI-LANE DIVIDED ROAD**

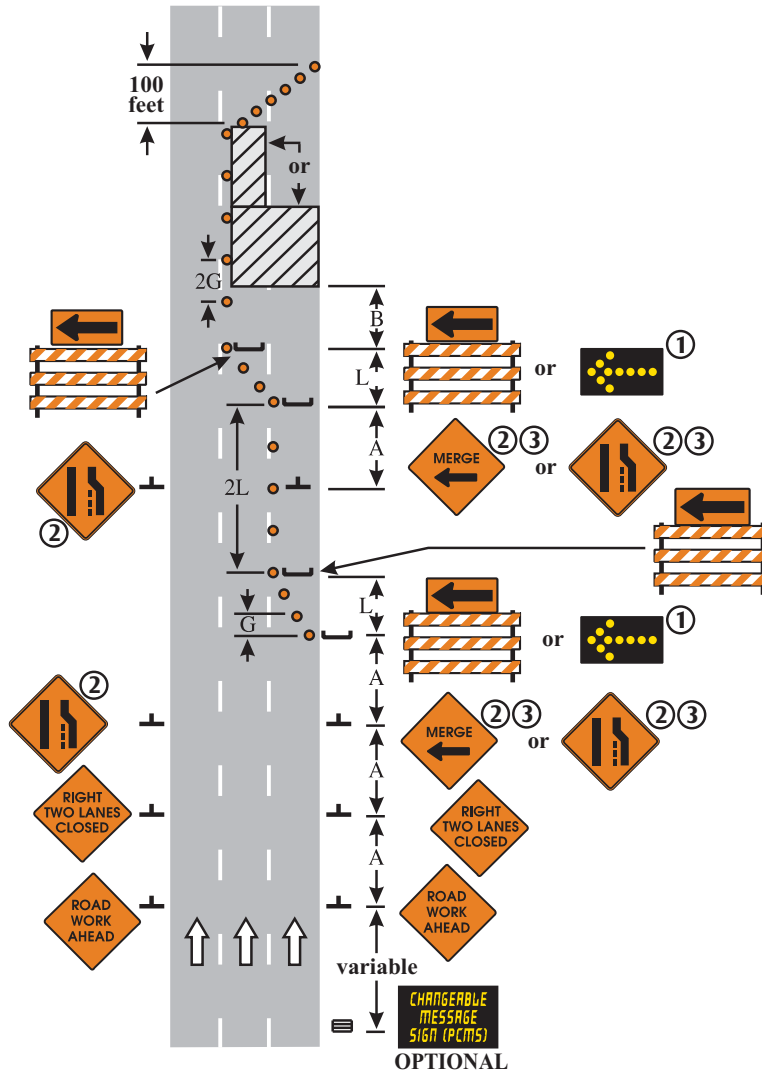
3DAYS or LESS

6K-56

LAYOUT 56

NOTES:

1. The flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
2. The Lane Drop symbol sign and the Merge with arrow sign may be omitted when the posted speed limit is 40 mph or less.
3. When the Lane Drop symbol sign or the MERGE with arrow sign is used, the same sign shall be used for both lane closures in each direction.



**RIGHT TWO LANES CLOSED
MULTI-LANE DIVIDED ROAD**

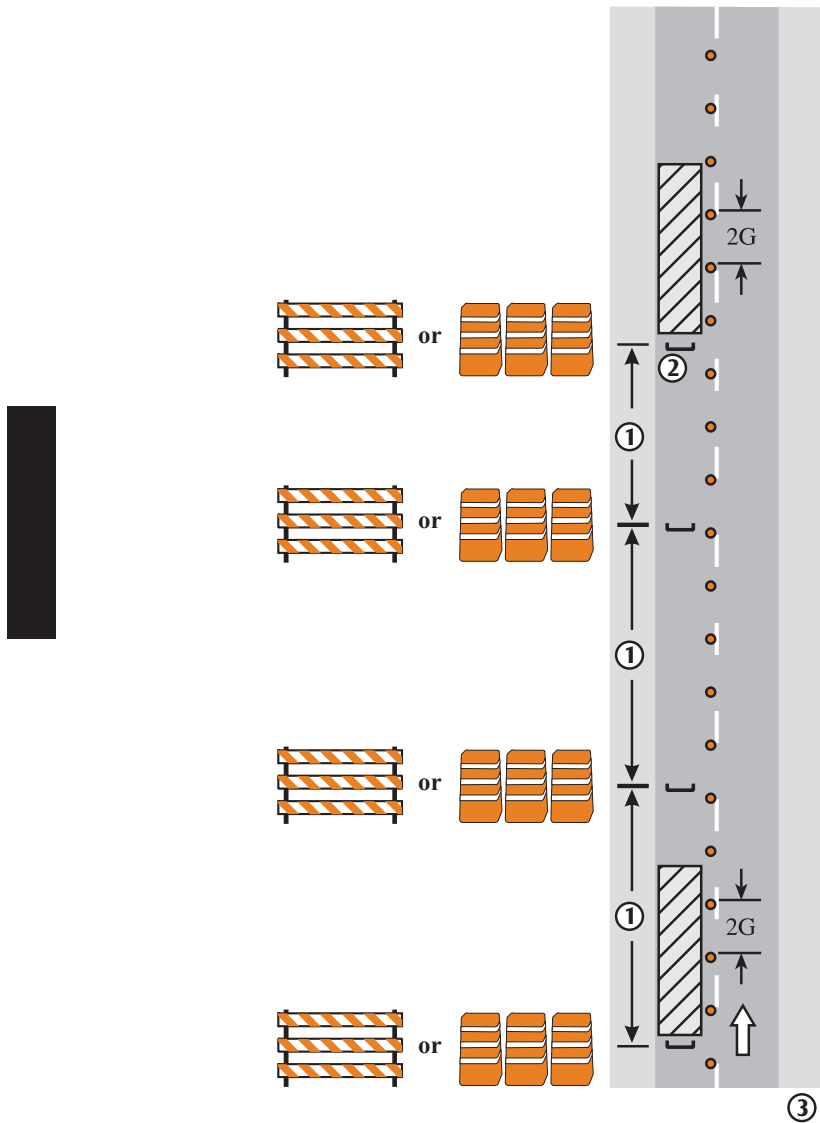
3 DAYS or LESS

6K-57

LAYOUT 57

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 omitted when the work space is occupied.
3. For advance signing, placement of traffic control devices, and lane taper, see the appropriate stationary layout.



**LANE CLOSURE EXTENSION
MULTI-LANE DIVIDED OR ONE WAY ROAD**

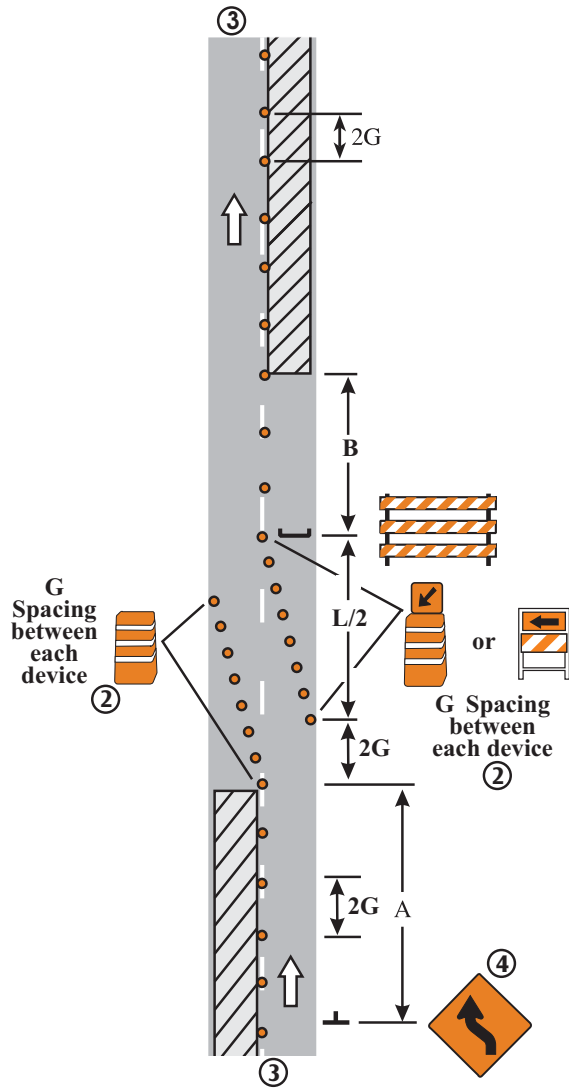
3 DAYS or LESS

6K-58

LAYOUT 58

NOTES:

1. For one lane of traffic only.
2. Continue the pattern and the spacing of devices for additional lateral shift.
3. For advance signing, placement of traffic control devices, lane taper, see the appropriate stationary layout.
4. The Lane Shift sign may be omitted when the posted speed limit is 40 mph or less.



**LANE SHIFT
MULTI-LANE DIVIDED OR ONE WAY ROAD**

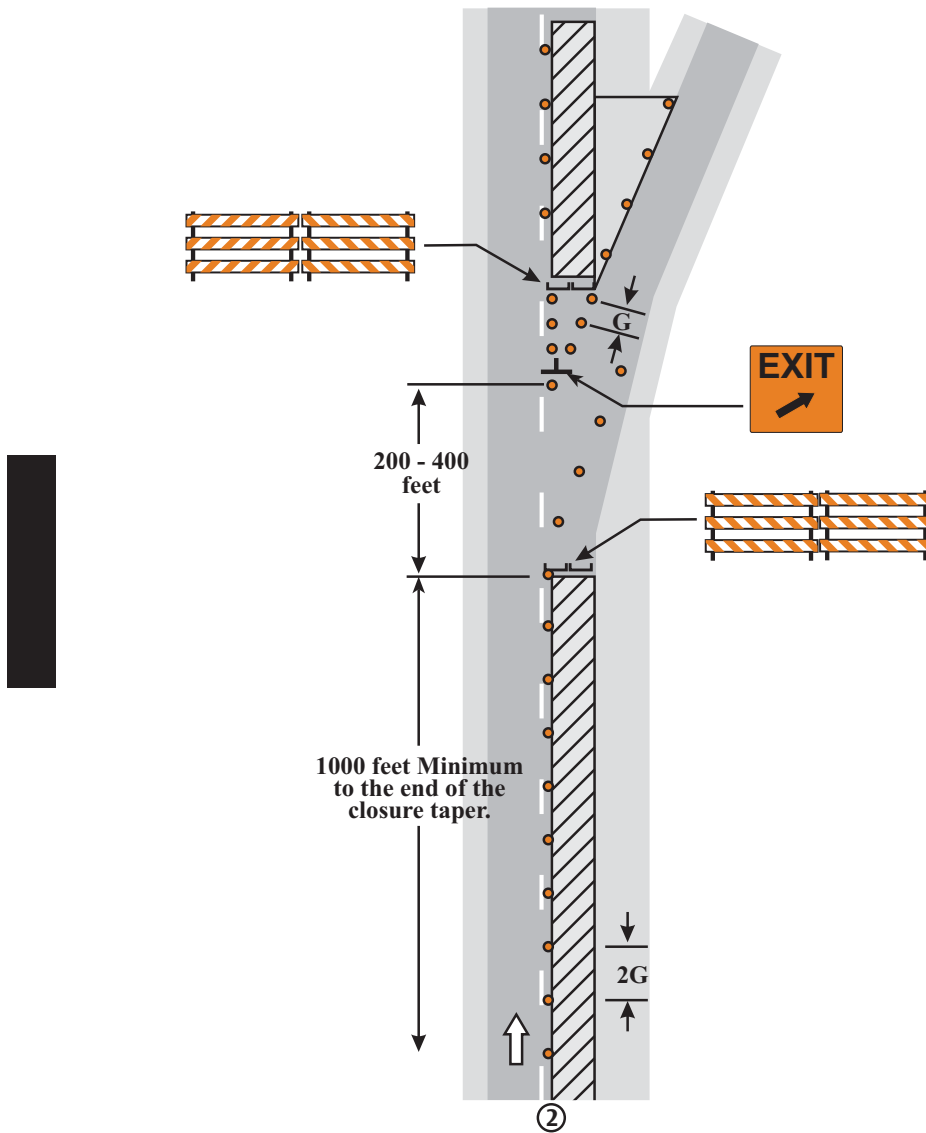
3 DAYS or LESS

6K-59

LAYOUT 59

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**

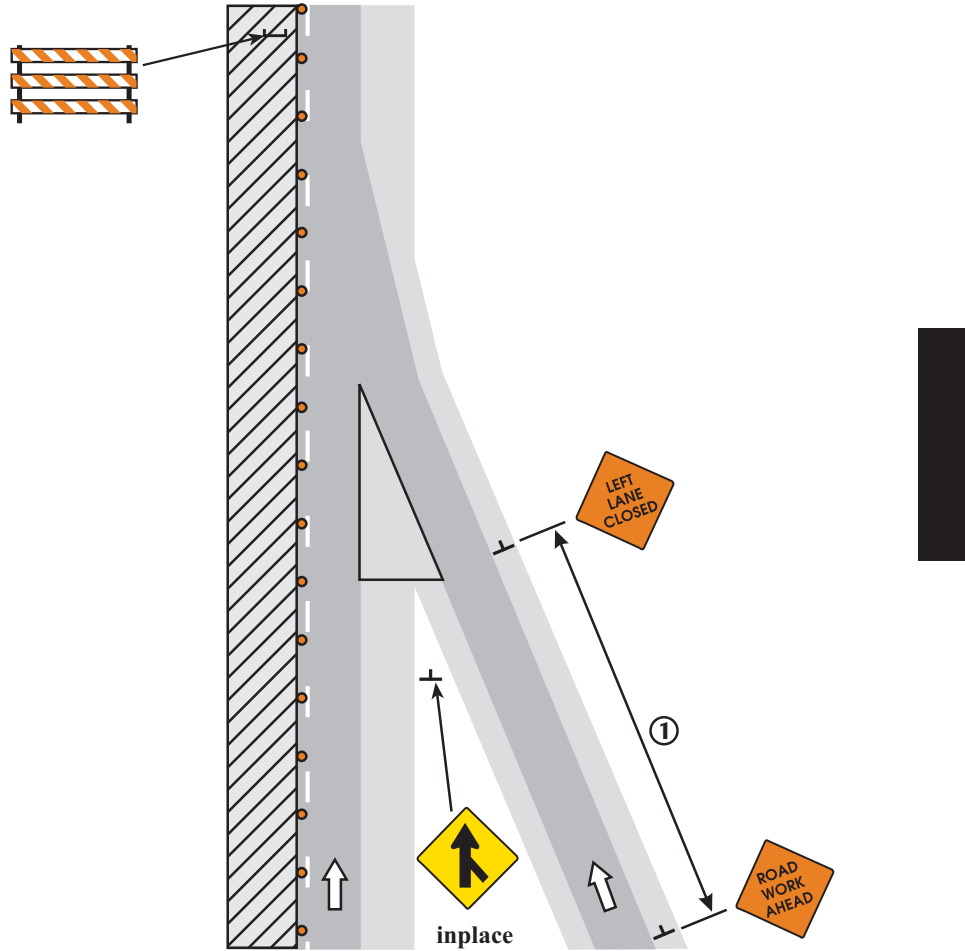
3 DAYS or LESS

6K-60

LAYOUT 60

NOTES:

1. The advance warning sign spacing is dependent on the ramp length and the location of in-place signing. The spacing should be as long as is practical.



**MAINLINE LEFT LANE CLOSED
ENTRANCE RAMP OPEN**

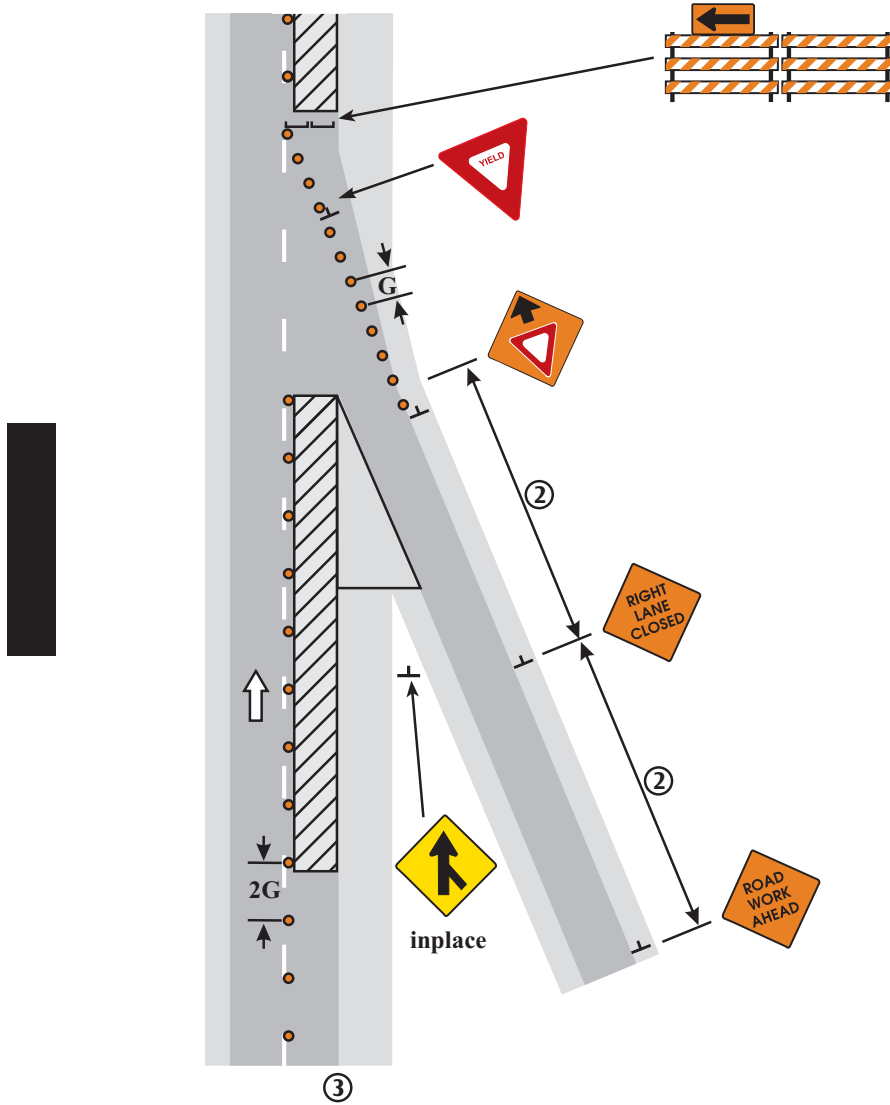
3 DAYS or LESS

6K-61

LAYOUT 61

NOTES:

1. Adjust the ramp entrance to fit the conditions.
2. The advance warning sign spacing is dependent on the ramp length and the location of in-place signing. The spacing should be as long as is practical.
3. For advance signing, placement of traffic control devices, and lane closure, see the appropriate stationary layout.



**MAINLINE RIGHT LANE CLOSED
ENTRANCE RAMP OPEN**

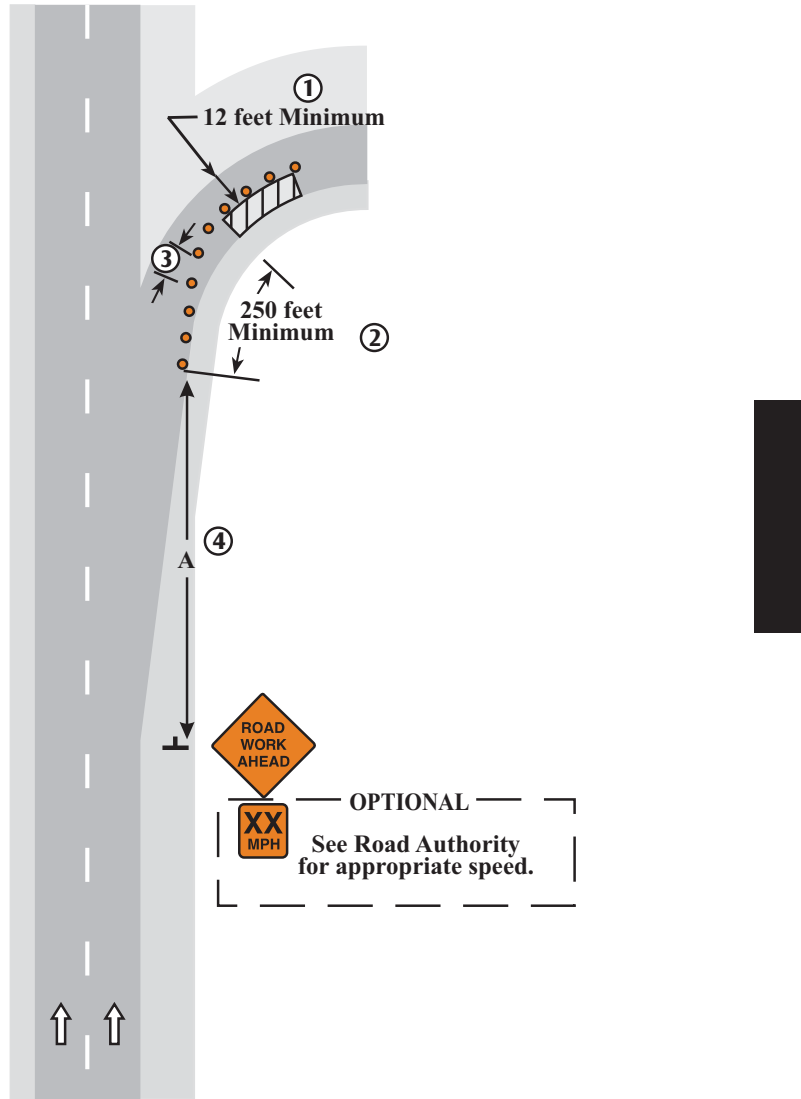
3 DAYS or LESS

6K-62

LAYOUT 62

NOTES:

1. Truck off-tracking should be considered when determining whether the 12 foot minimum lane width is adequate.
2. Use a minimum of a 250 foot taper.
3. For Loops use 25 foot spacing between devices.
For Ramps use 50 foot spacing between devices.
4. The spacing for advance warning signs is dependent on the design of the interchange, and the location of inplace signing.



PARTIAL RAMP CLOSURE

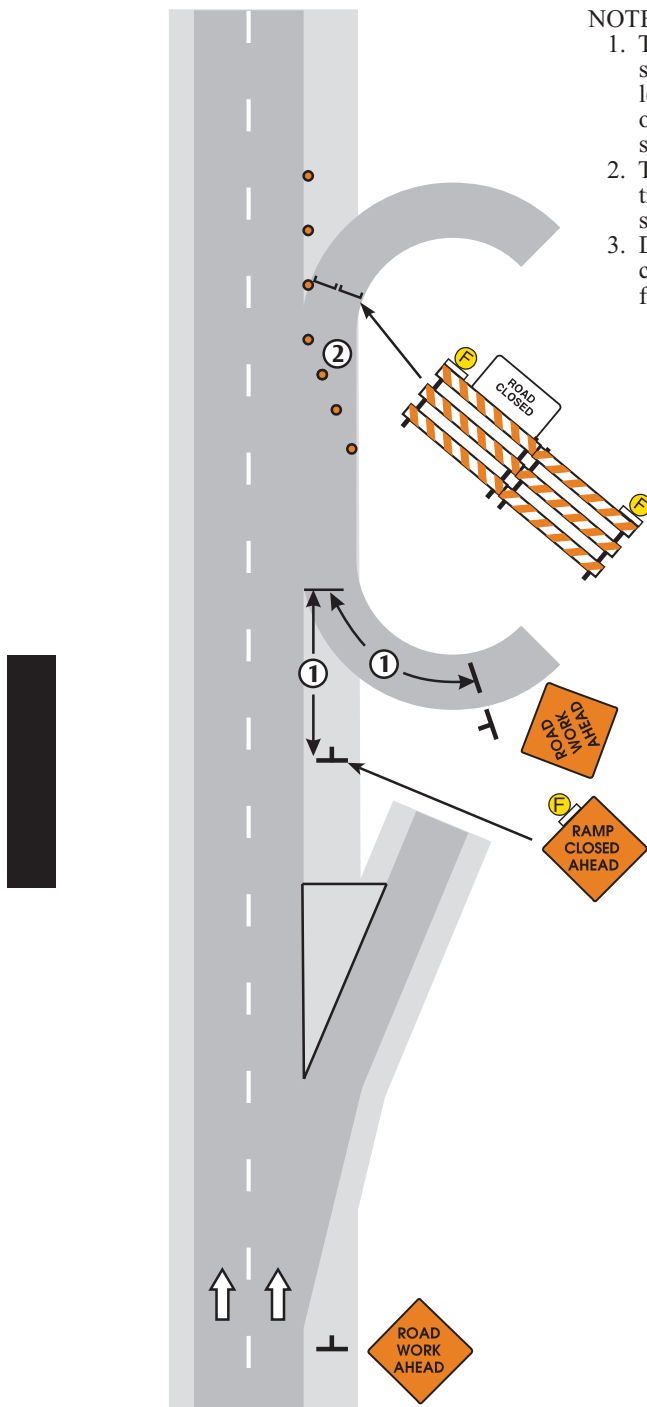
3 DAYS or LESS

6K-63

LAYOUT 63

NOTE:

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 an hour or greater.



EXIT LOOP CLOSURE

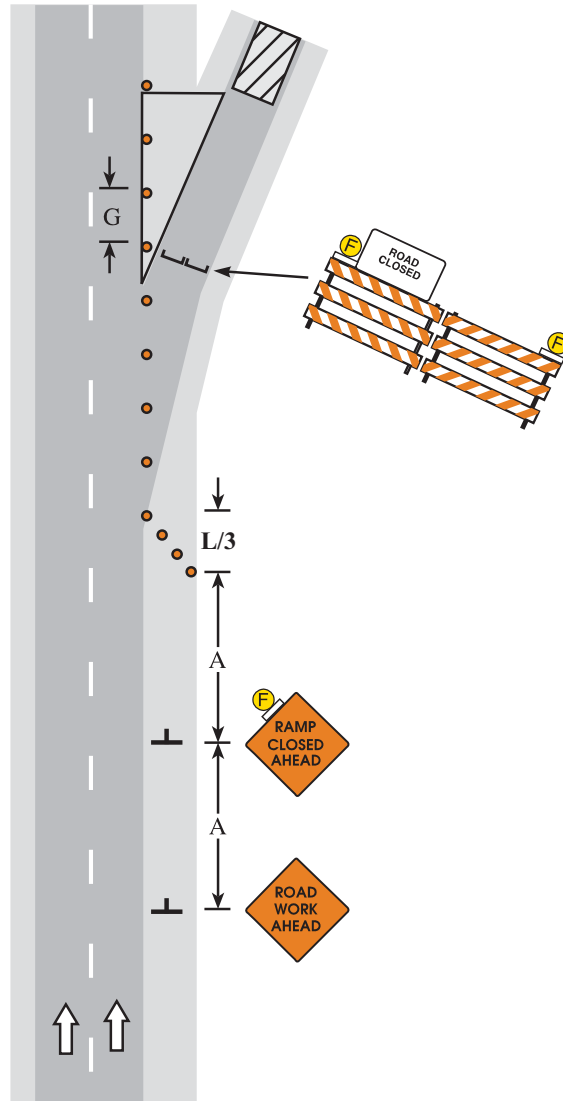
3 DAYS or LESS

6K-64

LAYOUT 64

NOTES:

1. Detour signing should be considered if the ramp is closed for an hour or greater.



EXIT RAMP CLOSURE

3 DAYS or LESS

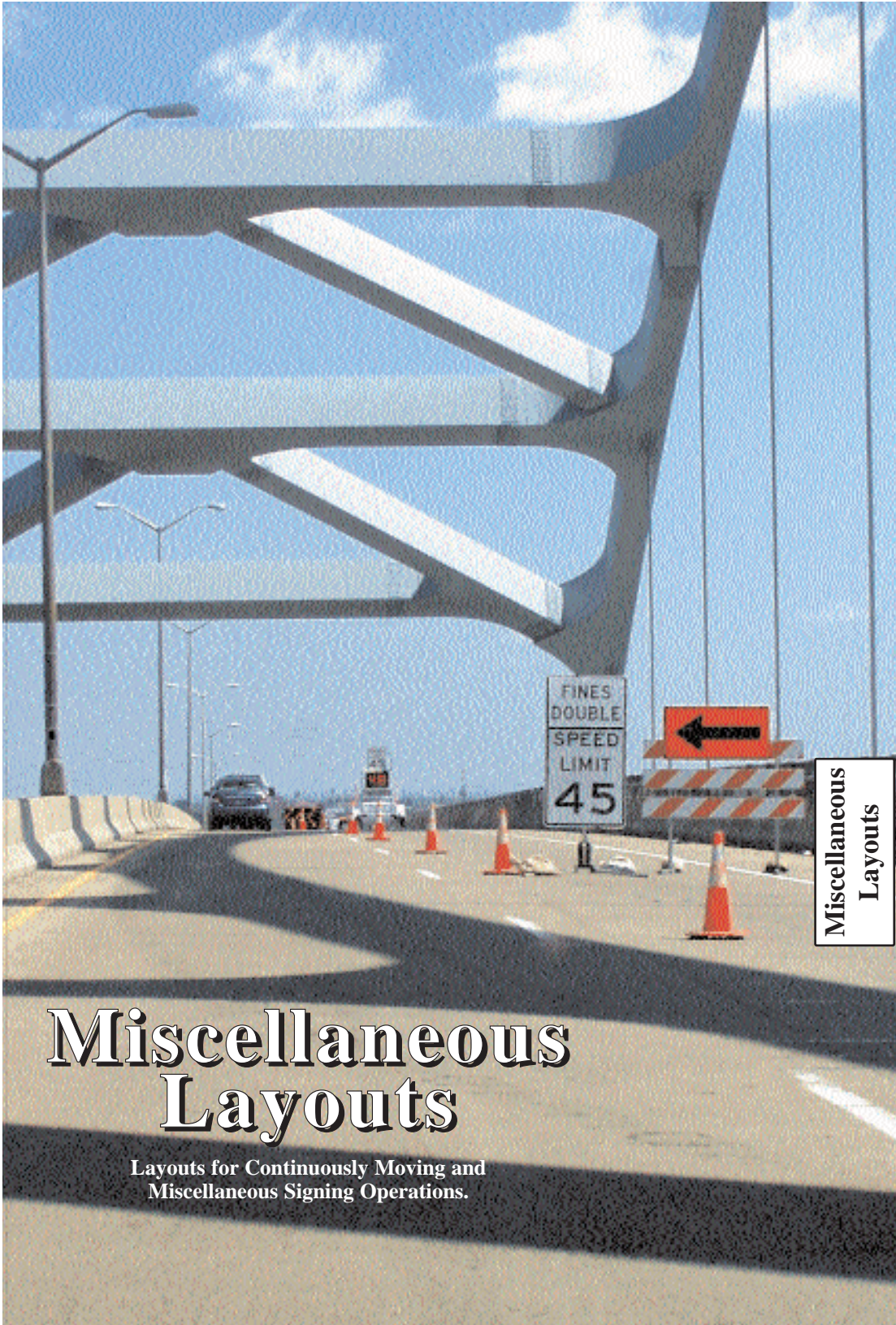
6K-65

LAYOUT 65



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There is no Layout 66.



Miscellaneous
Layouts

Miscellaneous Layouts

Layouts for Continuously Moving and
Miscellaneous Signing Operations.

MISCELLANEOUS LAYOUTS

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

Miscellaneous Operations

Normally, these are continuously moving operations where the equipment operators remain inside/on the work vehicle.

Layout
No.

Pavement Marking - Two-Lane Roads	67, 68
Pavement Marking - Multi-Lane Roads	69, 70
Off Road Operation	71
Motor Grader - Gravel Road Maintenance	72

Miscellaneous Signing

These are unusual layouts that may be used to warn motorists of unexpected roadway operations.

Layout
No.

Surfacing Operation at Intersection	74
Bump	73
Blasting	75
Multiple Work Spaces	77
Multiple Cross-Road Intersections	76
Advisory Speed Limits	74
Dynamic Speed Display Sign	78
Stopped Traffic Warning System	79

Miscellaneous Closures

These are specialized layouts for closures or roadway or pedestrian facilities.

Layout
No.

2-Lane, 2-Way Road Closure	80, 81
Undivided, Multi-Lane Road Closure	82
Divided, Multi-Lane Closure	83
Sidewalk Detour	84
Sidewalk Bypass	85

These Layouts as well as the entire Field Manual, the Flagging Handbook and other documents are available on the Mn/DOT, Traffic Engineering website at:

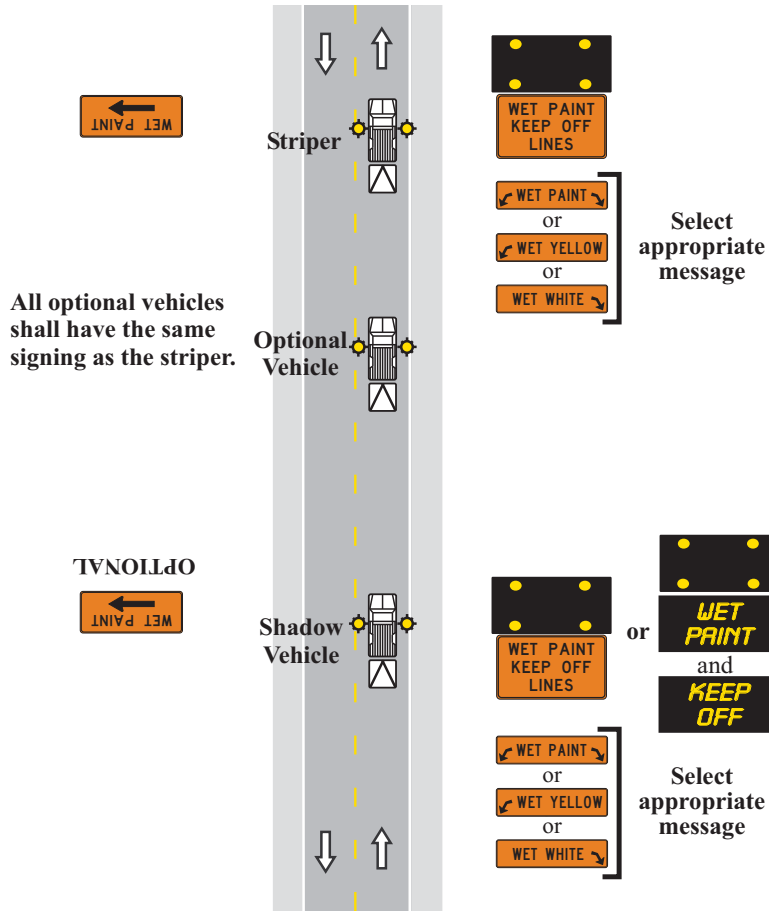
<http://www.dot.state.mn.us/trafficeng/>

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 truck mounted attenuator.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "Wet Paint" signs should be considered.

FRONT FACING SIGNS

REAR FACING SIGNS



**STRIPING OPERATIONS
TWO LANE TWO WAY ROAD**

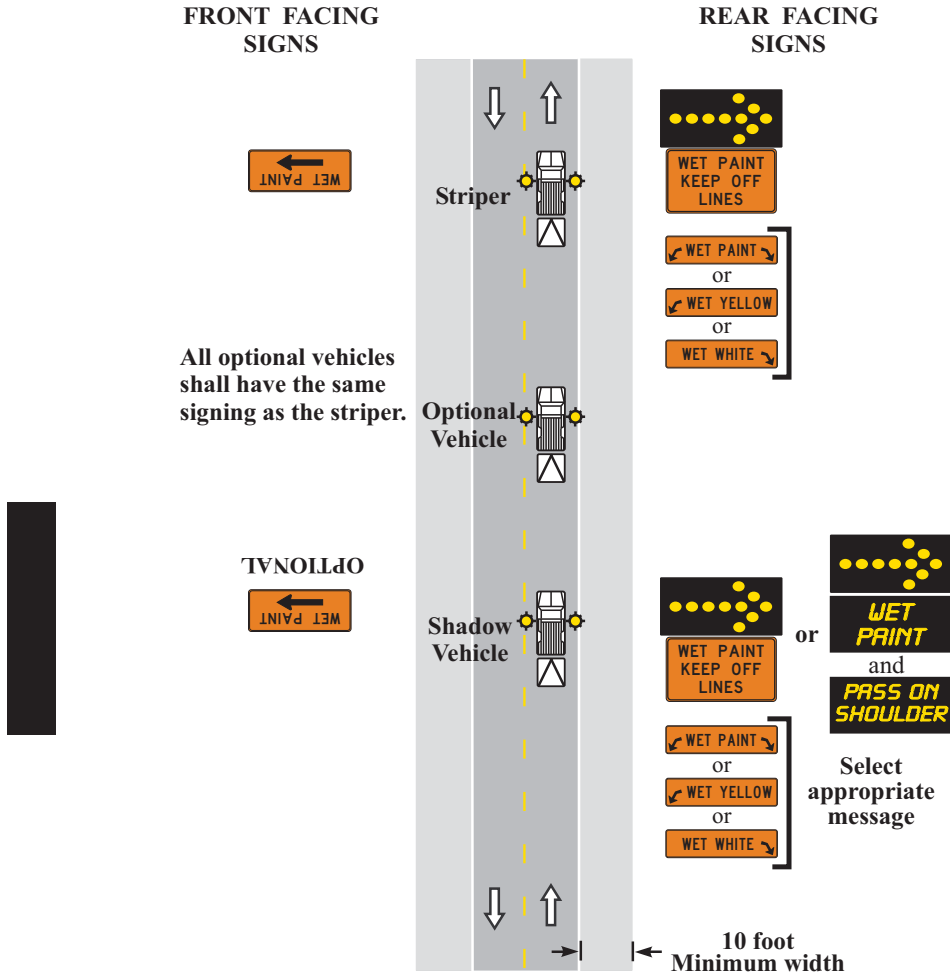
15 MINUTES or LESS

6K-67

LAYOUT 67

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 truck mounted attenuator.
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 - PASSING ON SHOULDER**

15 MINUTES or LESS

6K-68

LAYOUT 68

NOTES:

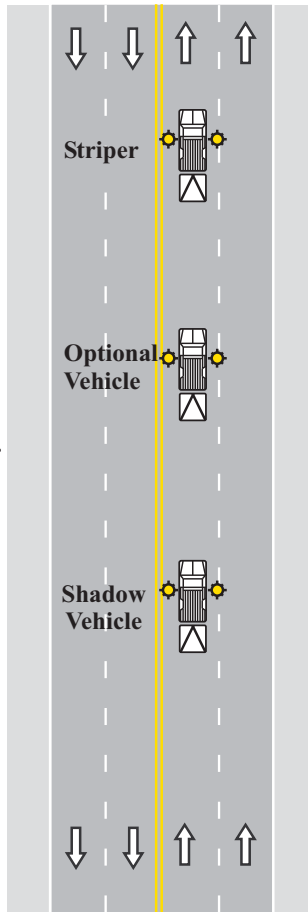
1. All vehicles shall display two 360-degree yellow flashing vehicle lights or strobes.
2. The separation distance between the striper and the last shadow vehicle should be determined by the track free time of the pavement marking material.
3. Any vehicle(s) operated totally or partially in a high speed traffic lane should be equipped with a truck mounted attenuator.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "Wet Paint" signs should be considered.
5. Remove sign when operating this vehicle in the right lane.

FRONT FACING SIGNS



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

REAR FACING SIGNS



Select appropriate message



or



Select appropriate message

**STRIPING OPERATIONS
CENTERLINE - LANE LINE - EDGELINE STRIPING
FOUR LANE UNDIVIDED ROAD**

15 MINUTES or LESS

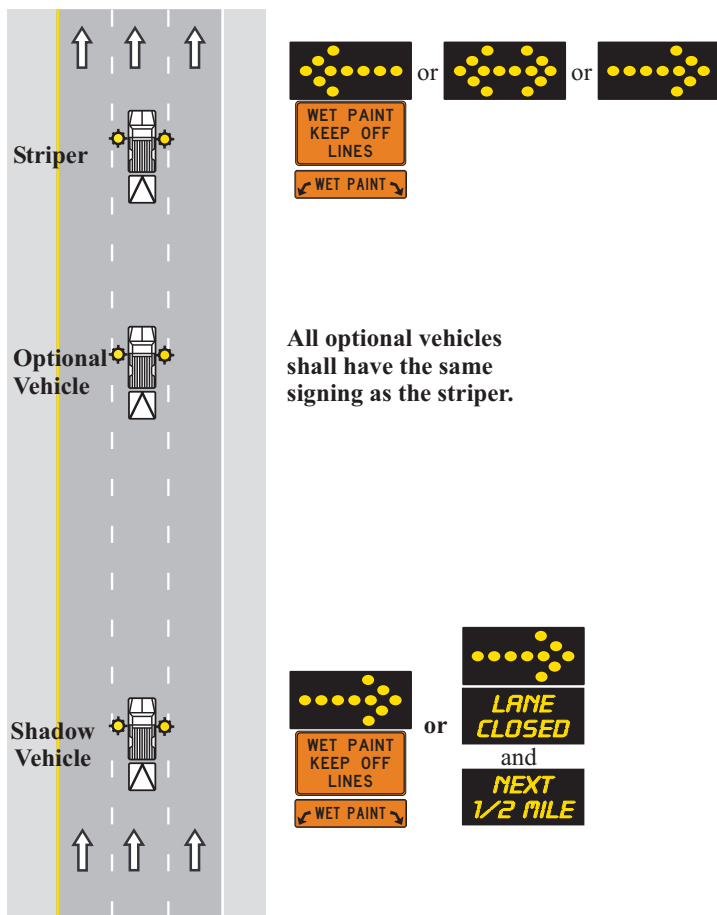
6K-69

LAYOUT 69

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 truck mounted attenuator.
4. If tracking of the wet paint is anticipated, the use of cones or stationary "Wet Paint" signs should be considered.

REAR FACING SIGNS



**STRIPING OPERATIONS
LANE LINE STRIPING - CENTER LANE OPERATIONS
MULTI-LANE DIVIDED ROAD**

15 MINUTES or LESS

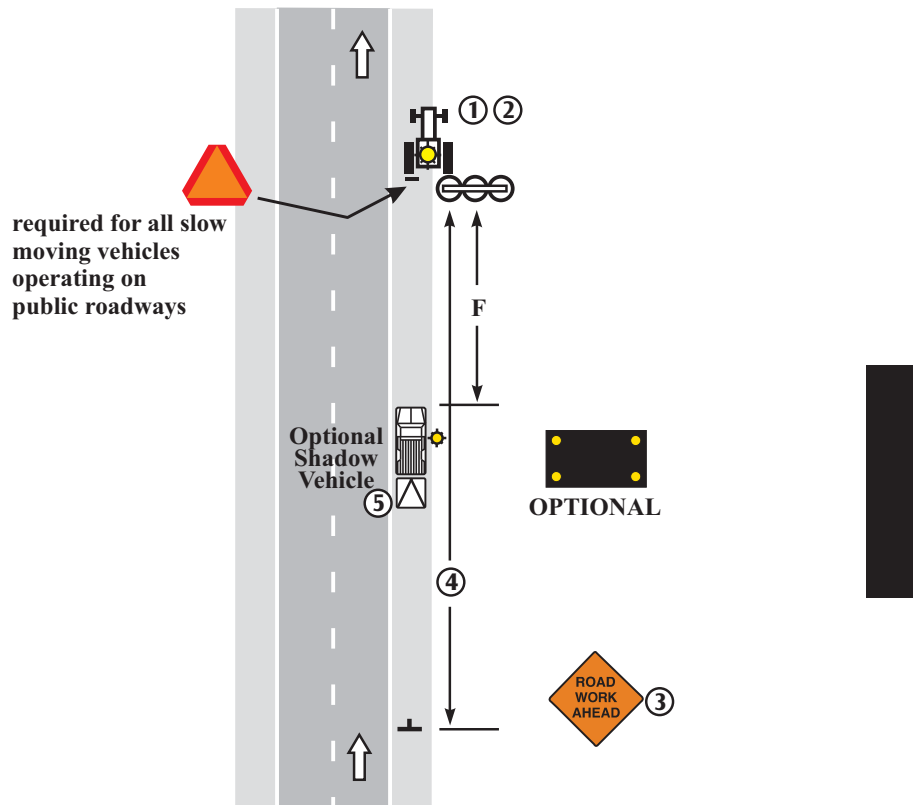
6K-70

LAYOUT 70

NOTES:

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

**SEE
NOTE 5**



**WORK OFF ROADWAY
MOBILE OPERATIONS HAVING LITTLE
OR NO INTERFERENCE WITH TRAFFIC**

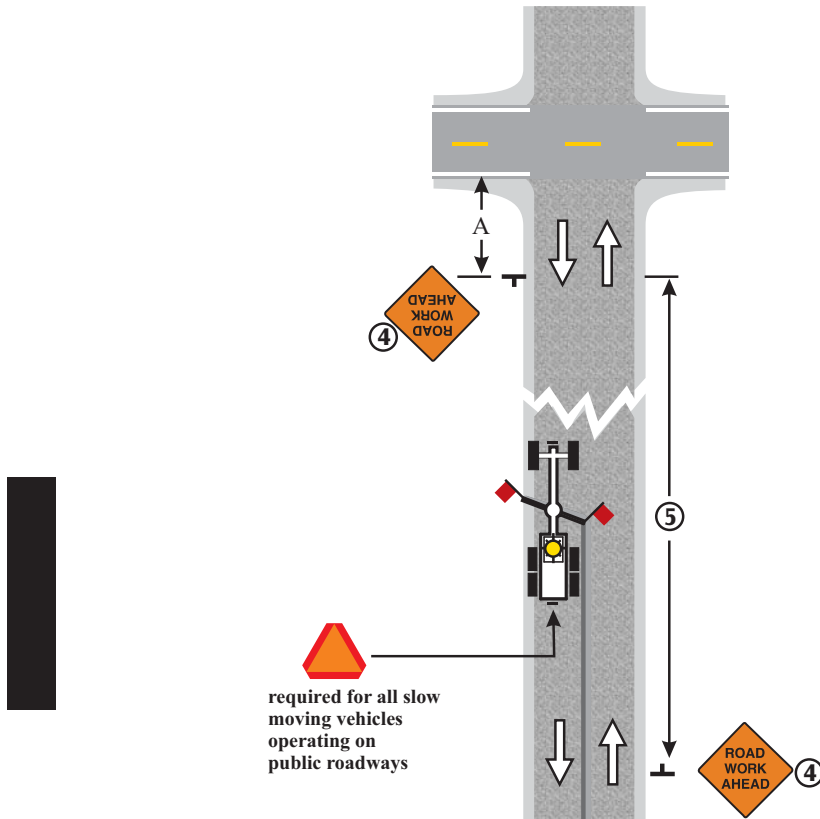
15 MINUTES or LESS

6K-71

LAYOUT 71

NOTES:

1. Grading operations should be scheduled and completed during daylight work shifts. Work should be suspended during poor weather or visibility conditions.
2. Motor Graders shall be equipped with a flashing vehicle light visible 360 degrees around the vehicle when viewed from a distance of 60 feet.
3. 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.
4. The ROAD WORK AHEAD signs may be omitted when there is an adequate approach decision sight distance to the motor grader along the majority of the route.
5. 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**

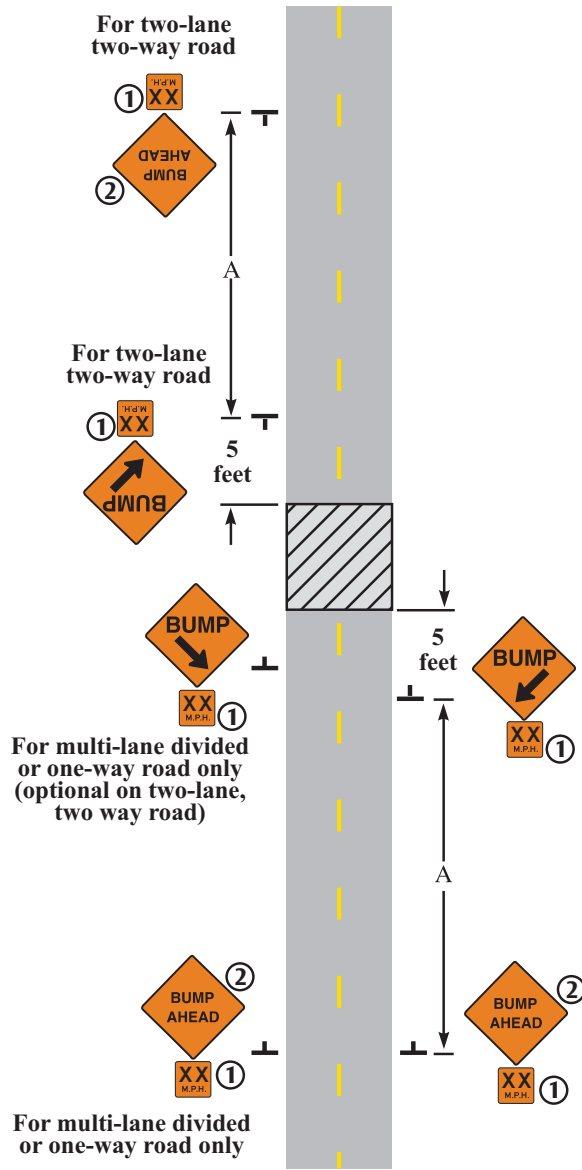
15 MINUTES or LESS

6K-72

LAYOUT 72

NOTES:

1. When used, Advisory Speed plaques shall be installed below the appropriate warnings.
2. These devices may be omitted when the posted speed limit is 40 mph or less.



TYPICAL BUMP SIGNING

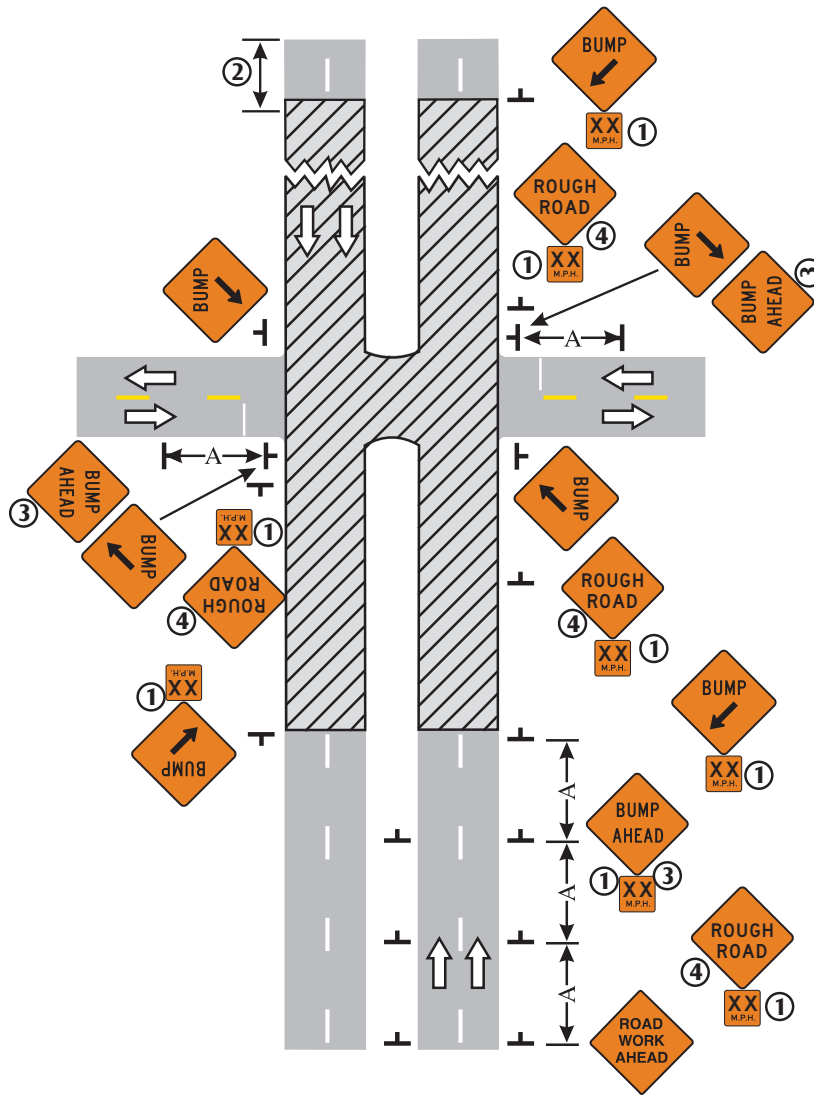
3 DAYS or LESS

6K-73

LAYOUT 73

NOTES:

1. When used, Advisory Speed plaques shall be installed below the appropriate warnings.
2. Use the same advance warning signs and spacings for the other approach to the milled roadway surface area.
3. The BUMP AHEAD and Advisory Speed plaque may be omitted when the posted speed is 40 mph or less.
4. Use the appropriate advance warning sign for the roadway condition, i.e. GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD.



**RE-SURFACING OPERATION
WORK SPACE BEFORE AND THRU INTERSECTION
MULTI-LANE DIVIDED ROAD**

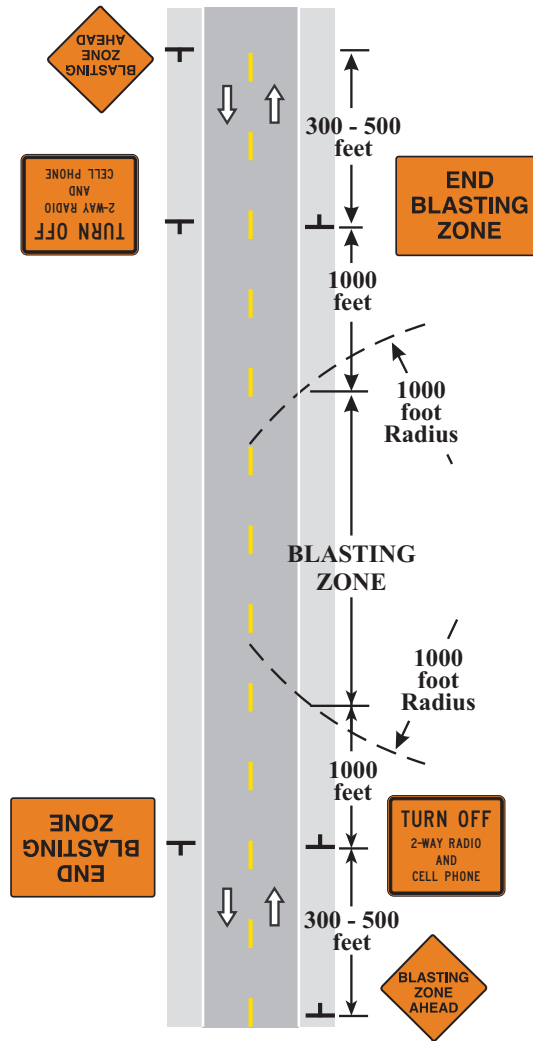
3 DAYS or LESS

6K-74

LAYOUT 74

NOTES:

1. Whenever electric blasting caps are used for blasting within 1000 feet of a roadway, the signing shown shall be used. On a divided highway, the signs should be installed on both sides of the directional roadways.
2. The signs shall be covered or removed when there are no explosives in the area or the area is otherwise secure.
3. Any intersecting road within the 1000-foot radius of the blasting area shall be signed in a similar manner.
4. Prior to blasting, the blaster in charge shall determine whether highway traffic in the blasting zone will be endangered by the blasting operation. If there is danger, highway traffic will not be permitted to pass through the blasting zone during blasting operations. See Layouts 81, 82, or 83.



BLASTING ZONE

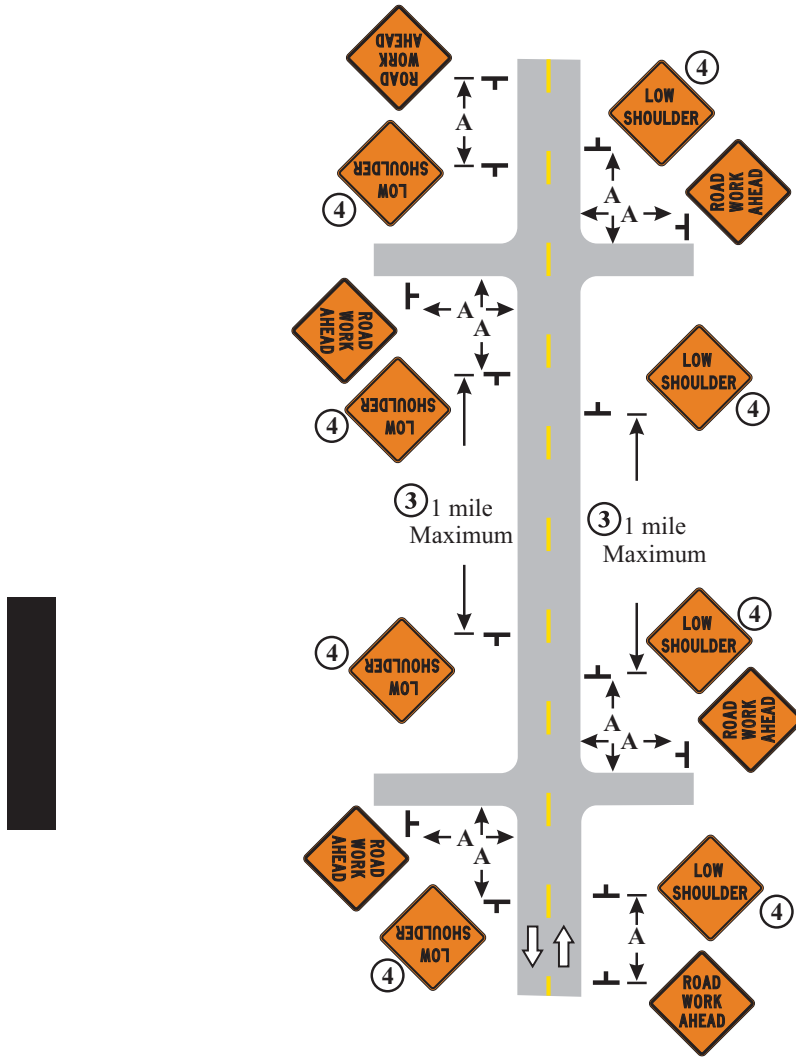
3 DAYS or LESS

6K-75

LAYOUT 75

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 area of paving, etc).
3. Confirmation signing for a continuous condition should be placed at approximately 1 mile spacing.
4. Use the appropriate advance warning sign for the roadway condition, i.e. GROOVED PAVEMENT, LOOSE GRAVEL, ROUGH ROAD.



**CROSSROAD & CONFIRMATION SIGNING
TRAFFIC CONTROL ZONE**

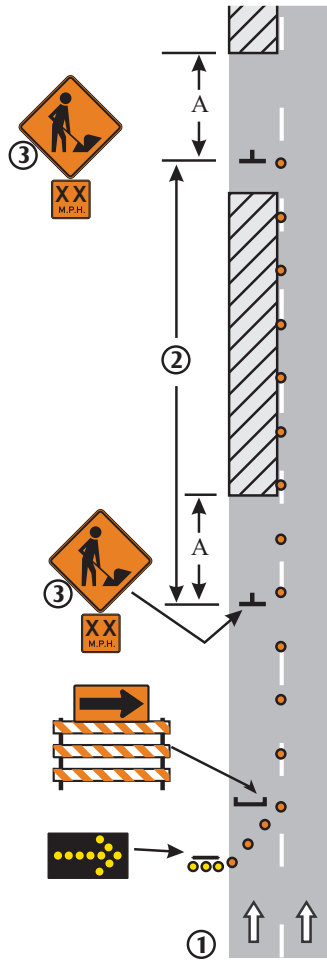
3 DAYS or LESS

6K-76

LAYOUT 76

Notes:

1. Use the appropriate layout for channelizing, advance signing, and spacing.
2. In long work zones, this sign assembly may be repeated before each worker area. When used, it shall be installed less than one mile in advance of the workers.
3. If used, an Advisory Speed Limit plaque shall be installed beneath the Worker Ahead symbol sign or the appropriate advance warning sign(s).
4. The advisory speed value shall not be higher than any in-place regulatory speed limit.
5. An advance warning sign with an Advisory Speed Limit plaque should not be placed near a regulatory speed sign.
6. See “*Work Zone Speed Limit Guidelines*” for more information on work zone speed limits.



**ADVISORY SPEED LIMIT
MULTI-LANE ROAD**

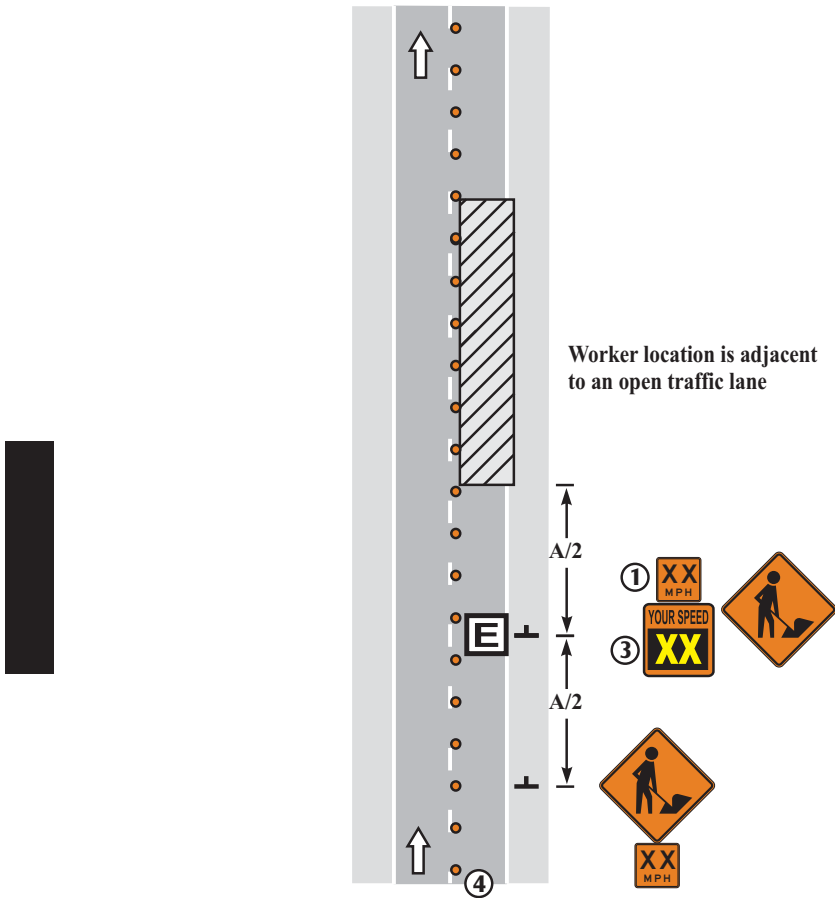
12 HOURS or LESS

6K-77

LAYOUT 77

NOTES:

1. The advisory speed plaque and appropriate warning sign should be located near the Dynamic Speed Display (DSD) (also known as "YOUR SPEED") sign, but may be up to a maximum of 100 feet ahead if found necessary.
2. The advisory speed plaque shall be removed when workers are not present, and the DSD sign should be removed, disabled, or re-programmed for the posted speed limit.
3. If the DSD sign is used with a regulatory speed limit (black on white sign), then the "YOUR SPEED" sign on the DSD device shall also be black legend on a white background.
4. TTC devices required to closed the traffic lane have not been shown.
5. Refer to the "Work Zone Speed Limit Guideline" for additional guidance on setting Advisory Speed Limits and optimum layout distances.



**DYNAMIC SPEED DISPLAY SIGN
(YOUR SPEED SIGN)**

12 HOURS or LESS

6K-78

LAYOUT 78

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NOTES:

1. The layout only shows the additional signs and devices required to setup a Stopped Traffic System. See other Temporary Traffic Control layouts for the proper temporary traffic control devices beyond the ROAD WORK AHEAD signs.
2. The STOPPED TRAFFIC WHEN FLASHING signs or the PCMS should activate and deactivate when the downstream detector senses average traffic speeds meeting threshold values as set by the engineer. A maximum one minute average speed drop of 20 mph or more below the posted speed limit (posted prior to road work in the queue area) may typically be used for a threshold value on high speed roadways. To deactivate the signage, the maximum one minute average speed typically should recover to within 10 mph of the posted speed limit or higher.
3. The estimated maximum queue length may be determined by engineering analysis or previous experience, and should be reviewed and field adjusted to fit actual traffic conditions such that the first warning device is upstream of the queue.
4. When PCMS devices are used, the two part message should read: STOPPED TRAFFIC - - PREPARE TO STOP and the PCMS may be used for other appropriate messages whenever the stopped traffic message is not required.

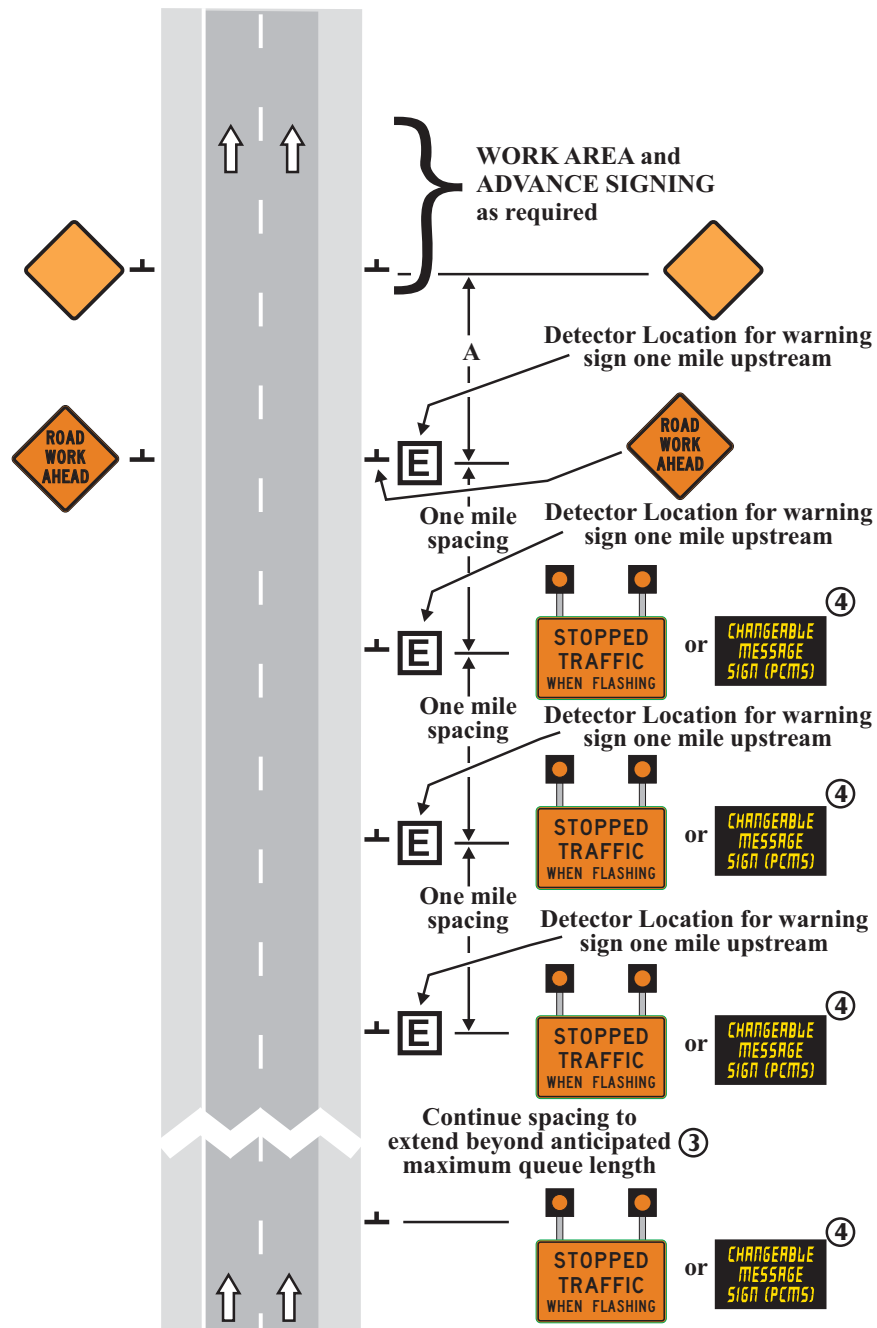


STOPPED TRAFFIC AHEAD WARNING SYSTEM
Layout 79a

3 DAYS or LESS

6K-79a

LAYOUT 79a & b



STOPPED TRAFFIC AHEAD WARNING SYSTEM
 Layout 79b

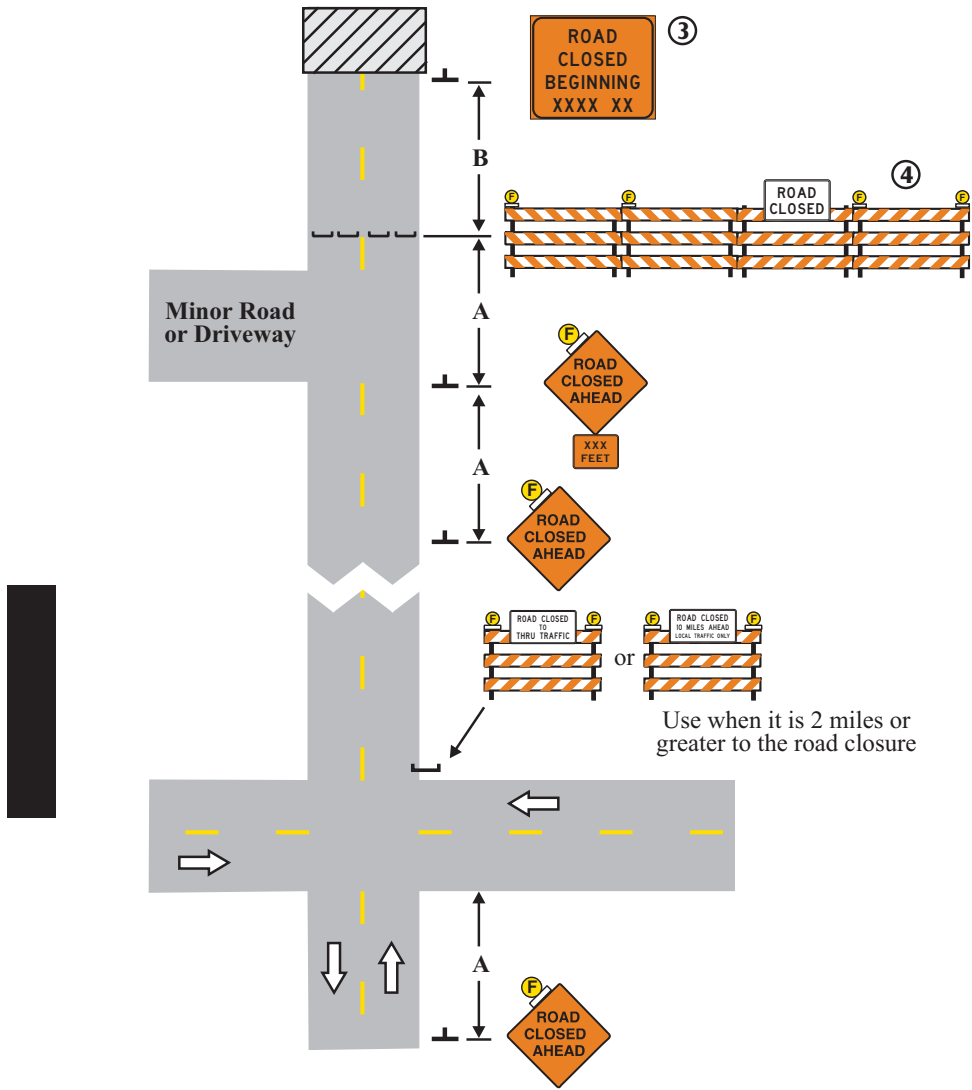
3 DAYS or LESS

6K-79b

LAYOUT 79a & b

NOTES:

1. The Road Authority will determine if a detour is required and specify the detour route.
2. Flashers are not required on signs and on Type III barricades for a daylight only closure.
3. Advance warning signs should be used seven days in advance of the closure.
4. Install at the last driveway or intersection beyond which there is no public access.



ROAD CLOSURE

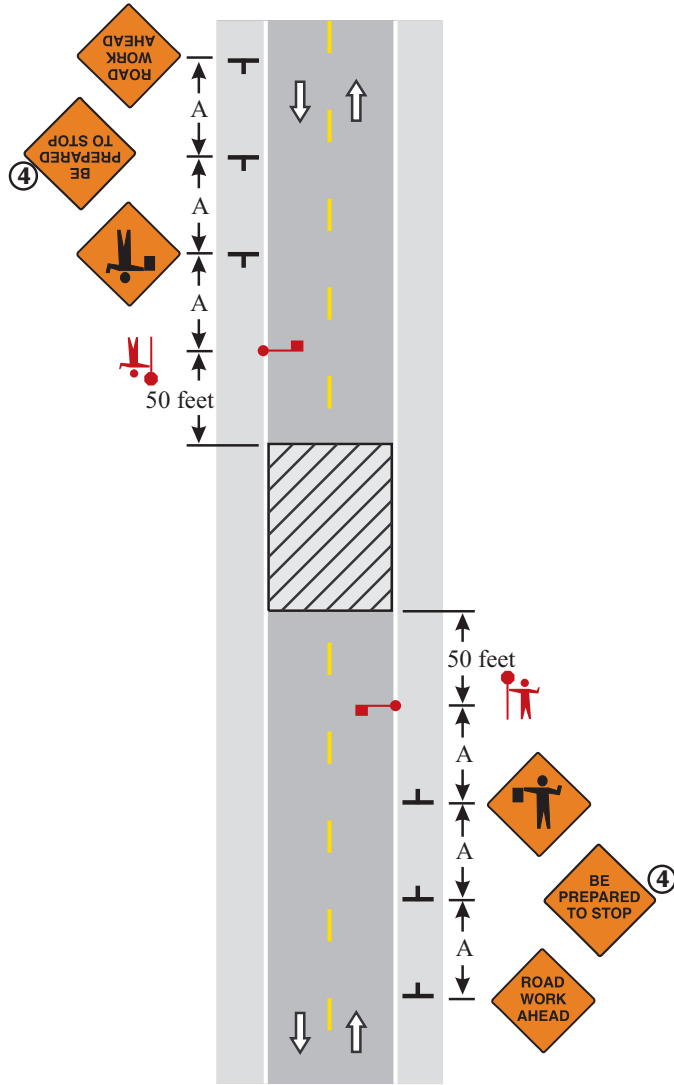
3 DAYS or LESS

6K-80

LAYOUT 80

NOTES:

1. The traffic from both lanes should not be stopped for more than 15 minutes.
2. Conditions represented are for work during daytime hours only.
3. For night closures, the following should be used:
 - a. Law enforcement officers with squad car for flaggers.
 - b. A changeable message sign in each direction.
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**

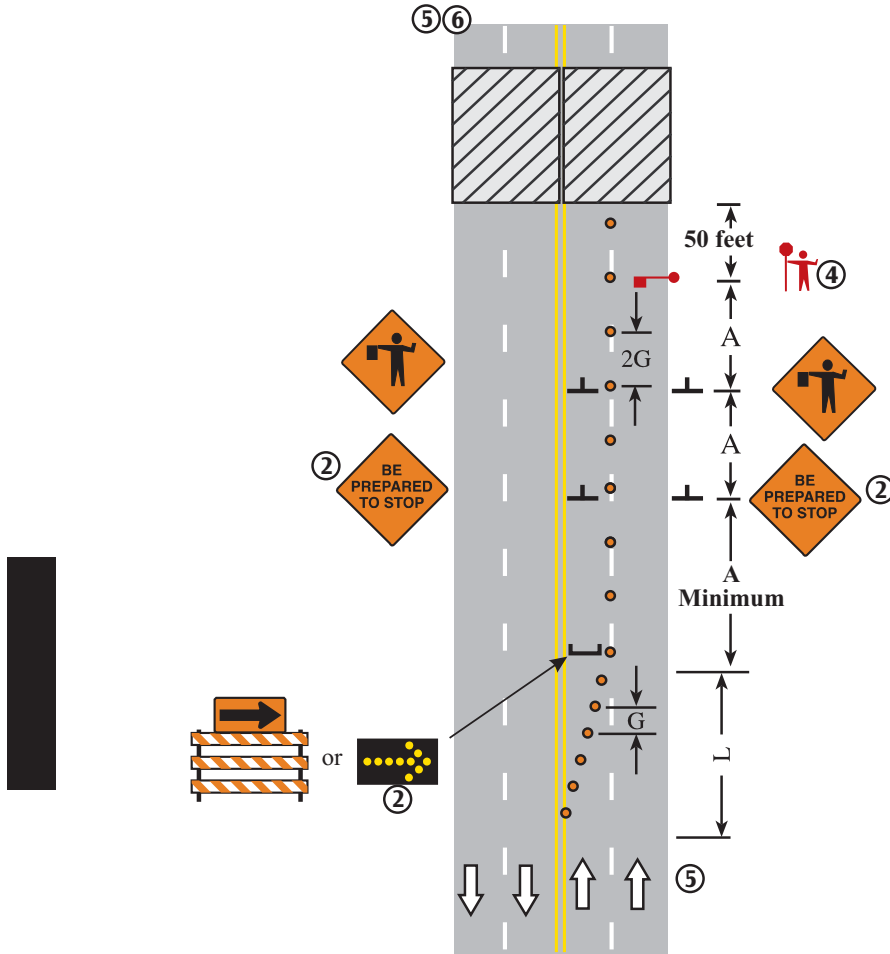
15 MINUTES or LESS

6K-81

LAYOUT 81

NOTES:

1. The traffic from both lanes should not be stopped for more than 15 minutes.
2. The BE PREPARED TO STOP sign and the flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
3. For roads with 3 or more lanes of traffic in one direction, use the appropriate stationary layout.
4. A law enforcement officer with squad car shall be used instead of a flagger during night operations.
5. Advance traffic control devices for a left lane closure shall be as shown in Layouts 34 or 35.
6. The advance warning sign sequence is shown for one way direction only. The other direction shall be identical.



**TEMPORARY ROAD CLOSURE
MULTI-LANE UNDIVIDED ROAD**

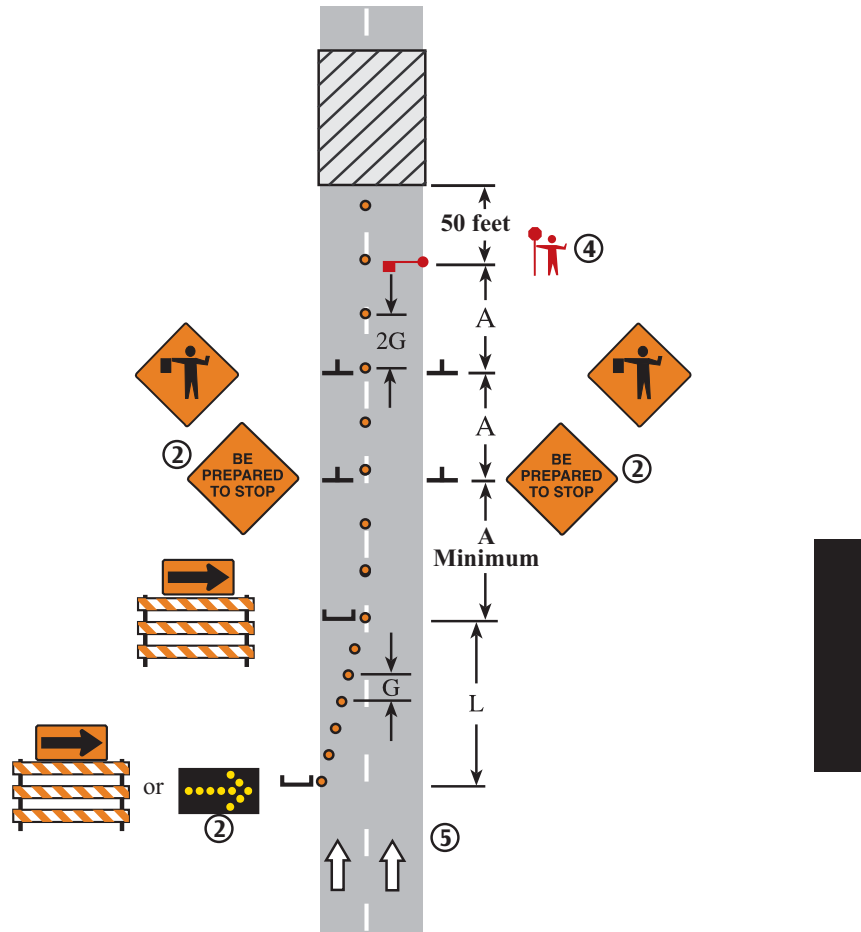
15 MINUTES or LESS

6K-82

LAYOUT 82

NOTES:

1. The traffic from both lanes should not be stopped for more than 15 minutes.
2. The BE PREPARED TO STOP sign and the flashing arrow board shall be used when the posted speed limit is 45 mph or greater.
3. For roads with 3 or more lanes of traffic in one direction, use the appropriate stationary layout.
4. A law enforcement officer with squad car shall be used instead of a flagger during night operations.
5. Advance traffic control devices for a left lane closure shall be as shown in Layout 52.



**TEMPORARY ROAD CLOSURE
MULTI-LANE DIVIDED ROAD**

15 MINUTES or LESS

6K-83

LAYOUT 83

NOTES:

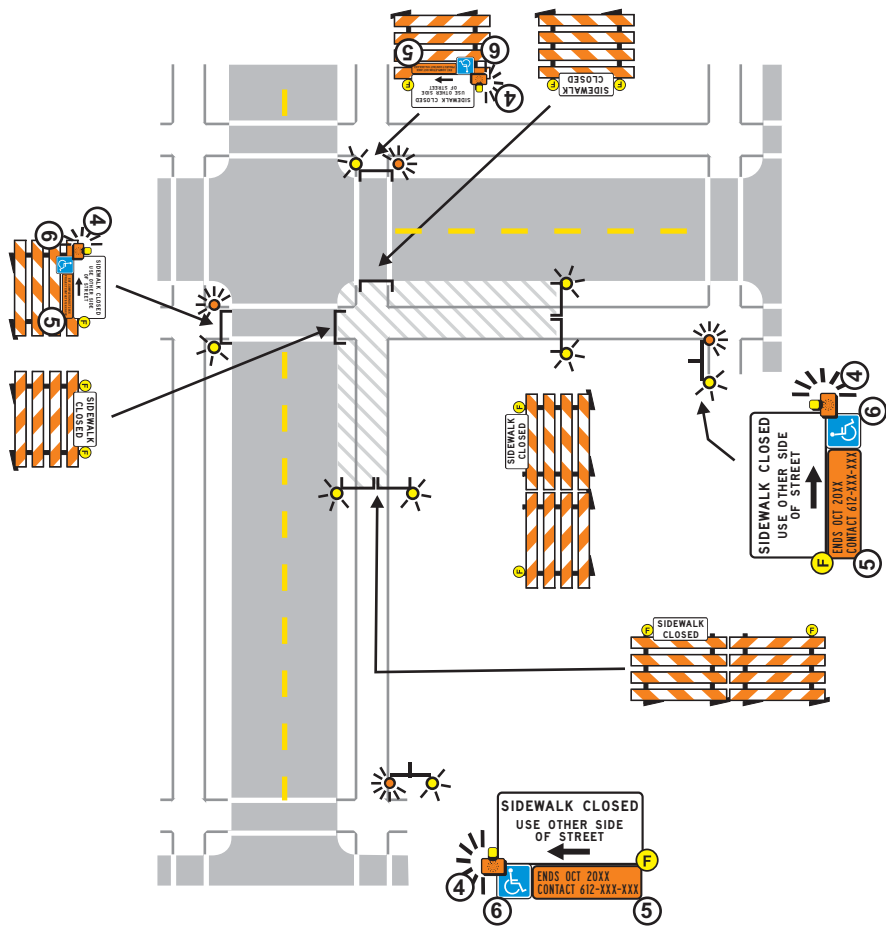
1. When crosswalks, sidewalks or other pedestrian facilities are blocked, closed or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.
2. The examples show only key typical dimensions. Refer to the Mn/DOT "Temporary Pedestrian Access Route" (TPAR) website (<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.
3. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.
4. 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 as listed in note 5 below. 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.
5. Typical sign message for a temporary pedestrian detour should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.
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 persons with disabilities should not use the primary temporary pedestrian detour. The reason for the non-compliance should be posted and an alternate route should be posted when the primary temporary pedestrian detour is non-complaint to TPAR standards.
7. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.
8. Pedestrian traffic signal displays controlling closed crosswalks shall be covered.

**CROSSWALK CLOSURES AND PEDESTRIAN DETOURS
LAYOUT 84a**

3 DAYS or LESS

6K-84a

LAYOUT 84a & b



CROSSWALK CLOSURES AND PEDESTRIAN DETOURS LAYOUT 84b

3 DAYS or LESS

6K-84b

LAYOUT 84a & b

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. The examples show only key typical dimensions. Refer to the Mn/DOT "Temporary Pedestrian Access Route" (TPAR) website (<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.
3. 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.
4. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.
5. When both sides of a temporary pedestrian bypass require channelizing devices, then the devices should be a similar type (railing system, barricade, or fencing system), excluding when TTC barrier (such as concrete barrier) is used to protect pedestrians from an open traffic lane.
6. 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 by-pass including duration, length of (and/or distance to) the bypass, any restrictions or hazards and project information as listed in note 7 below. 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.
7. Typical sign message for a temporary pedestrian bypass should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.
8. 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 persons with disabilities should not enter the temporary pedestrian by-pass. An alternate route should be posted when the temporary pedestrian bypass is non-complaint to TPAR standards.
9. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.
10. When a sidewalk is closed but workers are present who will provide assistance or directions to pedestrians, then the devices as shown are not required.

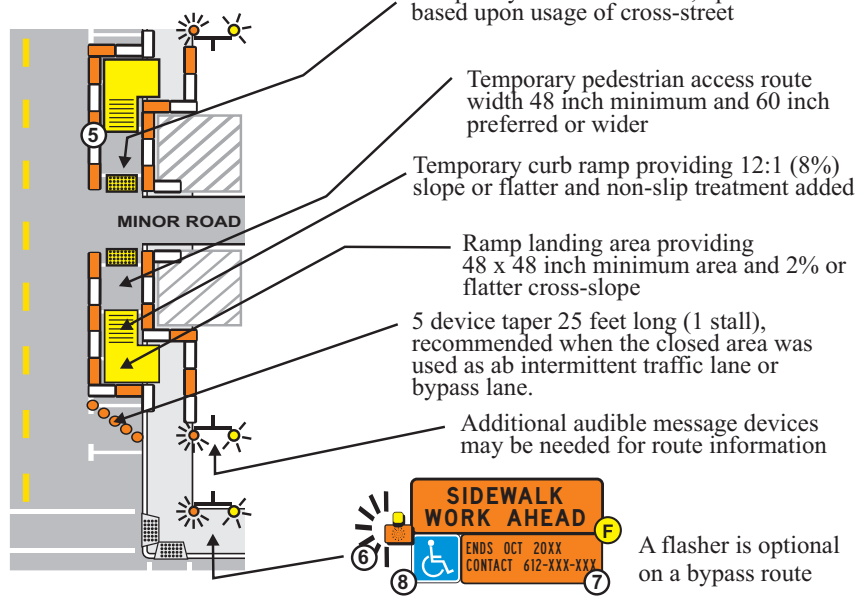
**SIDEWALK BY-PASS
LAYOUT 85a**

3 DAYS or LESS

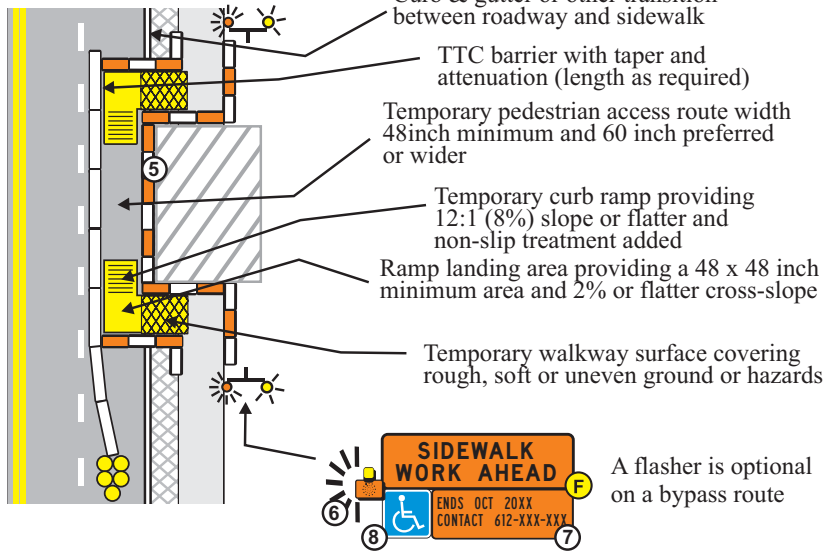
6K-85a

LAYOUT 85a & b

LOW-SPEED ROADWAY



HIGH-SPEED ROADWAY or LOW-SPEED MULTI-LANE



SIDEWALK BY-PASS LAYOUT 85b

3 DAYS or LESS

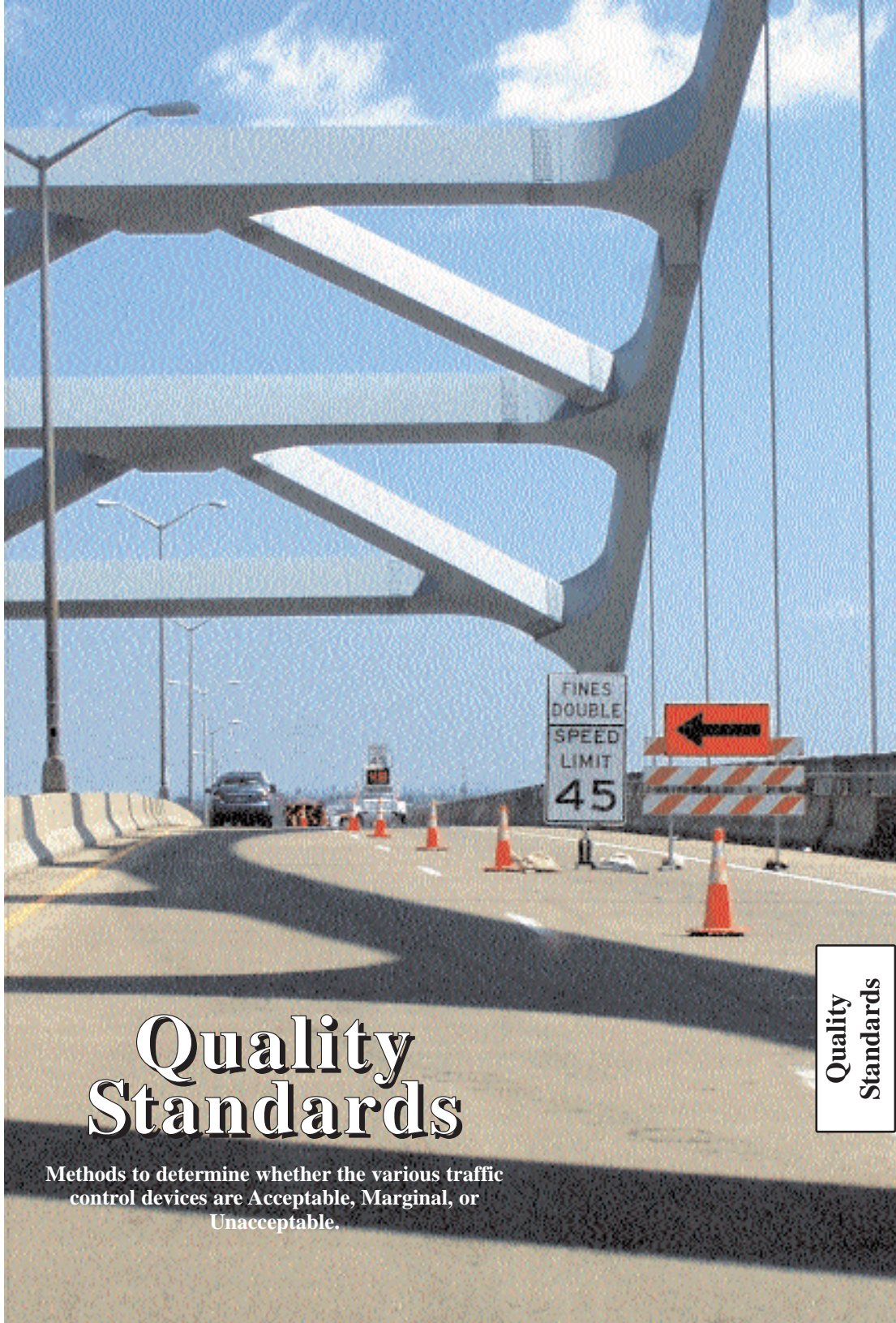
6K-85b

LAYOUT 85a & b

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Quality Standards

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

Quality Standards

Contents

Introduction .....	.6K-87
Crashworthy Criteria .....	.6K-88
Quality Classification & Requirements of Devices .....	.6K-89
Evaluation Guide - Warning Signs .....	.6K-91
Evaluation Guide - Type A and B Channelizers .....	.6K-94
Evaluation Guide - Type I, II or III Barricade Panels or Vertical Panels ..	.6K-96
Evaluation Guide - Warning Lights .....	.6K-97
Evaluation Guide - Arrow Boards .....	.6K-98
Evaluation Guide - Portable Changeable Message Signs .....	.6K-101
Evaluation Guide - Trailer-Mounted Electronic TCDs .....	.6K-102
Evaluation Guide - Temporary Pavement Marking Tape and Paint .....	.6K-103
Evaluation Guide - Temporary Raised Pavement Markers .....	.6K-104



These Layouts as well as the entire Field Manual, the Flagging Handbook and other documents are available on the Mn/DOT, Traffic Engineering website at:

<http://www.dot.state.mn.us/trafficeng/>

INTRODUCTION

Traffic controls are a necessary part of a Temporary Traffic Control 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 temporary traffic control zone 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 occurred during their storage, shipment, installation, relocation, and removal. Whenever a high number 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.

These standards have been developed in an effort to offset the deterioration in the appearance of Temporary Traffic Control Zone 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 jobsite. Doing so will minimize agency involvement and reduce costs related to on-site replacement.

These standards are intended to address the day-to-day operations of traffic control within a Temporary Traffic Control Zone and are not meant to cover the needs of emergency situations.

CRASHWORTHY CRITERIA

FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and Temporary Traffic Control Zone hardware used on the National Highway System meet the crashworthy performance criteria. Additionally, a definition for the word "crashworthy" was included. Crashworthy is now defined as "a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, 'Recommended Procedures for the Safety Performance of Highway Features'."

In the 2009 Federal MUTCD and the current edition of the 2011 MN MUTCD, a specific compliance date of January 17, 2005 was announced. Local road authorities were not adequately prepared for this "crashworthy" compliance.

Minnesota received permission from the FHWA to extend these compliance dates. Mn/DOT then issued Technical Memorandum No. 06-06-T-03, dated January 30, 2006, extending this compliance date to January 17, 2010, for all local roads in the State of Minnesota. Since local road authorities perform many operations on low-speed (0-40 mph) Trunk Highways, Mn/DOT also issued Technical Memorandum No. 06-09-T-04, dated April 1, 2006, to extend the compliance date on low-speed Trunk Highways until January 17, 2010. The compliance date for high-speed Trunk Highways remained at the January 17, 2005 date and "crashworthy" compliance is required with respect to temporary (work zone) signs, barricades and channelizing devices.

The 2011 MN MUTCD reflects these compliance dates.



QUALITY CLASSIFICATIONS AND REQUIREMENTS

The quality of the Temporary Traffic Control Zone devices in this standard has been divided into three classifications: acceptable, marginal, and unacceptable. Acceptable devices meet the all MN MUTCD requirements such as design, size, color, weight, etc., and are properly placed as specified, and clearly perform their intended function. The term "Marginal" for the purpose of this manual means "marginally acceptable", reaching the lower end of acceptability. Devices that fall into the "unacceptable" classification shall not be delivered to the jobsite.

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 Zone.

Intermediate and Long Term Duration

Within each Temporary Traffic Control Zone that is planned to remain in place for more than twelve (12) hours, the following requirements shall be followed:

- 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 panels, 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

Within Temporary Traffic Control Zones that are planned to be in place for less than twelve (12) hours, the following requirements may be followed:

- 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 the 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 touchup of the lettering.
- This message is legible both day and night.
- Signs on portable structures shall be longitudinally perpendicular to the ground and may be placed on a side slope resulting in 3 inches maximum out-of-plumb per foot of height.
- Post mounted signs shall be installed within 3 inches of plumb for the height of the posts.
- The back side is free of any reflective materials except small logos or identification markings and have a bare surface or be painted a uniform color as approved by the local road authority.
- The sign is inplace at the specified spacing and properly aligned to traffic.
- The sign support structure has been installed according to the approved crashworthy requirements.

Examples of "Acceptable" warning signs



6K-91

EVALUATION GUIDE: WARNING SIGNS

Marginal

The sign is considered marginal, if it meets any 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.
- The sign face is free of any residue.
- Some color fading may be evident, but the background color and retroreflectivity are still apparent at night.
- This message is legible both day and night.
- Signs on portable structures are longitudinally perpendicular to the ground and the side slope results in no more than 3 inches out-of-plumb per foot of height.
- Post mounted signs shall be within 3 inches of plumb for the height of the posts.
- All warning signs are in place at the specified spacing and properly aligned to traffic.

Examples of "Marginal" warning signs



6K-92

EVALUATION GUIDE: WARNING SIGNS

Unacceptable

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

- Asphalt splatter, cement slurry, or abrasions that are evident throughout the face of this sign.
- A letter has a loss of more than 50 percent or more of its stroke area or portions of letters are missing such that they become confusing to identify.
- There is noticeable color fading or loss of retroreflectivity is noticeable at night.
- The message is illegible.
- The sign is missing, knocked down or turned such that the message can not be seen.



6K-93

EVALUATION GUIDE: TYPE A & B CHANNELIZING DEVICES

Acceptable

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

- The devices' shape should remain clearly identifiable with no significant distortion and must 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 reflective bands have little or no loss of retroreflectivity, with only minor tears and scratches.
- Any dents do not seriously reduce the retroreflectivity of the sheeting
- 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 reflective bands have numerous tears and scratches; but have no large areas of residue or missing reflective material.
- Any dents do not reduce the strength of the device.
- The device maintains its intended shape.
- No more than one device in a row is missing.



6K-94

**EVALUATION GUIDE:
TYPE A & B CHANNELIZING DEVICES**

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 reflective 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 reflective sheeting.
- Two or more consecutive devices are missing.



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 reflective sheeting.
- The orange is vivid and the stripes provide contrast.
- The barricade is installed in its specified location with adequate ballast, and properly aligned to traffic.
- 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:

- There are numerous surface abrasions through the panel surface.
- Some color fading is evident; however, it has no large areas of residue or missing reflective material.
- The orange is vivid and the stripes provide contrast.
- The barricade is turned at a skew to traffic that reduces its effectiveness.



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 and/or cement slurry, or any combination of missing and covered reflective material would make the panel unacceptable.
- 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.
- The barricade is missing, knocked down, or turned away from traffic.



EVALUATION GUIDE: WARNING LIGHTS

Acceptable

To be acceptable, the 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: ARROW BOARDS

Acceptable conditions for all arrow boards

For an arrow board to be acceptable, it shall meet 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 considered 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), or
- The truck-mounted arrow board is mounted less than 6 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, when 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 considered unacceptable if it meets any of the following conditions:

- Any lamp out in the head,
- More than two (2) lamps out in the stem, or
- The arrow panel not dimming properly.

EVALUATION GUIDE: ARROW BOARDS

CHEVRON MODE



Marginal

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

- Two (2) or more lamps out in any one chevron, or
- The arrow panel is not dimming properly.

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



Marginal

An arrow board in this mode is marginal, when it meets the following condition:

- At least four (4) lamps functioning properly (on the Bar or 4 Corners), or
- 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 Bar or 4 Corners), or less than seven (7) lamps functioning properly in either of the 2 diamond shapes (on the Alternating Diamonds), or
- The arrow panel is not dimming properly.

EVALUATION GUIDE: ARROW BOARDS

DOUBLE ARROW MODE



Marginal

An arrow board in this mode is marginal, when 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, or
- The arrow panel is not dimming properly.



**EVALUATION GUIDE:
PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)**

Acceptable

To be acceptable, a PCMS shall meet the following condition:

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

Marginal

A PCMS is marginal, when 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 considered unacceptable if it meets any of the following conditions:

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

Unacceptable for Trailer-Mounted PCMS

A trailer-mounted PCMS is considered unacceptable if it meets any of the following conditions:

- The sign panel more than 3 inches out of plumb, or
- 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 to be acceptable, it shall meet all 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 when it meets the following conditions:

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

Unacceptable for all PCMSs

An electronic traffic control device is considered 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), or
- The bottom of any overhead signal head is lower than 17 feet or higher than 19 feet above the roadway surface.

**EVALUATION GUIDE:
TEMPORARY PAVEMENT MARKING TAPE & PAINT**

Acceptable

Pavement marking tape or paint is acceptable, shall meet the following condition:

- All pavement marking tape or paint (solid lines and skip lines) shall be in place and meet all material specifications.

Marginal

Pavement marking tape or paint is marginal, when it meets any of the following conditions:

- Less than ten percent (10%) of all tape, paint, message, or symbol is missing.
- Less than two (2) consecutive skip lines is missing.
- Less than a fifty (50) foot section of solid line is missing.

Unacceptable

Pavement marking tape or paint is considered unacceptable if it meets any of the following conditions:

- More than ten percent (10%) of all tape, paint, message, or symbol is missing.
- More than two (2) consecutive skip lines is missing.
- More than a fifty (50) foot section of solid line is missing.



**EVALUATION GUIDE:
TEMPORARY RAISED PAVEMENT MARKERS (TRPM)**

Acceptable

TRPMs are acceptable, when it meets the following condition:

- All temporary raised pavement markers required are in place and meet all material specifications.

Marginal

TRPMs are is marginal, when it meets any of the following conditions:

- Less than ten percent (10%) of all TRPMs are missing.
- Less than three (3) consecutive temporary raised pavement markers are missing.

Unacceptable

TRPMs are considered unacceptable if it meets any of the following conditions:

- More than ten percent (10%) of all TRPMs are missing.
- More than three consecutive temporary raised pavement markers are missing.



MINNESOTA FLAGGING HANDBOOK



February, 2011

Flagging
Handbook

This Flagger 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 Mn/DOT, Traffic Engineering website at:

<http://www.dot.state.mn.us/trafficeng>

6K-106

INTRODUCTION

To You, the Flagger:

REMEMBER - *Your job is the most important one on the crew. The lives of all individuals in the work space depend on YOU!*

The following information is designed to give you some 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** turn your back on or stand in the path of moving traffic.*

EQUIPMENT

Clothing

Flaggers shall wear high-visibility apparel labeled as meeting ANSI 107-104 standard performance for Class 2 or 3 risk exposure.

- Vest, shirt, or jacket and pants (when required) shall be orange, yellow, strong yellow-green or a fluorescent version of these colors.
- At night and in low visibility situations, the vest, shirt or jacket and pants shall be retroreflective.
- Pants shall be worn at night and in low visibility situations.
- A hat in the above colors is also recommended.
- Neat appearance

Retroreflective clothing

Retroreflective clothing shall:

- Be visible at a minimum distance of 1000 feet.
- Identify the wearer as a person through the full range of body motions.

Tools

- Standard STOP/SLOW paddle shall be used unless it is not available in an emergency situation
 - 18" x 18" minimum octagon with letters at least 6 inches high
 - 5 foot minimum staff (to the bottom of the sign) 7 foot is recommended
 - Fully reflectorized in standard colors
- If flagging at night, use illuminated flagger station and flashlight with wand
- Two-way radios for multiple flagger situations.

FLAGGING POSITION

- Be alert, remain standing at all times
- **Face oncoming traffic - NEVER turn your back to oncoming traffic** or stand in the path of moving traffic. See Figure 1.
- **A flagger's normal station is on the shoulder of the road.**
- Park your vehicle off the road, away from your station.
- Stand alone, do not mingle with the work crew or the public.
- Make sure you are visible to oncoming traffic, not standing where the sun is impeding visibility or in a shadow.
- Stand in a location that allows approaching traffic adequate time to respond. Use the Decision Sight Distance in the following chart to determine a good visibility location. The driver must be able to recognize you as a flagger for



Decision Sight Distance

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

at least the Decision Sight Distance.

FLAGGING SITUATIONS

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

When the 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 a point where the driver detects the flagger shall not exceed one mile.

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

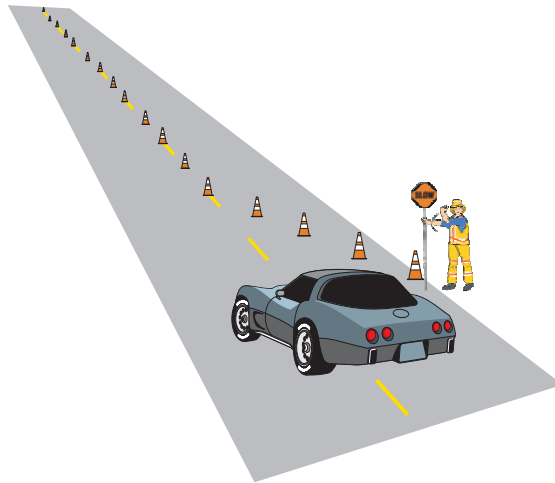
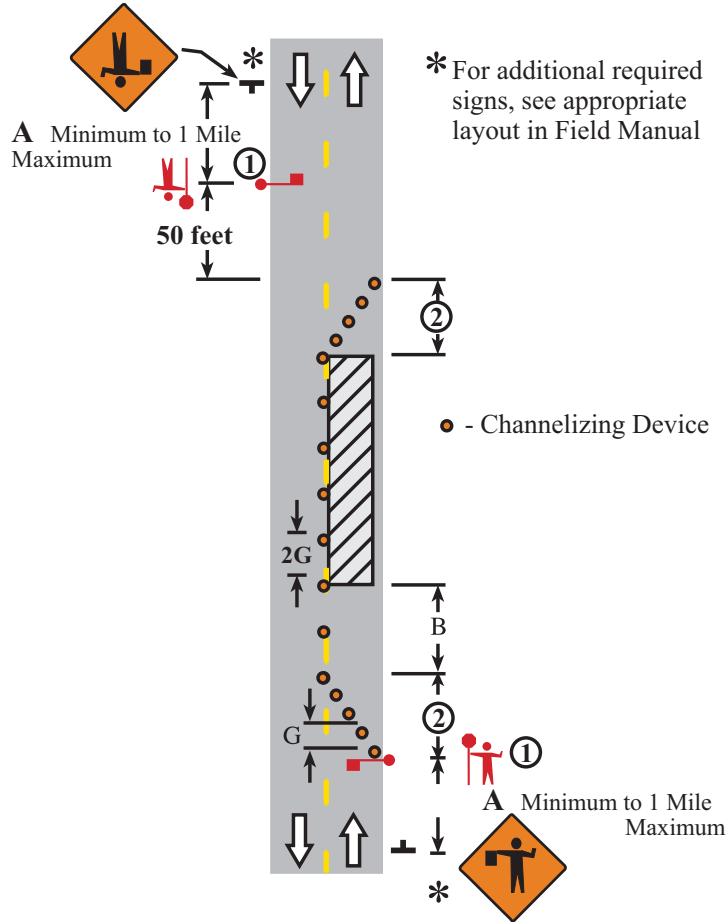


Figure 1
Preferred Flagging Position

6K-108

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	250	25	85	550
35 - 40	325	25	170	700
45 - 50	600	50	280	900
55	750	50	335	1200
60 - 65	1000	50	485	1400
70 - 75	1200	50	670	1600



NOTES:

1. The approach sight distance to the flagger shall be at least the Decision Sight Distance.
2. The two-way taper should be 50 feet using 5 equally spaced channelizing devices.

Figure 2
 Flagger Location for a Lane Closure

6K-109



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

Single Flagger

There are two different applications of the single flagger situation.

1. 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 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. A single flagger may also be used to stop traffic in a lane while that lane is closed. An example would be a truck depositing material off the edge of the roadway. In this situation, the flagger would stop the traffic in this lane while the other lane flows free. When the lane is open again, the flagger allows the traffic to proceed in their normal lane. 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.

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 radios designated for proper communication. One flagger should be the lead flagger and coordinate all activities.



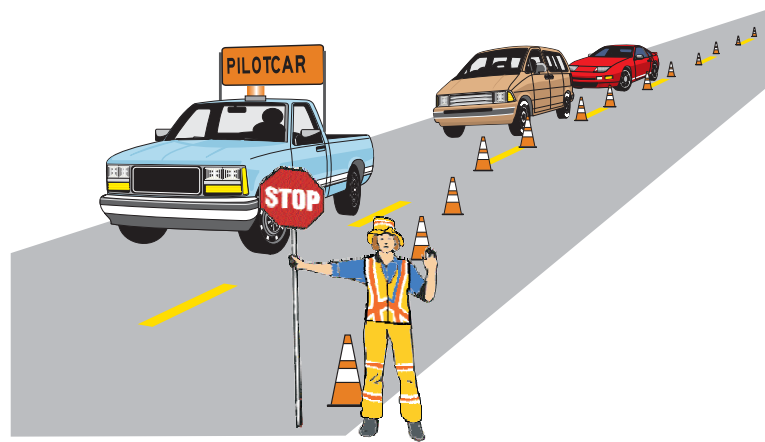
Figure 3
Two Flagger Operation

6K-110

When two flaggers are used and two-way radios are unavailable, the flag transfer method may be used. The driver of the last vehicle proceeding into the one lane section is given a flag (or other token object) and instructed 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 flaggers may also be used in conjunction with a pilot car. In this situation, the flagger stops the traffic until the pilot car arrives and has pulled into position to lead the traffic through or around the activity area. The flagger then releases traffic to follow the pilot. When a large gap in traffic or a pre-determined length of time occurs, as instructed by the supervisor, traffic is stopped. During pilot car operations, traffic should follow the pilot car and remain in a tight group to prevent traffic from separating along the route. To help keep the traffic group tight, flaggers should not allow additional cars to follow the group if last car in the group has proceeded more than 300 feet from the flagging location. The flagger shall then stop and hold all traffic until the pilot car has returned for the next trip.



*Figure 4
Use of a Pilot Vehicle*

Advance Flagger

An advance flagger may be used 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.



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 the arm extended horizontally away from the body. The free arm should be raised with the palm 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.

AUTOMATED FLAGGING DEVICES

Automated Flagging 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. These devices are capable of stopping traffic and allowing traffic to proceed slowly without the need for a flagger in the immediate vicinity of the sign or on the roadway. They can be remotely operated by a one operator at a central location or by separate operators near each device location. A single operator may only be used on roadways with unobstructed sight lines, less than 1500 ADT, and less than 1000 feet between the devices.

NIGHTTIME FLAGGING

Flagger stations shall be well illuminated except in emergency situations. The flagger shall wear retroreflective pants and vest, shirt or jacket. Reflective channelizing devices shall be used.

EMERGENCY SITUATIONS

In emergency situations a minimum size 24" x 24" 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.

The Use of Hand Signalling Devices by a Flagger

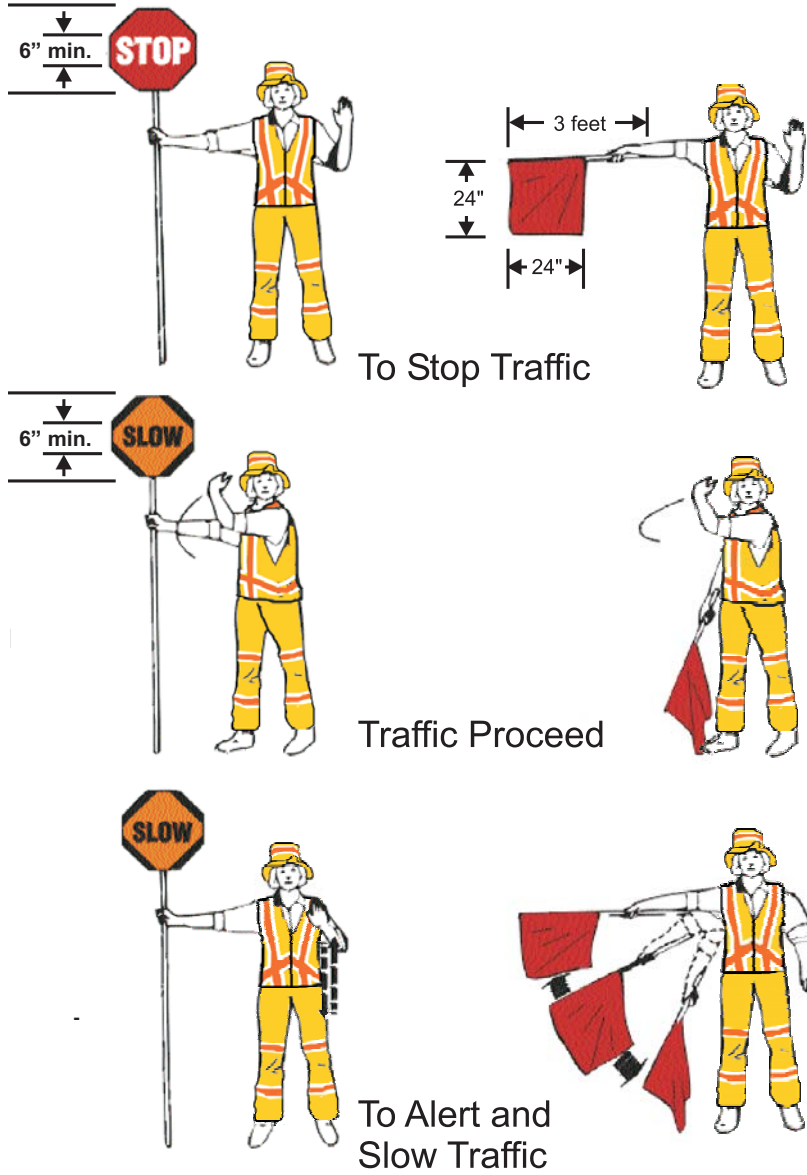


Figure 5
Preferred Flagging Method
Using a Paddle.

Figure 6
Emergency Flagging Method
Using a Flag.



FLAGGING AT INTERSECTIONS

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

When flagging in an intersection, consider the following:

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

PROPER CONDUCT

- Do not abandon your post for any reason until the work is finished or a replacement flagger arrives.
- Do not engage in extended conversations with motorists or lean on vehicles. Be polite, but brief.
- Do not argue with a motorist. Be courteous.
- If a driver refuses to obey instructions, record a description of the car, driver, license plate and the circumstances. Report this information to your supervisor as soon as possible.
- Remove or cover all signs indicating the presence of a flagger, when a flagger is not actually flagging. This includes lunch and breaks.
- Be alert for emergency vehicles. They have "priority rights". Allow them to pass as quickly as possible.

NOTES TO THE SUPERVISOR

- All flaggers should be properly instructed prior to the start of work. Training should be based on the requirements of individual road authorities.
- The importance of the job should be impressed upon the flagger. They are responsible for all workers safety.
- Arrange for the flagger to have rest breaks.
- Drive through the temporary traffic control zone after all signs, devices and the flagger are in place. Check the visibility of the signs, flagger and the activity area.
- Remove or cover all signs indicating the presence of a flagger, when a flagger is not actually flagging.

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

CHECKLIST FOR FLAGGER TRAINING

Contractor: _____

Name of Mn/DOT Qualified Trainer: _____

Qualification #: _____

- Remember your job is the most important one on the crew. The lives of all individuals in the work space depend on YOU!
- For your personal safety as a flagger **NEVER** turn your back on or stand in the path of moving traffic.
- Clothing
 - Any flagger on a Mn/DOT project shall be attired with high visibility, retro-reflective vests, pants and cap that are in accordance with current high visibility apparel contracts approved by Mn/DOT's safety director.
- Tools
 - Standard STOP/SLOW paddle (in good condition) shall be used unless it is not available in an emergency situation
 - 18" x 18" minimum octagon with letters at least 6 inches high
 - 5 foot minimum staff (to bottom of the sign) 7 foot is recommended
 - Fully retroreflective in standard colors
 - Illuminated flagger station and flashlights with wand if flagging at night
 - Two-way radios for multiple flagger situations
 - Warning signs posted in proper position ahead of the flagger

Continued on next page.

6K-115



- Flagging position on the road way:
 - Be alert, remain **STANDING** at all times
 - Face oncoming traffic **NEVER** turn your back to oncoming traffic or stand in the path of moving traffic
 - A flagger's normal station is on the shoulder of the road
 - Park your vehicle off the road, away from your station. A flagger is difficult to see when next to a vehicle. Never sit in or on your vehicle while flagging.
 - Know proper hand and flag signals as shown in the Minnesota Flagger Handbook.
 - Stand alone, do not mingle with the work crew or motorists.
 - Make sure you are visible to approaching traffic, not standing where the sun is obstructing visibility or in a shadow.
 - Review the decision sight distance chart in the Minnesota Flagger Handbook. The driver should be able to recognize you as a flagger for at least the decision sight distance. Avoid blind spots past curves in the roadway or just over hills.
 - **Emergency vehicles** have “priority rights”. Allow them to pass as quickly and safely as possible.

Flagger Signature _____

Date _____

**Mn/DOT District & Central Office and Gopher State One-Call
Office Phone Numbers**

District 1A - Duluth	Minnesota Dept. of Transportation 1123 Mesaba Avenue Duluth, MN 55811 218-725-2700
District 1B - Virginia	Minnesota Dept. of Transportation 101 N. Hoover Road Virginia, MN 55792 218-749-7709
District 2 - Bemidji	Minnesota Dept. of Transportation 3920 Highway 2 West Bemidji, MN 56601 218-755-6500
District 2 - Crookston	Minnesota Dept. of Transportation 1320 Sunflower Street Crookston, MN 56716 218-277-7950
District 3A - Brainerd	Minnesota Dept. of Transportation 7694 Industrial Park Road Baxter, MN 56425 218-828-5700
District 3B - St. Cloud	Minnesota Dept. of Transportation 3725 12th Street North St. Cloud, MN 56303 320-223-6500
District 4 - Detroit Lakes	Minnesota Dept. of Transportation 100 West Highway 10 Detroit Lakes, MN 56501 218-846-3600
District 4 - Morris	Minnesota Dept. of Transportation 610 Highway 9 South Morris, MN 56267 320-208-7000
District 6A - Rochester	Minnesota Dept. of Transportation 2900 48th Street NW Rochester, MN 55901-5848 507-286-7500
District 6B - Owatonna	Minnesota Dept. of Transportation 1010 21st Avenue NW Owatonna, MN 55060-1005 507-446-5500

**Mn/DOT District & Central Office and Gopher State One-Call
Office Phone Numbers**

District 7 - Mankato	Minnesota Dept. of Transportation 2151 Bassett Drive Mankato, MN 56001-6888 507-304-6100
District 7 - Windom	Minnesota Dept. of Transportation 180 County Road 26 Windom, MN 56101 507-831-8000
District 8 Hdqrs. - Willmar	Minnesota Dept. of Transportation 2505 Transportation Road Willmar, MN 56201 320-231-5195
District 8 - Marshall Regional Office	Minnesota Dept. of Transportation 1800 East College Drive Marshall, MN 56258 507-537-6146
District 8 - Hutchinson Regional Office	Minnesota Dept. of Transportation 1400 Adams Street SE Hutchinson, MN 55350 320-234-8480
Metropolitan District	Minnesota Dept. of Transportation 1500 West County Road B2 Roseville, MN 55113 651-582-1000
Central Office Office of Traffic, Security and Technology	Minnesota Dept. of Transportation Mail Stop 725 1500 West County Road B2 Roseville, MN 55113 651-234-7000
To order more manuals	Minnesota Dept. of Transportation Mail Stop 260, Manual Sales 395 John Ireland Boulevard St. Paul, MN 55155-1899 651-366-3017
Gopher State One-Call Twin City Area Greater Minnesota	612-454-0002 800-252-1166

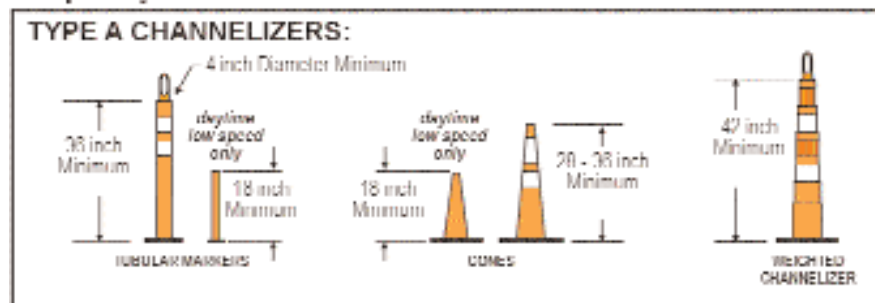
NOTES

Temporary Traffic Control Distance Charts

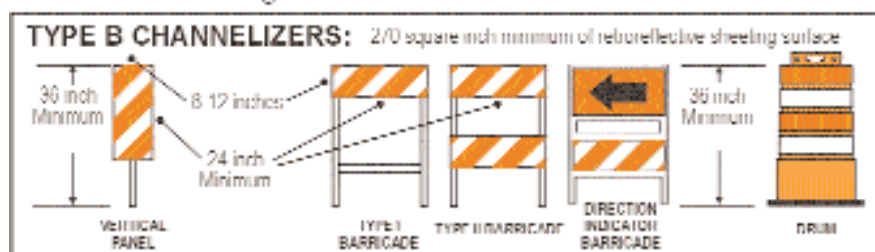
Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (12 ft lane) (L) feet	Shifting Taper (1/2) feet	Typical Shoulder Taper (1/3) feet	
0 - 30	G = 25 ft	250	550	200	100	75	
35 - 40		325	700	325	175	125	
45 - 50	G = 50 ft	600	900	600	300	200	
55		750	1200	700	350	250	
60 - 65		1000	1400	800	400	275	
70 - 75		1700	1600	900	450	300	

Posted Speed Limit Prior to Work Starting (mph)		Buffer Space (B) feet	Shadow Vehicle Following Distance (F) feet	Protection Vehicle Roll Ahead Buffer Distance (with or without TMA) (R) feet	
				Moving (15 mph max)	Stopped
0 - 30	G = 25 ft	85	250 - 550	100	100
35 - 40		170	325 - 700	100	100
45 - 50	G = 50 ft	280	600 - 900	175	175
55		335	750 - 1200	175	125
60 - 65		485	1000 - 1400	225	175
70 - 75		670	1200 - 1600	275	175

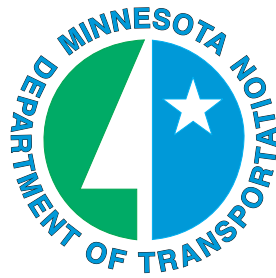
Type A channelizing devices are typically used in attended temporary traffic control zones.*



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 over night.*



* See the MN MUTCD, Part 6F for more details on application restrictions.



Minnesota Department of Transportation
Minnesota Manual on Uniform
Traffic Control Devices

