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Introduction

The purpose of this manual is to present guidelines for work zone traffic control to enhance safety and to help reduce accidents involving motorists, pedestrians and workers. This manual places particular emphasis on reducing traffic congestion and confusion by providing uniform applications of standard traffic control devices. The provisions established herein are applicable to all persons and work agencies performing work or investigations in or affecting a public right-of-way.

Part VI of the ***Manual of Uniform traffic Control Devices*** (MUTCD) is the national standard for all traffic control requirements. This Traffic Control Manual supplements Part VI.

Planning the Layout

The key to good traffic control is planning the layout using proper judgment. Consider factors such as duration of work, location of work, and characteristics of the roadway. Also consider pedestrian traffic control, local business access, parking and other fundamental requirements affecting the work zone.

Duration of Work

Work duration is a major factor in determining the number and types of devices used in temporary traffic control zones. As a general rule, the longer the operation will last, the more traffic control devices are needed.

Long-Term Stationary – Work that occupies a location more than 3 days.

Intermediate-Term Stationary – Work that occupies a location from overnight to 3 days.

Short-Term Stationary – Daytime work that occupies

a location for 1 to 12 hours.

Short Duration – Work that occupies a location up to 1 hour.

Mobile – Work that moves intermittently (stops up to 15 minutes) or continuously.

Location of Work

The choice of traffic control needed for a temporary traffic control zone depends upon where the work is located. As a general rule, the closer the work is to traffic, the more control devices are needed.

Roadway Characteristics

The traffic control layout must take into account the traffic volumes, speed, roadway alignment and the presence of intersections, pedestrians, and bicycles. Generally, more traffic control is required when speeds or volumes are high, when visibility is poor, and when there are conflicts due to intersections, pedestrians, and bicycles.

Low Volume – Some diagrams in this publication are appropriate only for low volume roads. As a general rule, a low volume road can be considered one on which the average daily traffic volume (ADT) does not exceed 500 vehicles per day. If the traffic volumes are not known, the following rule of thumb can be used to determine if the road can be treated as low volume for the purposes of installing work zone traffic control.

Rule of Thumb – Count the number of vehicles that pass a single reference point over a five (5) minute period. If not more than 3 vehicles pass the reference point in that period, then the road can be considered low volume for the purpose of installing work zone traffic control.

In addition, special attention should be given to local nearby facilities, such as schools, manufacturing plants, etc., that cause special traffic generation. Consideration should also be given as to whether the work zone location is subject to peak hour traffic increases. Peak hours are usually 7-9 a.m. and 4-6 p.m., and will vary in different areas.

Vehicular Traffic Control

On weekdays, from 7-9 a.m. and 4-6 p.m. avoid traffic lane closures at signalized intersections, on major traffic carrying streets or in the downtown area. Show how to handle signalized intersections.

A smooth, dust free, 12 feet wide traffic lane is considered desirable, however no lane less than 10 feet wide will be permitted.

Where external illumination is provided, the light source should be properly shielded to protect driver's eyes from glare.

When a rail grade crossing exists within or upstream of a transition area and it is anticipated that backups resulting from the lane closure might extend through the crossing, extend the traffic control channelizing devices so that the transition area precedes the grade crossing.

Pedestrian Traffic Control

Provide a safe convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks or footpaths.

Do not lead pedestrians into direct conflicts with work site vehicles, equipment or operations, or into direct conflict with mainline traffic moving by the work zone.

Provide minimum grade and safety standards outlined in the Americans with Disabilities Act (ADA).

Downtown

Minimize traffic disruption during peak traffic hours on weekdays, and during special events such as parades, art festivals, sidewalk sales, major conventions, conferences, races, etc.

Schedule work so traffic disruptions do not conflict with seasonal peak shopping and traffic flow periods or during a time of year when lengthy periods of inclement weather may occur and extend the period of traffic disruption caused by the work.

Schedule work such that it can be started and completed outside the period of Thanksgiving through New Year's Day.

Permits

A permit may be required for a railroad or light rail crossing. Coordinate with the appropriate rail transportation agency as necessary.

All requests to restrict right-of-way must be directed through the agency owning the right-of-way.

A permit may be required for partial or complete closure of

any public right-of-way, street, sidewalk or alley. At least 5 days advance notice and a traffic control plan will be required.

Notification

Coordinate with railroad company when work is near railroad crossing.

Inform fire, police and emergency services of impassable areas due to construction and maintenance work.

Local Business

Use signs to show how motorists may reach businesses located in or near the work site.

Coordinate sign wording and sign placement location with business owners or other affected entities prior to installation.

Make signs readable from moving vehicles.

Public Transit

Minimize disruption in and around transit stops.

Coordinate with the transit company when work impacts transit service at existing transit stops. Notify company 48 hours prior to contemplated closure of transit stops.

When restricting turns provide bus exemption signs wherever possible.

Assist transit users where necessary.

Public Access

Provide local access to all properties affected in the work zone.

Notify occupants of adjacent properties at least 48 hours in advance of change or loss of access and the anticipated duration.

Meet ADA (Americans with Disabilities Act) standards when constructing temporary ramps over curb, gutter, sidewalks and other construction.

Do not restrict access to utility meters and valves or fire hydrants.

Signalized Intersection

Provide off-duty police officer to direct traffic when manual control is needed in the intersection or within 100 feet of a signal head.

Parking

Keep emergency vehicular access free and clear to and through parking areas.

Post NO PARKING signs at least 24 hours prior to need. Space the signs no more than 50 feet apart.

Haul Routes

Identify the public thoroughfares that will be used as haul routes and site access and obtain approval of local jurisdiction as needed.

Provide traffic control at critical areas of haul routes to safely expedite traffic flow and minimize interference of normal public traffic.

Keep haul routes clean of dirt, debris, or other foreign matter.

Restore haul routes to the conditions that existed prior to the start of construction.

Elements of a Good Traffic Control Program

Minimize Liability

Have a current traffic control plan.

Apply the concepts of the MUTCD (Manual on Uniform Traffic Control Devices).

Minimize traffic disruptions.

Train all personnel.

Inspect work zone sites regularly for conformance or changing conditions.

Maintain good documentation.

Minimum Documentation

Who was on the site and when?

Where was the work taking place?

When were traffic control devices inspected, by whom?

Record any irregularities, action taken and follow up inspection.

Additional information should be gathered in the event of a crash.

Traffic Control Technician

Ask yourself, "What is the driver's view of the work site at night, during peak hours, etc?" "What is the Pedestrian's view?" "Disabled or blind man's view?"

Update the traffic control plan before being asked to.

Coordinate traffic control with emergency services, transportation services and local law enforcement.

Remain available to correct work zone signing upon need or notification.

Clean devices at least weekly and replace devices missing any part of the message or background.

Routinely schedule inspections.

- before beginning work shift;
- at mid-shift;
- half an hour after the end of the shift;
- once during the night

Flagger

Equipped with a 2ft "Stop/Slow" sign (page 23) and a 1.5 to 2ft long red lighted wand for night flagging.

Clothed per OSHA.

Traffic Control Devices

All traffic control devices shall be crash worthy. The following types of traffic control devices are used in work zone traffic control:

- Signs
- Channelizing Devices
- Warning Lights
- Pavement Markings
- Arrow Displays

Signs

Signs used in work zone traffic control are classified as regulatory, guide, or warning. Regulatory signs impose legal restrictions and may not be used without permission from the authority with jurisdiction over the roadway. Guide signs show destinations, directions, and distances. Warning signs give notice of conditions along the roadway.

The following signs are commonly used as regulatory, guide and warning signs. See Part VI of the MUTCD for additional signs.

Commonly Used Regulatory Signs



R1-1
30"x 30"



R1-2
36"x 36"x 36"



R5-1
30"x 30"



R3-1(2)
24"x 24"



R7-1
12"x 18"



R2-1
24"x 30"



R3-7R(L)
30"x 30"



R3-5R(L)
30"x 36"



R4-7aR(L)
24"x 30"



R4-7bR(L)
24"x 30"



R6-2aR(L)
18"x 24"



R6-1L(R)
36"x 12"

Notes

1. They impose legal obligations or restrictions on traffic. These signs are enforceable by a public policing agency. Use special care to insure proper use, maintenance and removal of all regulatory signs. Cover or remove conflicting existing regulatory signs.
2. They are typically rectangular in shape with black lettering on a white background with the exception of STOP, YIELD, DO NOT ENTER, and WRONG WAY signs.

Commonly Used Guide Signs



R11-3
60"x 30"



R11-3a
60"x 30"



R11-4 60"x 30"
W/ two M4-10L, R &
GUIDE SIGN 96"x 8"



R11-2
48"x 30"



R11-10
30"x 24"



M4-9R(L)
30"x 24"



M4-9a
30"x 24"



M4-10L(R)
48"x 18"



W1-7
48"x 24"



W1-6R(L)
48"x 24"



R11-7
30"x 24"



R11-8L(R)
30"x 36"



R11-9L(R)
30"x 12"



R11-5
30"x 12"

Notes

1. They are used to direct motorists on detour routes and provide information in advance of street closures. Signs are generally rectangular with black legend on an orange background.

Commonly Used Warning Signs



W20-1
36"x 36"
48"x 48"



W20-2
36"x 36"
48"x 48"



W20-3
36"x 36"
48"x 48"



W20-4
36"x 36"
48"x 48"



W20-5R(L)
36"x 36"
48"x 48"



W20-6
36"x 36"
48"x 48"



W20-7a
36"x 36"
48"x 48"



W21-7
36"x 36"
48"x 48"

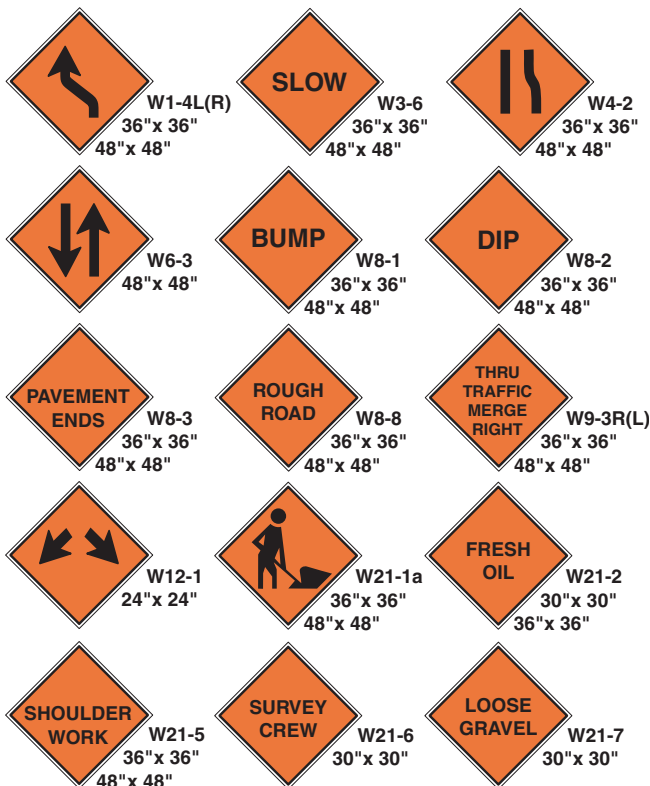


W13-1
18"x 18"



G20-2
36"x 18"

Commonly Used Warning Signs (Continued)



Notes

1. They are used to notify motorists of specific hazards or restrictions in construction and maintenance zones. Within construction zones there may be a variety of temporary roadway conditions. Motorists must be properly alerted to hazards or restrictions in advance so that they will have adequate time to react safely.
2. Signs are generally diamond shaped with black legend or symbol on an orange background.
3. 48" x 48" Advance Warning Signs shall be used on all major streets and streets with greater than 35 MPH speed limit.

Warning Signs – Construction, maintenance and utility warning signs are used extensively in street and highway work zones. As a general rule, these signs are located on the right-hand side of the street or highway. Normally, the first advance warning sign used is the ROAD WORK AHEAD sign. The UTILITY WORK AHEAD or WORKERS sign may be substituted where appropriate. Where signs are used to indicate the end of the work zone, the END ROAD WORK or END UTILITY WORK sign may be used as appropriate.

Size – The standard size for advance warning signs in work zones is generally 48 inches by 48 inches. Where speeds and volumes are moderately low, a minimum size of 36 inches by 36 inches may be used (see Part VI of the MUTCD for specific sign sizes). Sign sizes in contract plans or other agency documents may exceed MUTCD minimum requirements and shall be followed.

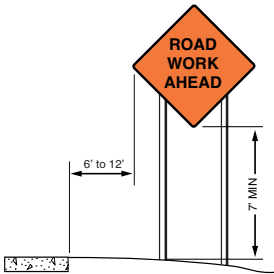
Mounting – Standards for height and lateral clearance of roadside signs are included in Part VI of the MUTCD. Temporary post-mounted signs should be mounted at a height of at least 7 feet, measured from the bottom of the sign. Signs mounted on Type III barricades that close any part of a road or lane should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails. Signs mounted on other portable supports or barricades used solely as a sign support may be at lower heights, but the bottom of the sign shall be not less than one foot above the traveled way.

Illumination and Retroreflectorization – All signs used during the hours of darkness shall be made of retroreflective material or illuminated. (Street or highway lighting is not regarded as meeting the requirements for sign illumination.)

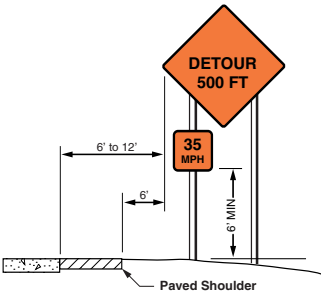
Portable Changeable Message Signs – Portable Changeable Message Signs may be used to supplement other signs, but not to substitute for any required signs. They may display a variety of messages and displays, but are typically only used to display “real-time” or changing condition information. The Changeable Message Sign should not display more than three messages or displays, and the entire message should be readable twice at the usual roadway speed limit.

Removal – When work is suspended for short periods, all signs that are no longer appropriate shall be removed, covered, turned, or laid flat so they are not visible to drivers.

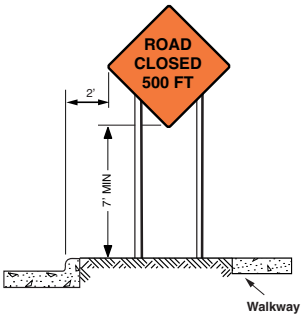
Warning Signs on Posts



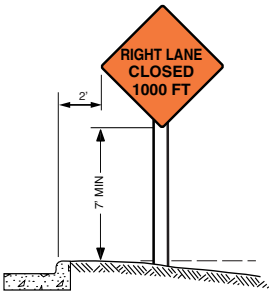
RURAL DISTRICT



RURAL DISTRICT WITH
ADVISORY SPEED PLATE

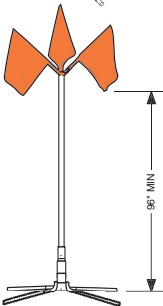
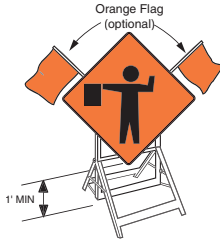
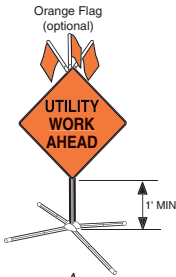


URBAN DISTRICT

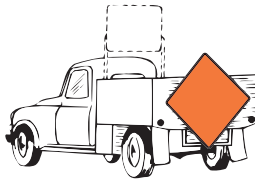


URBAN DISTRICT

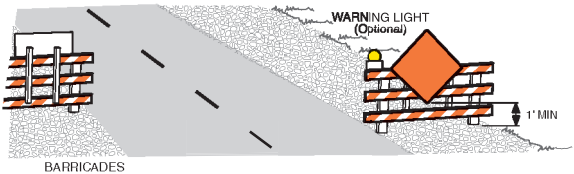
Warning Signs Not on Posts



HIGH LEVEL WARNING DEVICE
(Flag Tree)



PORTABLE AND TEMPORARY MOUNTINGS

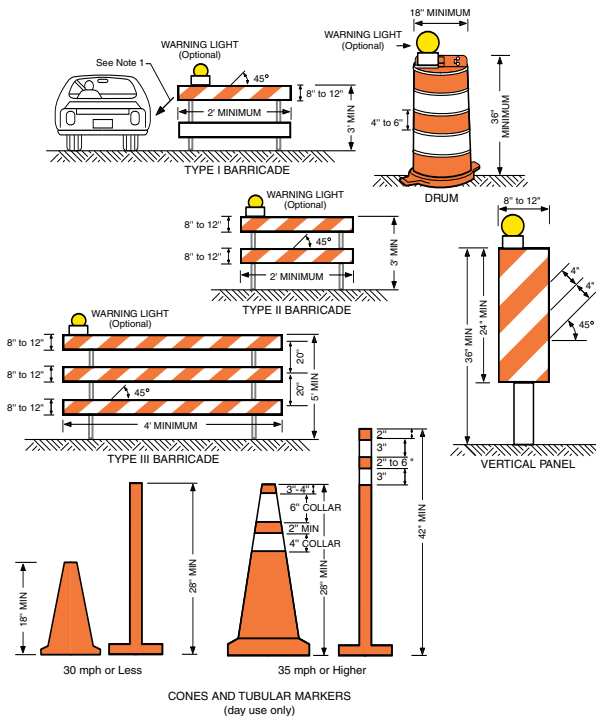


Spacing of Advance Warning Signs

Sign Spacing (feet)								
	25-30 mph	35-40 mph	45-55 mph	Expressway/ Freeway				
A	150	350	500	1,000	✓		✓	A
B	150	350	500	1,600	✓		✓	B
C	150	350	500	2,600	✓		✓	C

Distances shown are approximate. Sign spacing should be adjusted for curves, hills, intersections, driveways, etc., to improve sign visibility.

Channelizing Devices



Notes

1. Stripes on barricade rails slope downward at an angle of 45 degrees toward the direction traffic is to pass.
2. Barricade rail stripe widths shall be 6 inches except where rail lengths are less than 36 inches, then 4 inch wide stripes may be used.
3. The sides of barricades facing traffic shall have retroreflective rail faces.
4. On nonreflective surfaces of barricades, drums and vertical panels, provide the name and phone number of person/company to contact in emergency. Letters not less than 1.5 inches in height..
5. Use of cones and tubular markers for night time use is not permitted.

Channelizing Devices

Crash worthy channelizing devices are used to warn and alert drivers of the presence of a work zone, to protect workers, and to guide and direct drivers and pedestrians safely. Such devices include cones, tubular markers, vertical panels, drums, barricades, and barriers.

Cones and tubular markers are used most commonly for short-duration maintenance and utility work during daytime only. Overnight applications require cones to be replaced with other type of channelizing devices. Drums are used most commonly where they will remain in place for a prolonged period. Sand bags and other ballast are encouraged to protect devices from overturning in the wind but shall not be placed on the top of channelizing devices. Ballast shall not be non-deformable objects such as rocks and chunks of concrete.

Channelizing devices should be spaced so that it is apparent that the roadway or work area is closed to traffic. There are several rules of thumb that can be used in the proper placement of channelizing devices.

1. Under some conditions, shorter spacing between devices in the buffer and work area may be more appropriate to enhance the separation between the work area and the open traffic lane(s). Examples are in urban areas, on congested roadways, during work at night, or where vehicles are frequently knocking over the devices.
2. Additional devices may be appropriate to outline the path for turning vehicles near intersections or where existing pavement markings conflict with the temporary travel path.

Warning Lights

Warning lights may supplement retroreflectorization on warning and channelizing devices. They are especially useful in areas prone to fog or frequent inclement weather.

Warning lights used in a series for delineation or channelization shall be Steady-Burn (Type 3.) Warning lights shall have a minimum mounting height of 30 inches. Only steady burn (Type 3) shall be used for traffic control delineations. Flashing lights SHALL NOT be used for delineation. The principal types and uses of warning lights are:

1. **Low intensity (4 candellas) Flashing Lights (Type 1)**
May be mounted on barricades or drums to warn of an isolated hazard at night. They may also be mounted on signs.
2. **High intensity (35 candellas) Flashing Lights (Type 2)**
May be mounted on advance warning signs, or on independent supports to draw attention to extreme hazards both day and night.
3. **Low intensity (2 candellas) Steady-Burn Lights (Type 3)**
May be used in a series to delineate the edge of the travelway and channelize traffic at night.

Pavement Markings

For long-term stationary projects, follow the guidelines of Part VI of the MUTCD in placing and removing pavement markings. The colors of temporary pavement markings and delineators follow the same standard as for permanent markings. When used to enhance the visibility of the roadway edge, white is specified along both sides of two-way roadways and the right side of one-way roadways. Yellow is used on the left side of one-way roadways. Centerlines and lane lines are yellow when separating opposing directions of traffic and white when separating lanes going the same direction.

Where existing pavement markings conflict with the temporary travel path, additional signing and channelizing devices are appropriate.

Arrow Displays

An arrow display in the arrow or chevron mode may be used to supplement signs and other devices for lane closures on multi-lane roadways. An arrow display shall not be used on a two-lane, two-way roadway for temporary one lane operation, or on a multilane roadway to shift all lanes of traffic at one location. An arrow display in the caution mode shall be used only for shoulder work, blocking the shoulder, or roadside work near the shoulder.

Panel Type	Roadway Speed	Min. Size	Min. # Lamps	Min. Legibility Distance
A	25-30 mph	24" x 48"	12	1/2 mile
B	35-40 mph	30" x 60"	13	3/4 mile
C	≥ 45 mph	48" x 96"	15	1 mile

For mobile operations on high-speed roadways (30" x 60") Arrow displays may be used.

OPERATING MODE

At least one of the three following modes shall be provided:

PANEL DISPLAY*

(Right shown; left similar)

Flashing Arrow



Move/Merge Right

Sequential Arrow



Move/Merge Right



Sequential Chevron



Move/Merge Right



The following mode shall be provided:

Flashing Double Arrow



Move/Merge Right or Left

The following mode shall be provided:

Flashing Caution

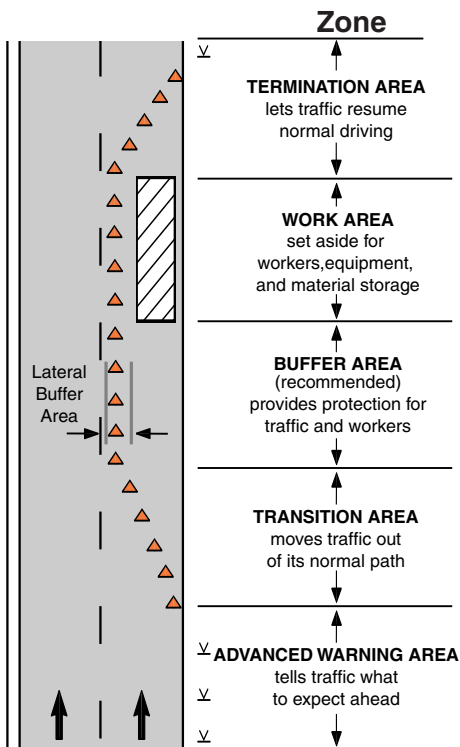


Caution

*Element layout for Type C Panel shown

Five Parts of a Traffic Control Zone

The traffic control zone is the distance between the first advance warning sign and the point beyond the work area where traffic is no longer affected. Below is a diagram showing the five parts of a traffic control zone.



Transition Area Taper Length

There are five types of tapers used in work zone traffic control. The length of each type of taper is based on formulas using the speed of the traffic and the width of the offset (or lane width). The following are the five types of tapers and their lengths.

Type of Taper	Taper Length
<i>Merging Taper</i> – The number of lanes is reduced on a multilane road	L minimum
<i>Shifting Taper</i> – A lateral shift, but no reduction in the number of travel lanes	1/2 L minimum
<i>Shoulder Taper</i> – The shoulder is closed	1/3 L minimum
<i>Two-way Traffic Taper</i> – Opposing directions of traffic share one open lane	50 feet minimum 100 feet maximum
<i>Downstream Taper</i> – The work area ends and traffic resumes normal driving (use is optional)	100 feet per lane minimum

Formulas for L

Speed Limit	Formula
40 MPH or less	$L = WS^2 / 60$
45 MPH or greater	$L = W \times S$

L = Taper Length in feet

W = Width of offset (lane width or lane shift) in feet

S = Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph

Taper Length (L) in feet

Speed (mph)	Width of offset (ft)			
	10	11	12	15
25	105	115	125	160
30	150	165	180	225
35	205	225	245	310
40	270	295	320	400
45	450	495	540	675
50	500	550	600	750
55	550	605	660	825
65	650	715	780	975

Buffer Lengths

The buffer area is a recommended part of the work zone. It serves to separate traffic flow from the work area or a potentially hazardous area and provides recovery space for an errant vehicle. The buffer area should not include any work activity or storage of equipment, vehicles or material.

Guidelines for Buffer Lengths

Speed (mph)	Length (ft)	Speed (mph)	Length (ft)
20	35	45	220
25	55	50	280
30	85	55	335
35	120	60	415
40	170	65	485

A lateral buffer space may also be used to separate passing traffic from the work area. Its use and width is based on conditions at the work site.

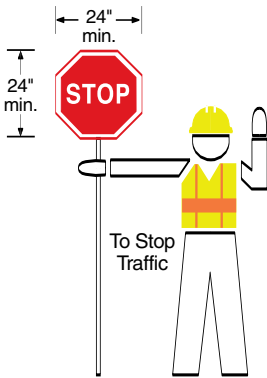
Channel Device Spacing

SPEED LIMIT (mph)	TRANSITION AREA		BUFFER AREA		WORK AREA	
	Cones	Other	Cones	Other	Cones	Other
25	25	25	25	50	25	50
30	"	30	"	60	"	60
35	"	35	"	70	"	70
40	"	40	"	80	"	80
45	45	45	90	90	90	90
50	50	50	100	100	100	100
55	55	55	110	110	110	110
60	60	60	120	120	120	120
65	65	65	130	130	130	130

Cones include tubular markers. Other devices include vertical panels, drums and barricades.

In the transition zone for devices other than cones and tubular markers the distance in feet is approximately equal to the speed limit in MPH. In the buffer and work areas for devices other than cones and tubular markers the distance in feet is approximately equal to 2 times the speed limit in MPH.

Flagging Procedures

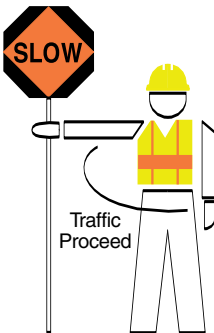


Properly Trained Flaggers

- 1 give clear messages to drivers as shown
- 1 allow time and distance for drivers to react
- 1 coordinate with other flaggers

Properly Equipped Flaggers

- 1 approved sign paddles
- 1 approved safety vest, shirt or coat
- 1 brightly colored hard hat for better visibility
- 1 retroreflective night equipment



Proper Flagging Stations

- 1 good approach sight distance
- 1 highly visible to traffic
- 1 never stand in moving traffic lane



Proper Advance Warning Signs

- 1 always use warning signs
- 1 allow reaction distance from signs
- 1 remove signs if not flagging

Flags should only be used in emergency situations. Flags used for signaling shall be a minimum of 24" x 24", red in color and mounted on a staff, about 3' long.

Typical Application Diagrams











The diagrams on the following pages represent examples of the application of principles and procedures for safe and efficient traffic control in work zones but are not intended to be standards. It is not possible to include illustrations to cover every situation that will require work area protection. These typical layouts are not intended as a substitute for engineering judgment and should be altered to fit the conditions of a particular site. Contract plans or other agency documents may also have applicable layouts to be followed.

The diagrams are not to scale, and the number of channelizing devices shown may not be the number needed at the work site. Use the tables on the typical diagrams to determine taper and buffer lengths, and use the table on page 22 for guidance on the spacing of devices.

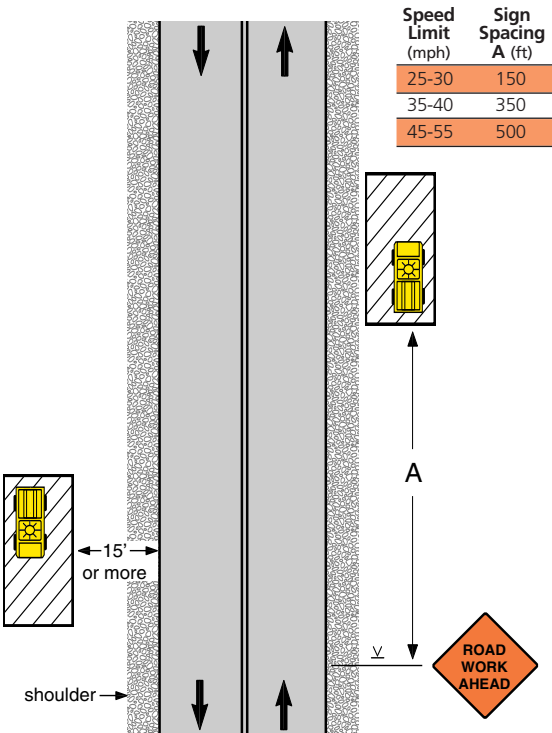
The notes and tables on the typical diagrams provide important information for the user.

Read all notes before using these diagrams. The information presented in these diagrams and tables are generally minimums. For further information, refer to Part VI of the MUTCD. It contains the standards for work zone traffic control.

Legend

	Channelizing Device		Work Vehicle with Flashing Light
	Arrow Display		High Level Warning Device
	Flagger Symbol		Work Area
	Portable Sign Support		Warning Sign
	Type III Barricade		Work or Protection Vehicle with Truck-Mounted Attenuator (TMA)

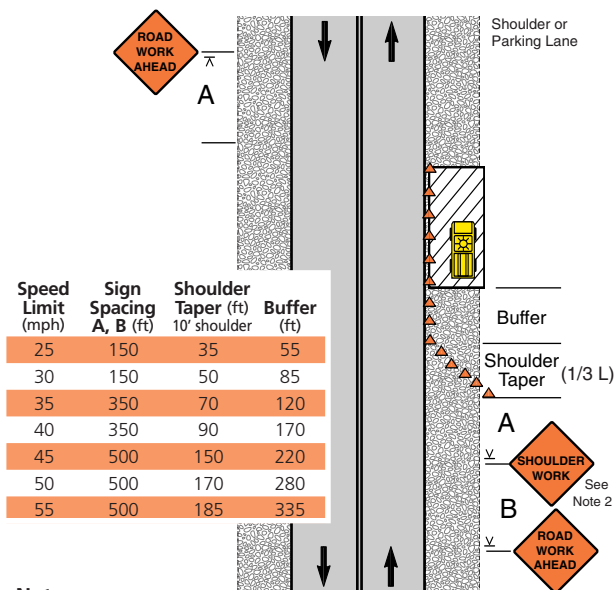
Work Outside the Shoulder



Notes

1. If vehicle and work activity are both behind a guard rail, more than 2 feet behind a curb, or 15 feet or more from the edge of any roadway, then only an activated flashing or revolving yellow light is needed.
2. For short-term, short-duration (60 minutes or less), or mobile operations, the warning sign may be omitted if an activated flashing or revolving yellow light and activated vehicle flashers are used.
3. Other acceptable advance warning signs are those indicating SHOULDER WORK, UTILITY WORK AHEAD, or the WORKERS sign.

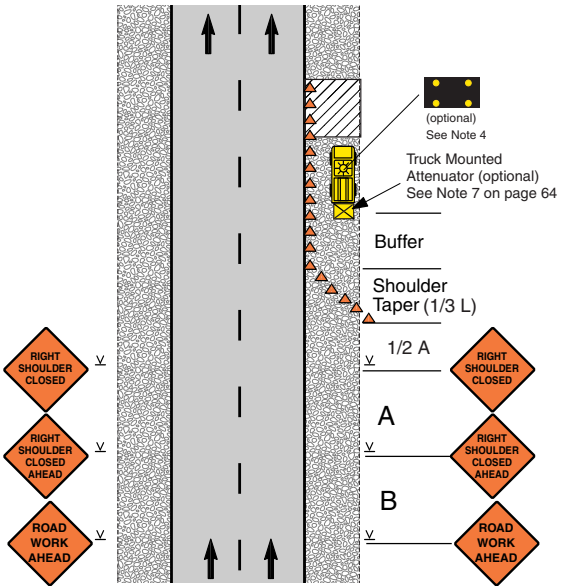
Work on Shoulder or Parking Lane



Notes

1. Encroachment into the traffic lane is allowable provided a 10-foot minimum travel lane width is maintained. A lane closure should be considered if there is encroachment on roads with speeds greater than 35 MPH, or for other conditions where workers, equipment, or the work activity would benefit from the lateral buffer (see pages 31 and 32).
2. If there is encroachment into the traffic lane, use ROAD NARROWS instead of SHOULDER WORK. For low volume roads, the SHOULDER WORK or ROAD NARROWS sign may be omitted.
3. For short duration work (60 minutes or less), the channelizing devices are optional if a protection vehicle with an activated flashing or revolving light is used. For short duration work with no lane encroachment, the signs are also optional.
4. WORKERS or UTILITY WORK AHEAD signs may be used instead of the SHOULDER WORK or ROAD WORK AHEAD signs.
5. When work area is at least 2 feet from traffic lane on low volume roads with speeds of 35 MPH or less, sign on opposite side may be omitted.

Shoulder Closed on Divided Roadway

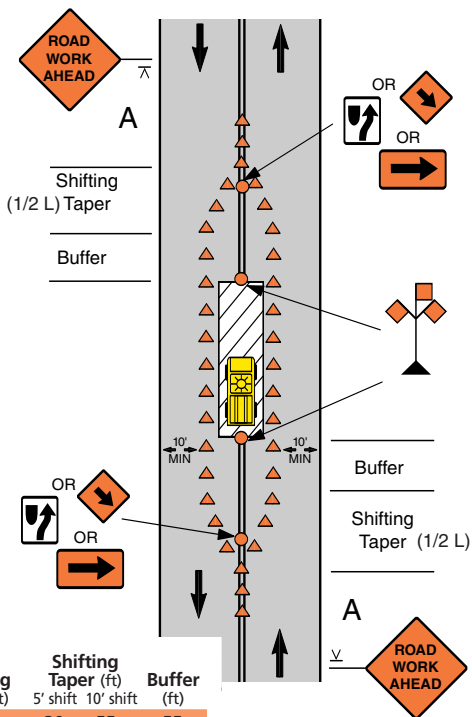


Notes

- SHOULDER CLOSED signs should be used on limited-access highways where there is no opportunity for disabled vehicles to pull off the traveled way.
- For short-duration work, one of the SHOULDER CLOSED warning signs may be omitted.
- UTILITY WORK AHEAD or WORKERS signs may be used instead of the warning signs shown.
- Use of an arrow display is optional. If used, it shall be operated in the caution mode.

Speed Limit (mph)	Sign Spacing A	Sign Spacing (ft) B	Shoulder Taper (ft) 10' shoulder	Buffer (ft)
35	350	350	70	120
40	350	350	90	170
45	500	500	150	220
50	1000	1600	170	280
55	1000	1600	185	335
60	1000	1600	200	415
65	1000	1600	220	485

Work in Center of Road (Maintaining Two-Way Traffic, 35 MPH or Less)

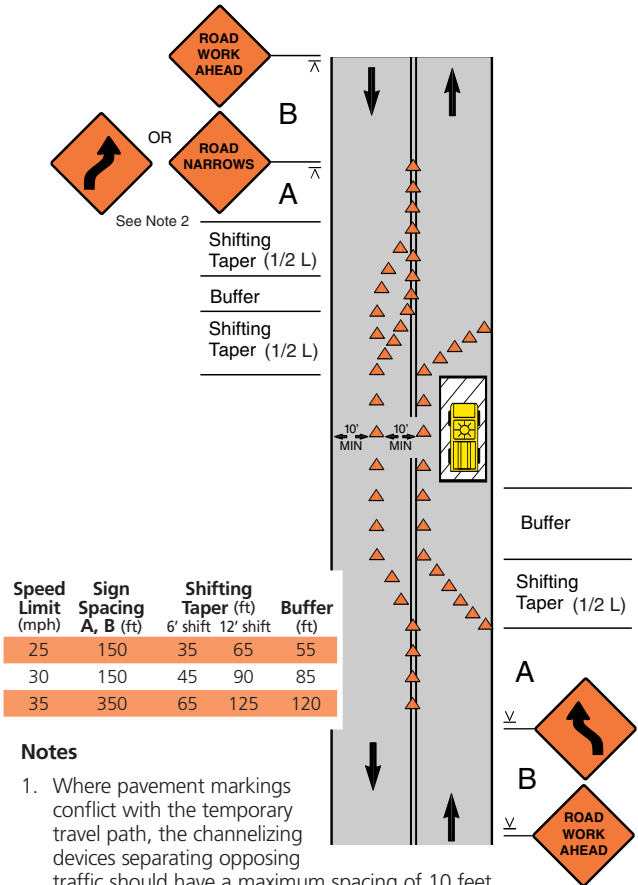


Notes

1. Additional advance warning may be appropriate such as ROAD NARROWS or REVERSE CURVE/TURN signs. The REVERSE CURVE/TURN sign is appropriate for larger deviations in the travel path.
2. Channelizing devices may be eliminated on low volume roads if the work vehicle displays a flashing or revolving yellow light.
3. The LARGE ARROW SIGN may be used instead of the KEEP RIGHT or DOWN ARROW sign where space permits.

Work in Travel Lane

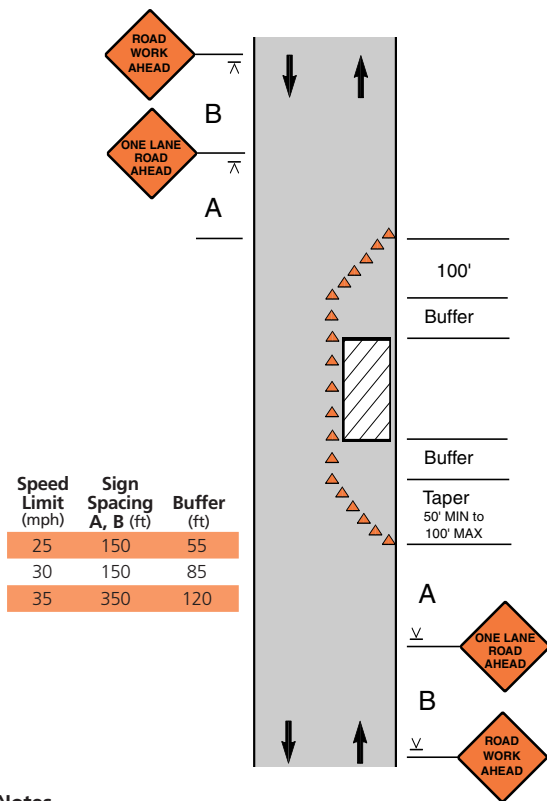
(Maintaining Two-Way Traffic, 35 MPH or Less)



Notes

- Where pavement markings conflict with the temporary travel path, the channelizing devices separating opposing traffic should have a maximum spacing of 10 feet.
- The ROAD NARROWS or REVERSE CURVE/TURN sign is optional on low volume roads or where the lane shift requires only a minor deviation in the travel path. The REVERSE CURVE/TURN sign is appropriate for larger deviations in the travel path.
- If speeds are 30 MPH or less, REVERSE TURN signs shall be used instead of REVERSE CURVE.

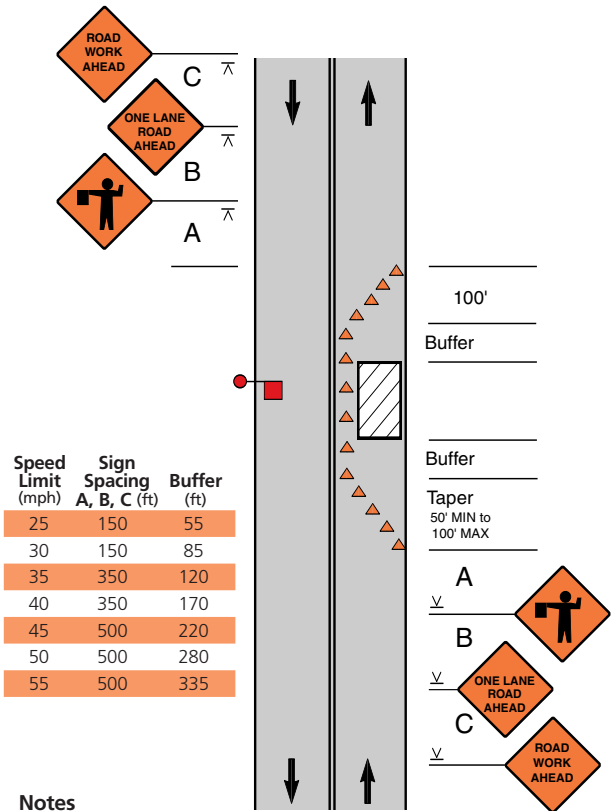
Lane Closure on a Low-Volume Road (No Flagger, Traffic Self-Regulating, 25 MPH or Less)



Notes

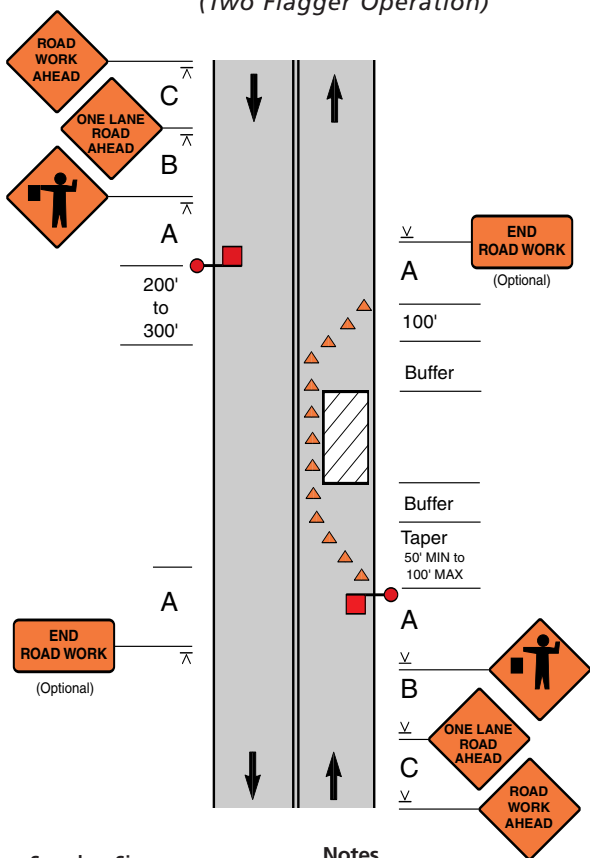
1. This layout is only appropriate where work areas are short and sight distance is good, thus allowing traffic to readily see the roadway beyond.
2. Where traffic does not self-regulate effectively, use one or two flaggers (see pages 31 and 32), or add STOP signs for each direction near the beginning of the tapers, with STOP AHEAD signs in advance.

Lane Closure on a Two-Lane Low-Volume Low Speed (30 mph or less) Road (One Flagger Operation)



1. A single flagger may be adequate for low volume roads. Where one flagger is used, such as for short work areas on straight roadways, the flagger must be visible to approaching traffic from both directions.
2. The flagger shall use approved flagging procedures according to the MUTCD and as shown on page 23.
3. For short duration work (60 minutes or less), the ROAD WORK AHEAD sign may be omitted.

Lane Closure on a Two-Lane Road (Two Flagger Operation)

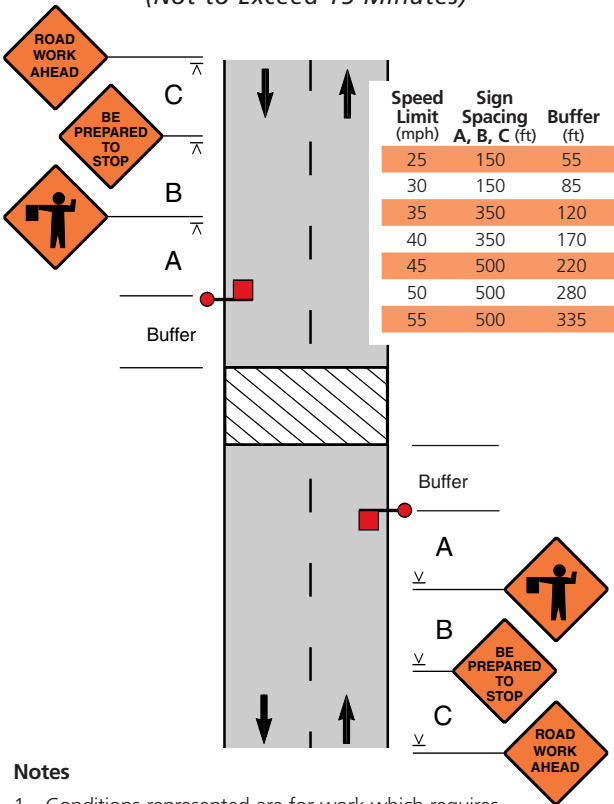


Speed Limit (mph)	Sign Spacing A, B, C (ft)	Buffer (ft)
25	150	55
30	150	85
35	350	120
40	350	170
45	500	220
50	500	280
55	500	335

Notes

1. The flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.
2. For short duration work (60 minutes or less), the ROAD WORK AHEAD sign may be omitted.

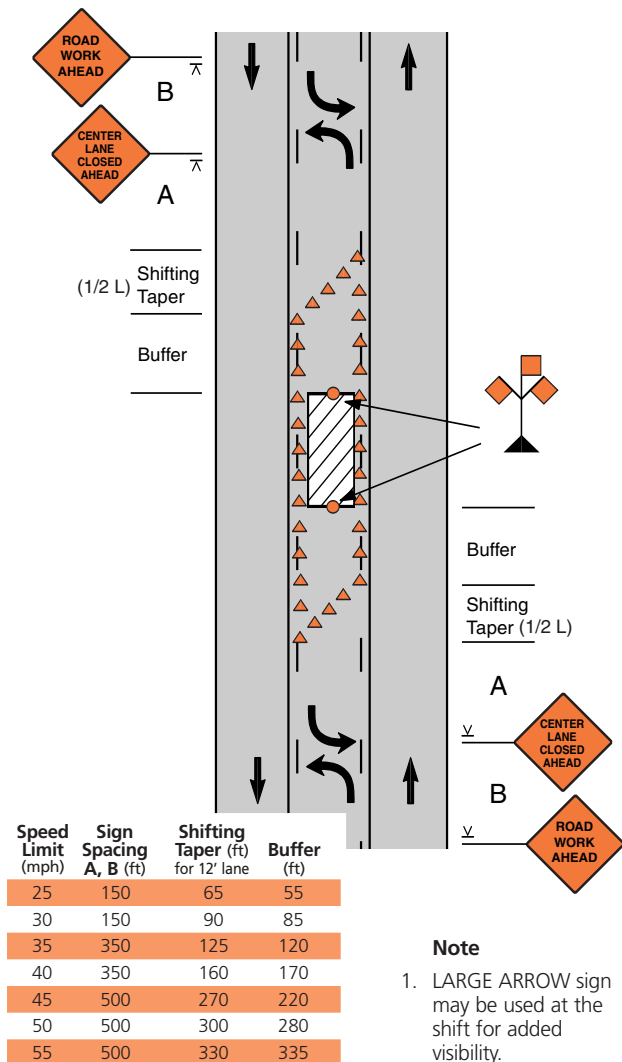
Temporary Road Closure (Not to Exceed 15 Minutes)



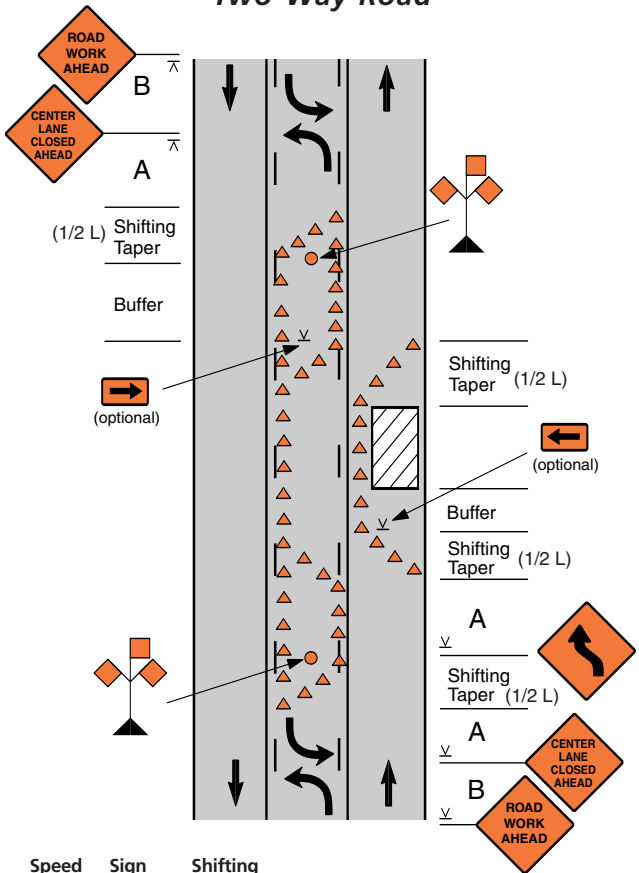
Notes

1. Conditions represented are for work which requires closings during daytime hours only.
2. This application is intended for a planned temporary closing not to exceed 15 minutes.
3. For high volume roads, a police patrol car or a changeable message sign or both may be added.
4. The flagger shall stop the first vehicle from the shoulder as shown. After stopping the first vehicle if the view of the flagger is obstructed, then he or she should move to the centerline to stop additional traffic.
5. Flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.

Center Turn Lane Closed on a Three-Lane, Two-Way Road



Lane Shift on a Three-Lane, Two-Way Road

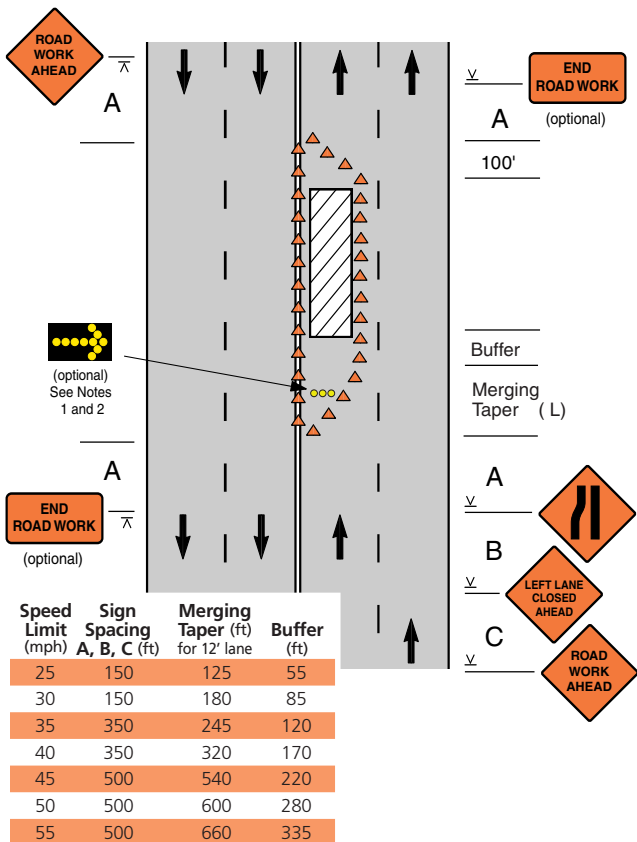


Speed Limit (mph)	Sign Spacing A, B (ft)	Shifting Taper (ft) for 12' lane	Buffer (ft)
25	150	65	55
30	150	90	85
35	350	125	120
40	350	160	170
45	500	270	220
50	500	300	280
55	500	330	335

Notes

1. LARGE ARROW signs may be used at the shifts for added visibility.
2. If the speeds are 30 MPH or less, REVERSE TURN signs shall be used instead of REVERSE CURVE.

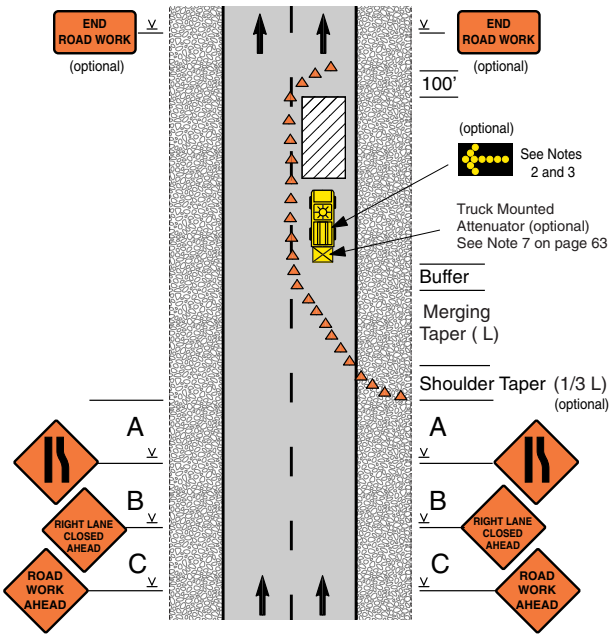
Lane Closure on a Four-Lane Undivided Road



Notes

1. Use of an arrow display is optional based on traffic volume, speed, and visibility. Generally, it is a good practice on roads with speeds of 35 MPH or greater. When used, it may be placed near the beginning of the taper, or it may be on a vehicle in the work area.
2. If an arrow display is not used, a LARGE ARROW sign may be used for added guidance.

Lane Closure on Divided Roadway

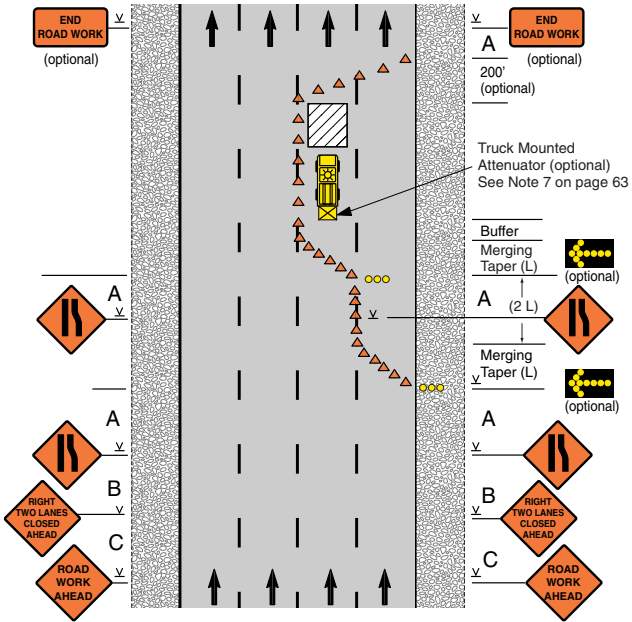


Notes

- When a side road intersects the roadway within the work zone, additional devices shall be erected to channelize traffic to or from the side road, and a ROAD WORK AHEAD sign shall be placed on each side road approach.
- An arrow display is optional based on traffic volume, speed, and visibility. Generally, it is a good practice where speeds are 35 MPH or greater. When used, it may be placed near the beginning of the taper or on a vehicle in the work area.
- If an arrow display is not used, a LARGE ARROW sign may be used to provide added guidance.

Speed Limit (mph)	Sign Spacing (ft)			Merging Taper (ft) for 12' lane	Buffer (ft)
	A	B	C		
30	150	200	200	180	85
35	350	350	350	245	120
40	350	350	350	320	170
45	500	500	500	540	220
50	1000	1600	2600	600	280
55	1000	1600	2600	660	335
60	1000	1600	2600	720	415
65	1000	1600	2600	780	485

Double Lane Closure on Divided Roadway

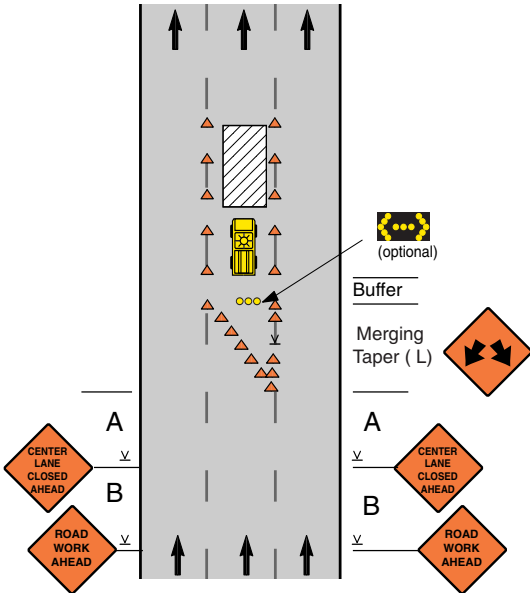


Notes

- When a side road intersects the roadway within the work zone, additional devices shall be erected to channelize traffic to or from the side road, and a ROAD WORK AHEAD sign shall be placed on each side road approach.
- The second arrow display may be placed near the beginning of the second merging taper or on a vehicle in the work area.
- If arrow displays are not used, LARGE ARROW signs may be used to provide added guidance.

Speed Limit (mph)	Sign Spacing (ft)			Merging Taper (ft) for 12' lane	Buffer (ft)
	A	B	C		
35	350	350	350	245	120
40	350	350	350	320	170
45	500	500	500	540	220
50	1000	1600	2600	600	280
55	1000	1600	2600	660	335
60	1000	1600	2600	720	415
65	1000	1600	2600	780	485

Center Lane Closure on Divided Multi-Lane Roadway (Speeds of 35 mph or Less)

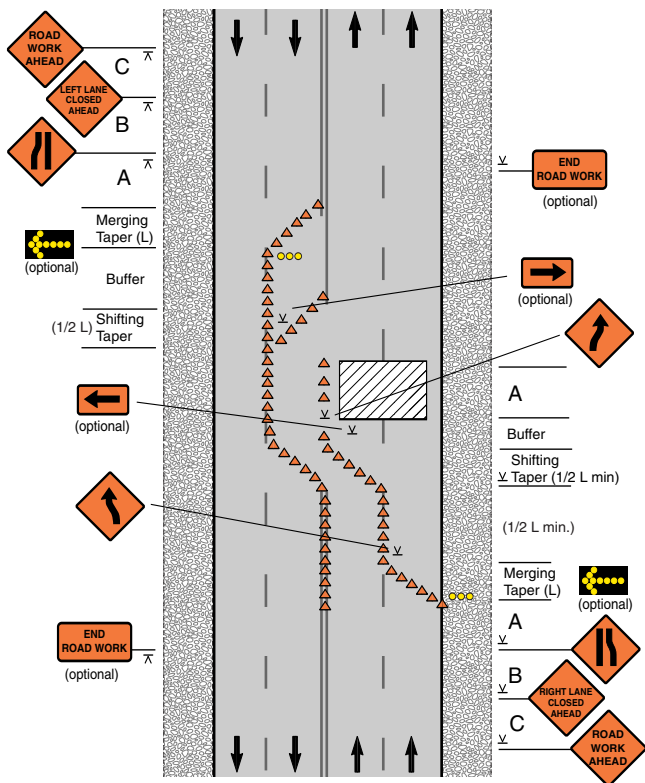


Notes

- The merging taper may direct traffic into either the right or left lane but not both. Consider turning volumes and bus stop locations to determine the direction for the merging taper.
- When an arrow display is used, it may be placed in the closed lane near the end of the merging taper, or it may be on a vehicle in the work area.
- If an arrow display is not used, a LARGE DOUBLE ARROW sign may be used to provide added guidance.

Speed Limit (mph)	Sign Spacing (ft)		Merging Taper (ft) for 12' lane	Buffer (ft)
	A	B		
25	150	200	125	55
30	150	200	180	85
35	350	350	245	120

Half Road Closure on Multi-Lane Roadway



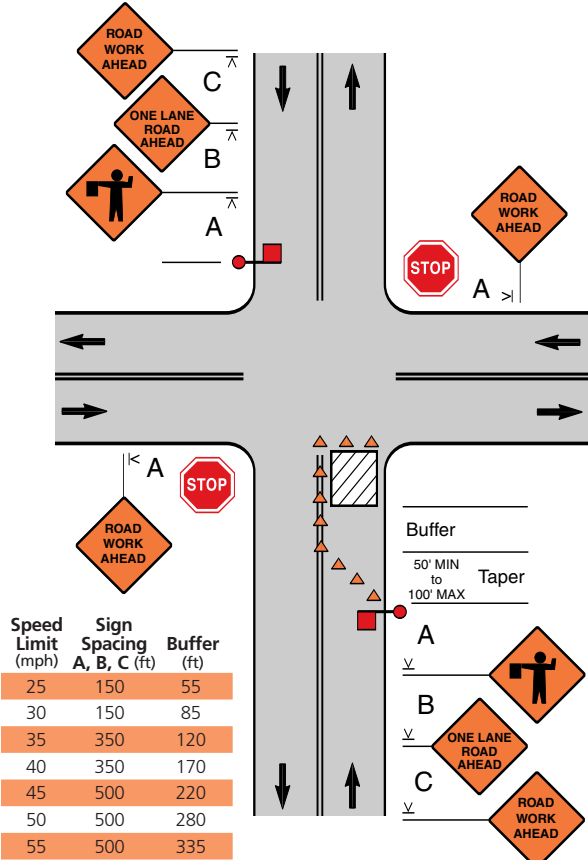
Speed Limit (mph)	Sign Spacing A, B, C (ft)	Merging Taper (ft) for 12' lane	Shifting Taper (ft) for 12' lane	Buffer (ft)
25	150	125	65	55
30	150	180	90	85
35	350	245	125	120
40	350	320	160	170
45	500	540	270	220
50	500	600	300	280
55	500	660	330	335

Half Road Closure on Multi-Lane Roadway (cont.)

Notes

1. Pavement markings no longer applicable shall be removed or obliterated as soon as practicable. Interim markings shall be used as necessary. For intermediate-term situations when it is not feasible to remove and restore pavement markings, channelizing devices shall be more closely spaced when the pavement markings conflict with the temporary travel path. In such locations a maximum channelizing device spacing of 10 feet is recommended.
2. For short-term and intermediate-term situations where it is not feasible to remove and restore pavement markings, channelization shall be made dominant by using a very close device spacing.
3. When a side road intersects the roadway within the work zone, additional devices shall be erected to channelize traffic to or from the side road and a ROAD WORK AHEAD sign shall be placed on each side road approach.
4. Use of an arrow display is optional based on traffic volume, speed, and visibility. Generally, it is a good practice on roads with speeds of 35 MPH or greater.
5. If an arrow display is not used, a LARGE ARROW sign may be used to provide additional guidance.
6. LARGE ARROW signs may be used at the shifts for added visibility.
7. If speeds are 30 MPH or less, REVERSE TURN signs shall be used instead of REVERSE CURVE in advance of the shifting tapers.

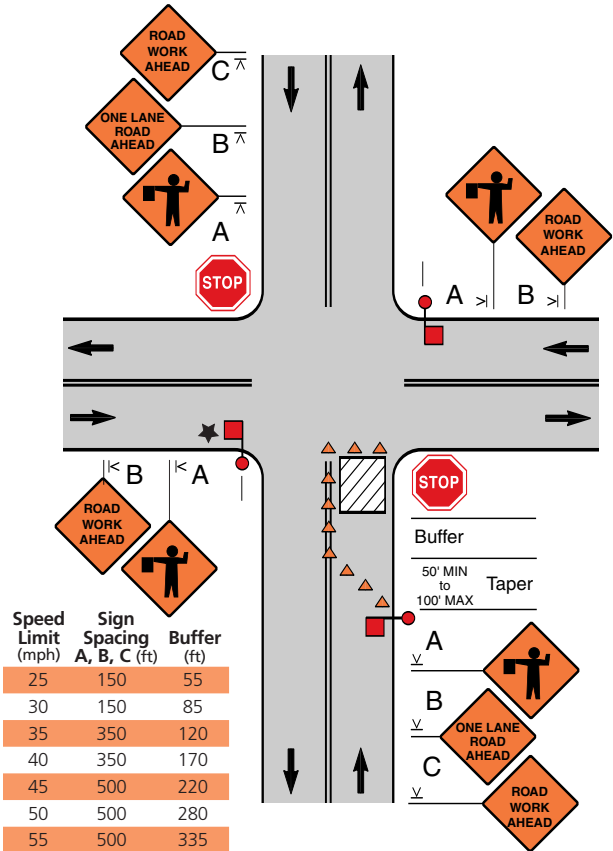
Lane Closure in Advance of an Intersection (Work Area on the Through Road)



Notes

1. Depending on traffic conditions, additional traffic control, such as flaggers and appropriate signage, may be needed on the side road approaches.
2. The flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.

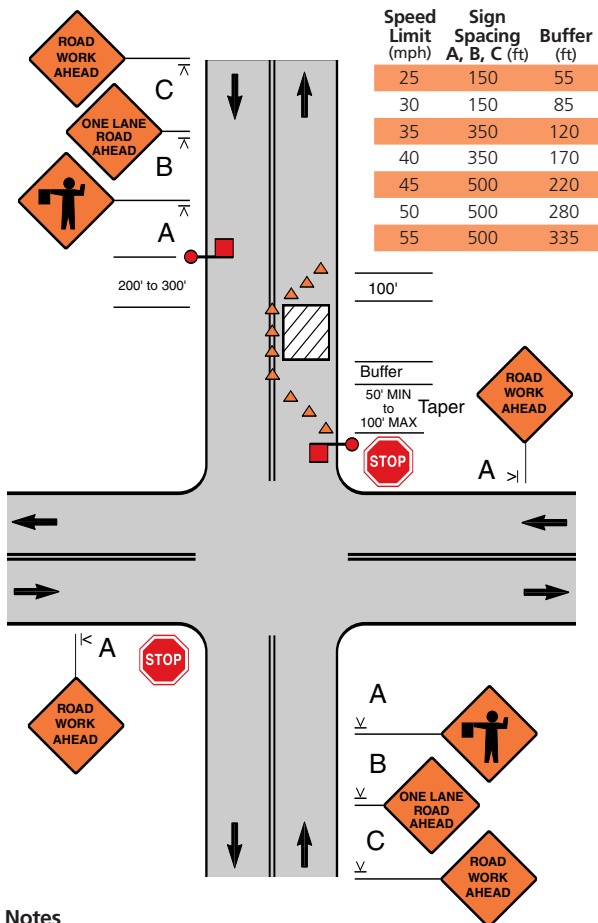
Lane Closure in Advance of an Intersection (Work Area on the Side Road)



Notes

1. Depending on traffic conditions, additional traffic control, such as flaggers and appropriate signage, may be needed.
- ★ 2. The middle flagger has the best view of traffic from all directions. This flagger should be designated **lead flagger** and should coordinate the actions of the other flaggers.
3. The flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.

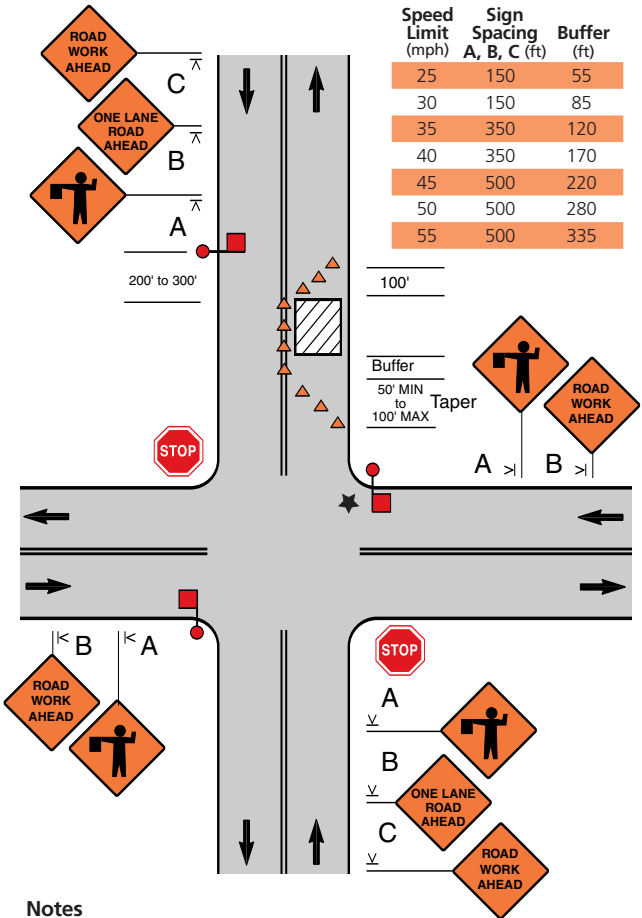
Lane Closure Beyond an Intersection (Work Area on the Through Road)



Notes

1. Depending on traffic conditions, additional traffic control, such as flaggers and appropriate signage, may be needed.
2. The flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.

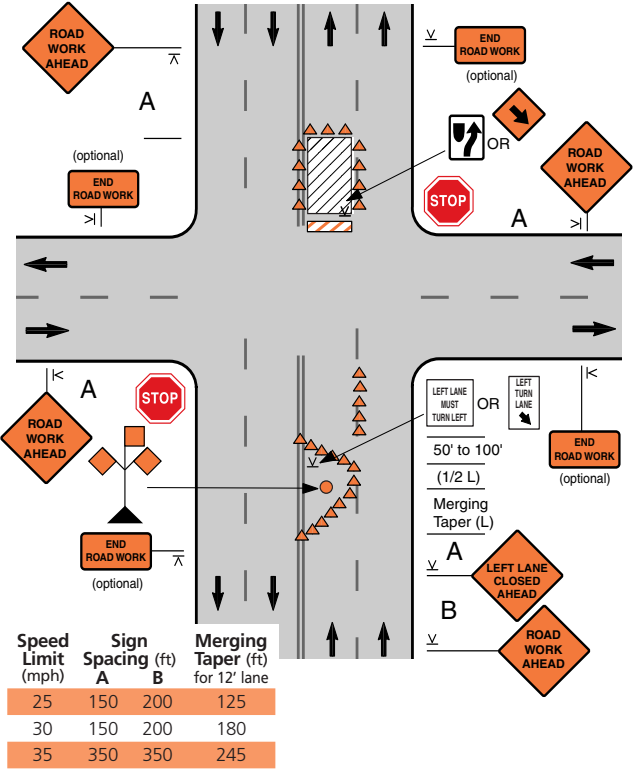
Lane Closure Beyond an Intersection (Work Area on the Side Road)



Notes

- Depending on traffic conditions, additional traffic control, such as flaggers and appropriate signage, may be needed.
- ★ The middle flagger should be designated **lead flagger** and should coordinate the actions of the other flaggers.
- The flaggers shall use approved flagging procedures according to the MUTCD and as shown on page 23.

Left Lane Closure on Far Side of Intersection *(Speeds of 35 mph or Less)*

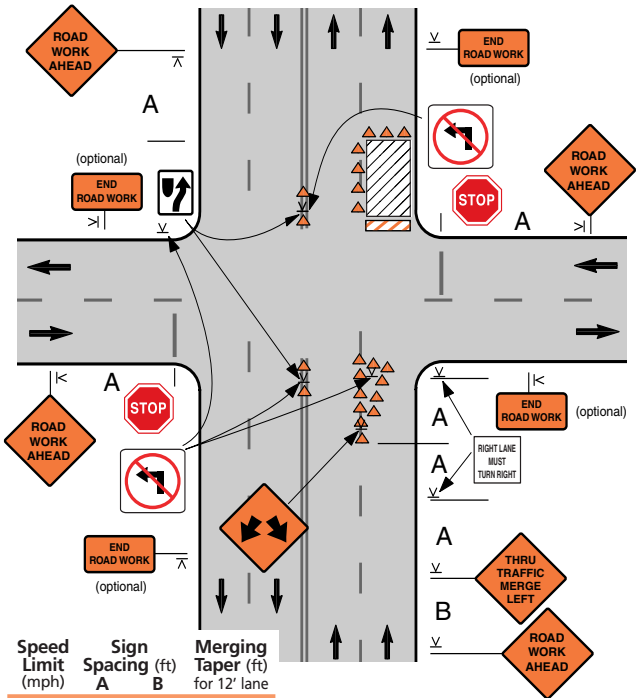


Notes

- Standard procedure is to close any lane that is not carried through the intersection on the near side of the intersection. However, if this results in the closure of a lane having significant turning movements, then that lane may be converted to a turn bay, or the lane may be restricted to turns only, as shown.
- A LARGE ARROW sign may be used instead of the KEEP RIGHT or DOWN ARROW sign where space permits.

Right Lane Closure on Far Side of Intersection

(Speeds of 35 MPH or Less)

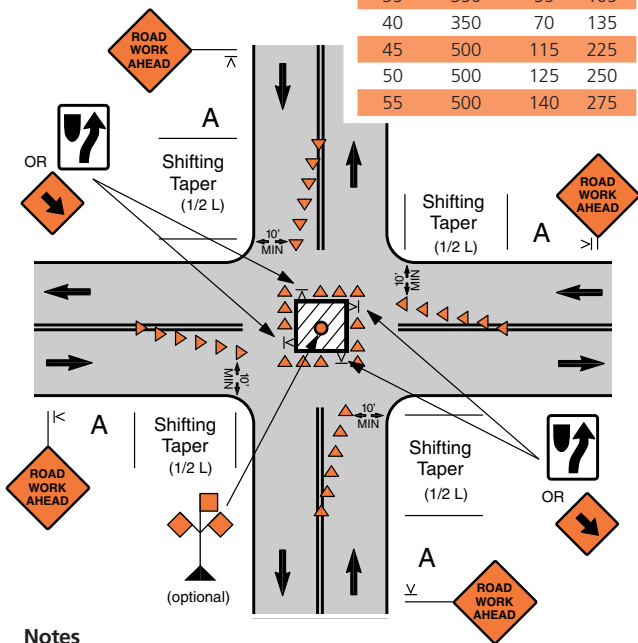


Notes

- Standard procedure is to close any lane that is not carried through the intersection on the near side of the intersection. However, if this results in the closure of a lane having significant turning movements, then that lane may be converted to a turn bay or the lane may be restricted to turns only as shown.
- A LARGE ARROW sign may be used instead of the KEEP RIGHT or DOWN ARROW sign where space permits.

Closure in the Center of an Intersection

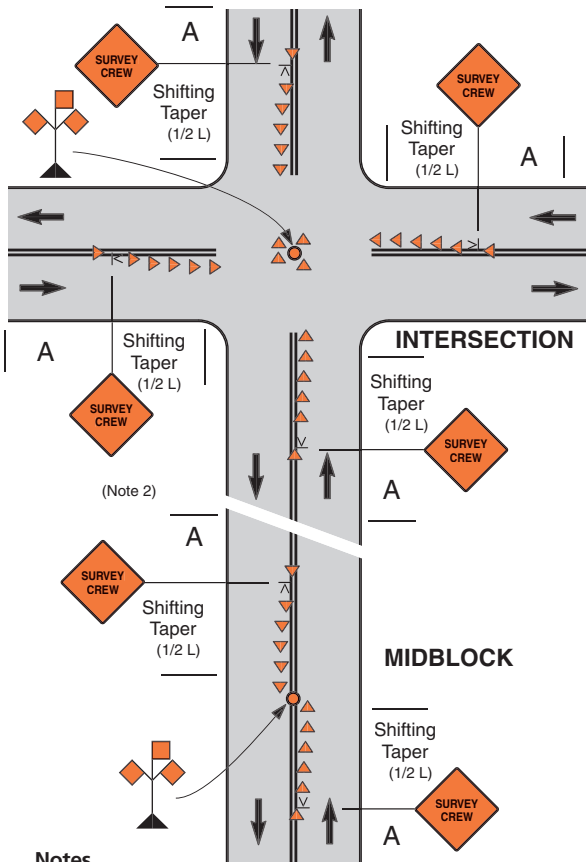
Speed Limit (mph)	Sign Spacing A, B (ft)	Shift Taper (ft)	
25	150	30	55
30	150	40	75
35	350	55	105
40	350	70	135
45	500	115	225
50	500	125	250
55	500	140	275



Notes

1. Additional advance warning may be appropriate such as ROAD NARROWS or REVERSE CURVE/TURN signs. The REVERSE CURVE/TURN sign is appropriate for larger deviations in the travel path.
2. Prohibit left turns as required by traffic conditions. Unless the streets are wide, it may be physically impossible to turn left, especially for large vehicles.
3. A minimum of five channelizing devices shall be used for each taper.
4. For short duration work (60 minutes or less), the channelizing devices may be eliminated if a flashing or revolving yellow light is displayed in the work space.

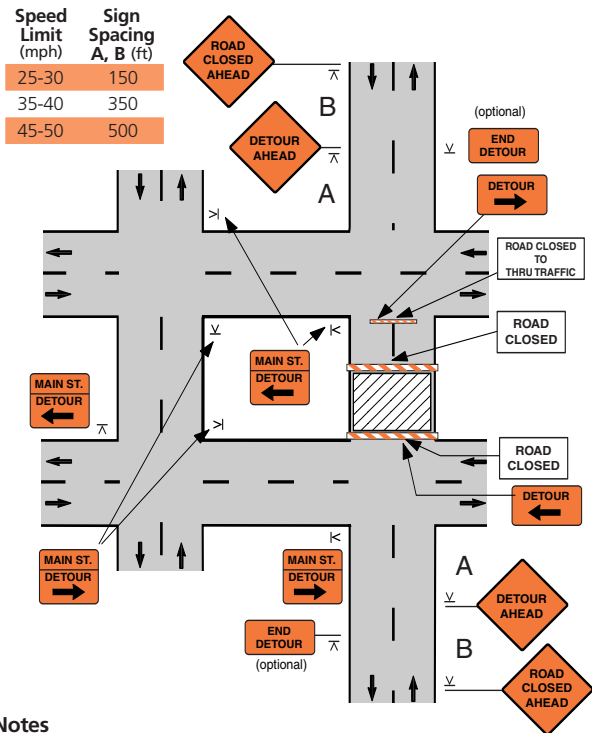
Surveying



Notes

1. Surveying that restricts traffic is not permitted at signalized intersections or on major traffic carrying streets during peak traffic hours, except when such work is in areas that are under construction or with prior approval of right-of-way owner.
2. High level warning device is mandatory when an instrument is set up in the street or when a range pole is set up in a signalized intersection.

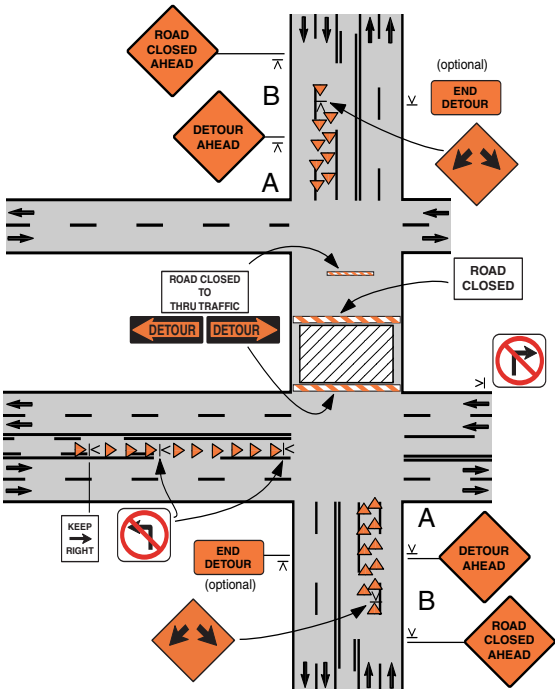
Street Closure with Detour



Notes

1. This layout is appropriate for city streets and township roads. See MUTCD Part VI for closing and detouring a numbered highway.
2. When a side road intersects the roadway within the work zone, place Type III barricades and ROAD CLOSED signs at the intersections, and provide advance signing of the closure on the side road approaches.
3. Using a street name sign with the DETOUR sign is optional. If used, the street nameplate goes above the DETOUR sign.
4. DETOUR sign with an advance turn arrow may be used in advance of a turn. On multilane streets, such signs should be used.
5. DETOUR signs may be located on the far side of the intersections.

Street Closure with Turn Lanes



Notes

1. This layout is appropriate for city streets and township roads. See MUTCD Part VI for closing and detouring a numbered highway.
2. When a side road intersects the roadway within the work zone, place Type III barricades and ROAD CLOSED signs at the intersections, and provide advance signing of the closure on the side road approaches.
3. DETOUR signs may be located on the far side of the intersections.

Pedestrian and Worker Safety

Pedestrian Safety

If pedestrian travel paths (sidewalks or footpaths) are closed or disrupted by a construction, maintenance, or utility operation, then pedestrian traffic control is needed. This includes the use of signs, channelizing devices, flags, etc. to direct pedestrian movement through or around the work site.

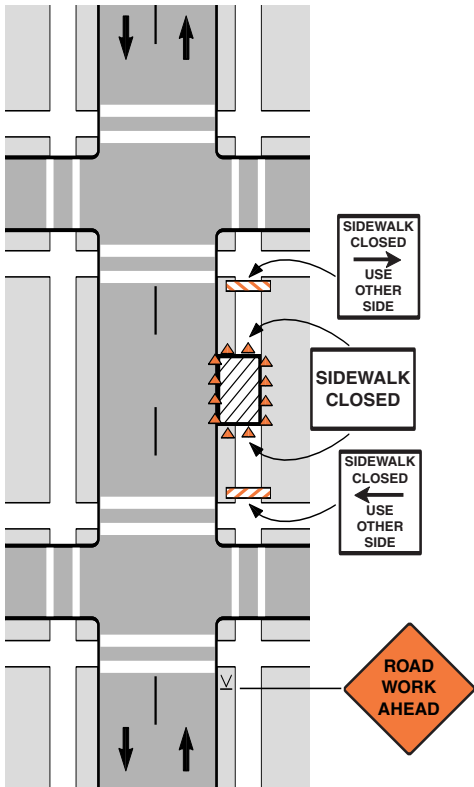
- 🚧 To separate work zones from the disabled and the vision impaired use solid rails or rigid plastic netting around the work zone. The rails or netting must be within 6 inches of the foot path and at least as high as the channeling devices.
- 🚧 Pedestrians need protection from potential injury. Obstructions should be clearly marked, especially at night.
- 🚧 Pedestrians should not be led into direct conflict with work site vehicles, equipment, or with mainline traffic moving through or around the work site.
- 🚧 Pedestrians should be provided with a safe, convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks or footpaths.

Worker Safety

The safety of workers in a work site is just as important as the safety of the public traveling through the work zone. The best protection for both is good work zone traffic control.

- 🚧 All workers should be trained in how to work next to traffic in a way that minimizes their vulnerability. In addition, workers with specific traffic control responsibilities should be trained in traffic control techniques, device usage, and placement.
- 🚧 Workers exposed to traffic should be attired in bright, highly visible clothing such as vests, shirts, or jackets. For daytime work, these garments may be orange, yellow, strong yellow green or fluorescent versions of these colors. Flaggers shall be attired in similar bright, highly visible clothing. Other specific agency requirements for garments may also apply, such as OSHA requirements for private sector employees.
- 🚧 For nighttime work, similar outside garments shall be retro-reflective and shall be designed to identify clearly the wearer as a person and be visible through the full range of body motions (i.e. retroreflective material on the front, back, and both sides of the garment).

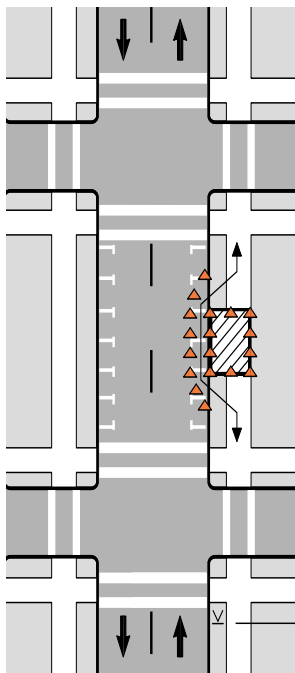
Sidewalk Closure (Pedestrian Detour)



Notes

1. Additional advance warning may be necessary.
2. Only the traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets. Use lane closure signing, ROAD NARROWS or LANE NARROWS signs as needed.
3. Provide minimum grade and safety standards outlined in the Americans with Disabilities Act (ADA).

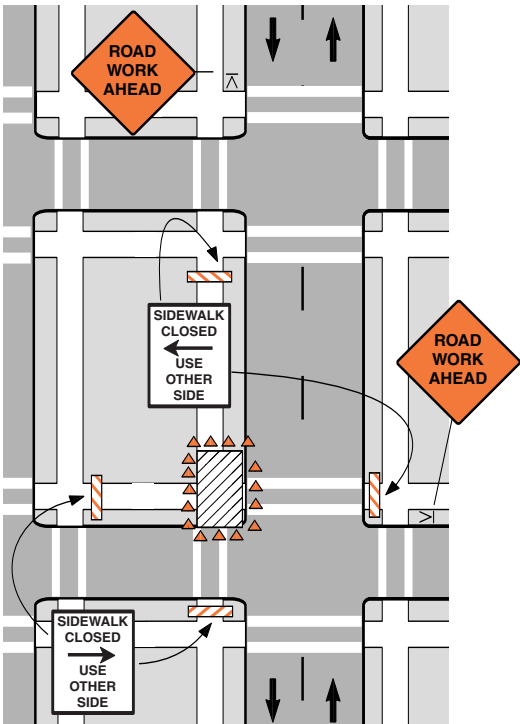
Sidewalk Closure *(Pedestrian Walkway Provided)*



Notes

1. Additional advance warning may be necessary.
2. Only the traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets. Use lane closure signing, ROAD NARROWS or LANE NARROWS signs, as needed.
3. Where high speeds are anticipated, use a barrier to separate the temporary walkway from vehicular traffic. Refer to part VI of the MUTCD for information on barriers.
4. Signs may be placed along a temporary walkway to guide or direct pedestrians; for example, KEEP RIGHT or KEEP LEFT signs.
5. Provide minimum grade and safety standards outlined in the Americans with Disabilities Act (ADA).

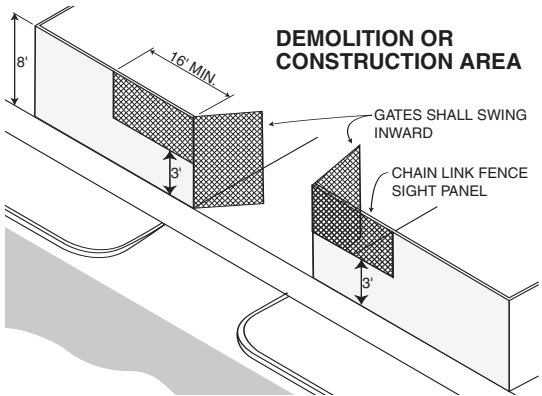
Sidewalk Corner Closure



Notes

1. Additional advance warning may be necessary.
2. Only the traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets. Use lane closure signing, ROAD NARROWS or LANE NARROWS signs, as needed.
3. Pedestrian traffic signal displays controlling closed sidewalks at signalized intersections should be covered or deactivated.
4. Night time street lighting should be considered.
5. Provide minimum grade and safety standards outlined in the Americans with Disabilities Act (ADA).

Construction Fence



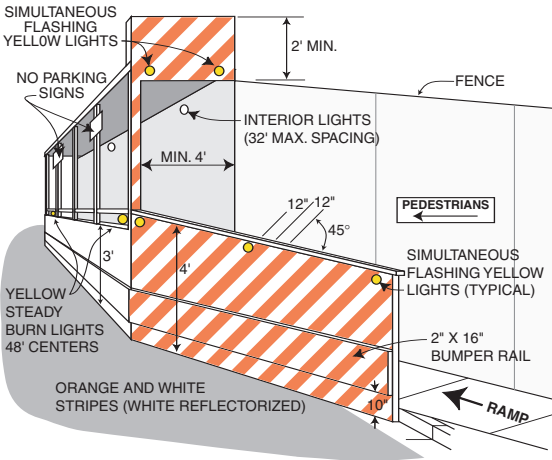
Notes

- Only pedestrian traffic control is shown. Other devices may be needed to control vehicles.
- Pedestrian protection normally required is as follows

HEIGHT OF CONSTRUCTION	DISTANCE FROM EDGE OF WALKWAY	PROTECTION REQUIRED
8 feet or less	Less than 6 feet	Railing
	6 feet or more	None
More than 8 Feet	Less than 6 feet	Fence and canopy
	6 feet or more but not more than 1/4 the height of construction	Fence and canopy
	6 feet or more, but between 1/4 to 1/2 the height of construction	Fence
	6 feet or more but exceeding 1/2 the construction height	None

- constructed of boards, plywood, or chainlink.
 - ramps provided for wheel chair use. Meet ADA requirements
 - where boards or plywood are used, 16-foot long chain link sight distance panels are required at vehicle entrances.
- Construction fences at locations where the adjacent walkway has been closed to pedestrians may be completely constructed of chain link fencing.
 - In those cases where the demolition work will take longer than one day to complete or three days to clear and level, in lieu of the requirements in the table above a 3-feet high chain link fence may be used, if authorized by the permitting agency

Canopied Walkway at Mid-Block

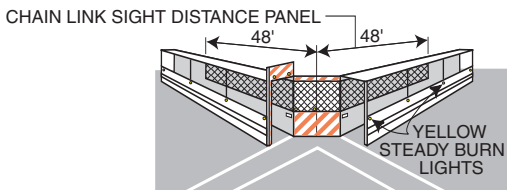
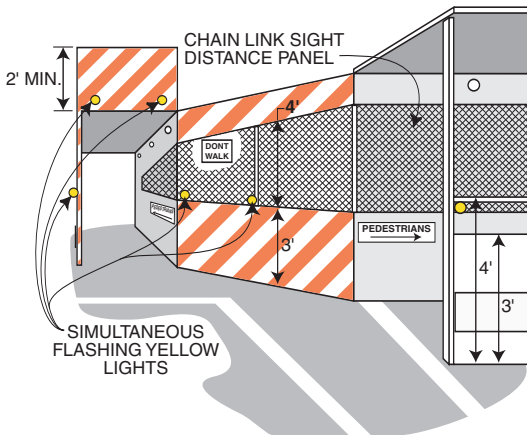


Notes

- Only pedestrian traffic control is shown. Other devices may be needed to control vehicles.
- Components of the walkway are as follows:
 - 4-feet wide walking area minimum
 - 8 feet wide walking area in heavily traveled pedestrian areas
 - 4-feet high railing on the street side between walkway entrances
 - 8-feet high clear walking height
 - Walking surface free of hazards (holes, debris, dust, mud, protruding nails, splinters, etc.)
 - Walking zone brightly illuminated from overhead with 60 or 100-watt electric lamps on a maximum of 32 feet intervals with electric hardwire circuit in conduit
 - 16-feet long chain link sight distance panels at vehicle entrances
 - Ramps provided for wheel chair use. Meet ADA slope requirements
- Do not transport materials aerially over a walkway unless walkway has been closed to pedestrian use. Prevent unsafe interference with pedestrian movement when transporting or moving materials or equipment across a walkway. Do not park vehicles across walkways

4. Construction fences located in the travel portion of the right-of-way shall display flashing yellow light at the entrance to the walkway.
5. At mid block locations provide 3 simultaneously flashing yellow lights for 4-feet wide walkways and 4 simultaneously flashing yellow lights for 8-feet wide walkways.

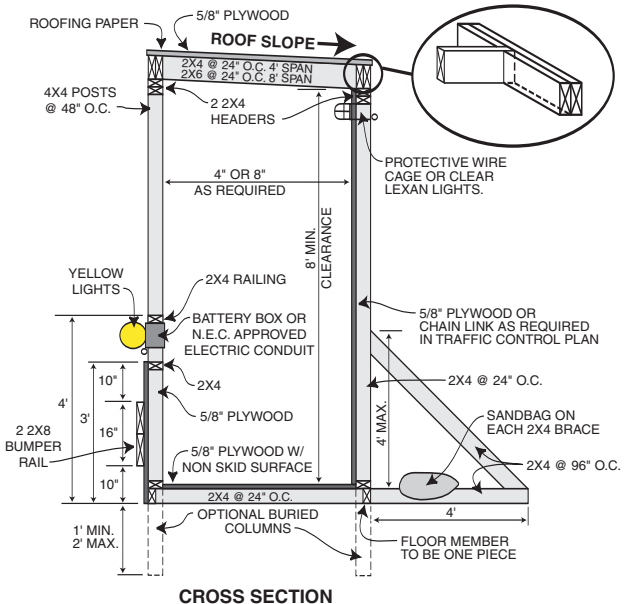
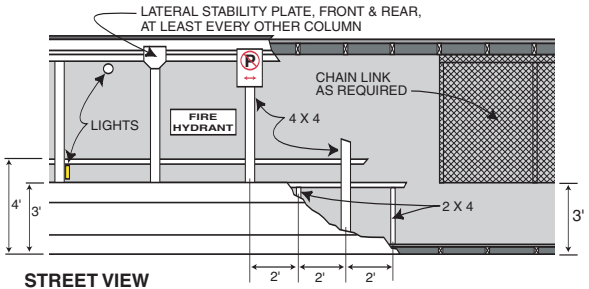
Canopied Walkway at Corner



Notes

1. Only pedestrian traffic control is shown. Other devices may be needed to control vehicles.
2. Display flashing yellow light at the entrance to the walkway located in the travel portion of the right-of-way.
3. At corner locations provide at least 5 simultaneously flashing yellow lights for 4-feet wide walkways and 7 simultaneously flashing yellow lights for 8-feet wide walkways.
4. Meet ADA access ramp slope requirements.

Typical Canopied Walkway Detail
(Street View - Cross Section)



Notes

1. Adhere to Section 4401 and 4407 of the Uniform Building code.
2. Canopies shall be constructed to support a minimum of 150 pounds per square foot live load, uniformly loaded.
3. No Parking signs shall be posted within 50' of each end and at no greater than 100' intervals mounted flush to barricade and 7' minimum above street surface.
4. Walkway width (4' or 8') shall be determined by pedestrian volume or permitting agency.
5. All surfaces shall be painted and maintained white except where orange and white reflectorized hazard markings are required.
6. All lights shall be maintained in working order at all times.
7. Pedestrian approach ramps must be provided at a maximum slope of 10:1 and meet ADA requirements.
8. Optional buried columns may be substituted for angled backside supports if approved by the agency owning the right of way.
9. Protective wire cage or clear lexan fixture with 60-100 watt incandescent lights. Junction boxes and conduit required, placed outside of walkway at 32' on center as well as all entrances and exits. (U.B.C. approved)
10. 7" diameter plastic steady burn electric yellow lights mounted below and outside of handrail spaced 48" on center.

Mobile Operations

Mobile operations are work activities that move along the road either intermittently or continuously. These operations present a serious hazard to workers and motorists. The most desirable method of reducing this hazard is for the vehicle operators to plan their work and avoid stopping in the traveled portion of a road or street whenever possible. Traffic should not be disrupted during peak traffic hours either downtown, at signalized intersections, or on high volume traffic carrying streets.

Safety for mobile operations should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Appropriately colored and marked vehicles with flashing or rotating lights, perhaps augmented with signs or arrow displays, may be used in place of signs and channelizing devices.

Lights and panels shall be located so they remain in full view in front and in rear of the vehicle at all times and are not blocked from sight by moving dump beds, mounted equipment or work activity.

For mobile operation to be successful, the advance warning area for these operations must move with the work area or be repositioned periodically to provide advanced warning for the motorist.

A MINIMUM OF ONE ROTATING FLASHER, STROBE LIGHT OR ARROW PANEL IS REQUIRED (TWO FLASHERS OR STROBES OR ONE ARROW PANEL IS RECOMMENDED)

OPERATING, ROTATING YELLOW FLASHERS, SEALED BEAM TYPE

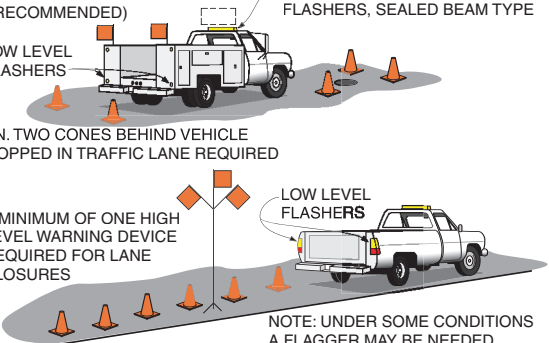
LOW LEVEL FLASHERS

MIN. TWO CONES BEHIND VEHICLE STOPPED IN TRAFFIC LANE REQUIRED

A MINIMUM OF ONE HIGH LEVEL WARNING DEVICE REQUIRED FOR LANE CLOSURES

LOW LEVEL FLASHERS

NOTE: UNDER SOME CONDITIONS A FLAGGER MAY BE NEEDED



Intermittent Mobile Operations – These mobile operations often involve frequent short stops, each as much as 15 minutes long for activities such as litter cleanup, pothole patching, or utility operations and are similar to stationary operations.

Signs, cones, barricades and other channelizing devices are required if vehicle is stopped in the street for more than 15 minutes.

With operations that move slowly (less the 3 MPH), it may be feasible to use stationary signing that is periodically retrieved and repositioned in the advance warning area. In addition, vehicles may be equipped with such devices as flashing vehicle lights, truck mounted attenuators, and appropriate signs.

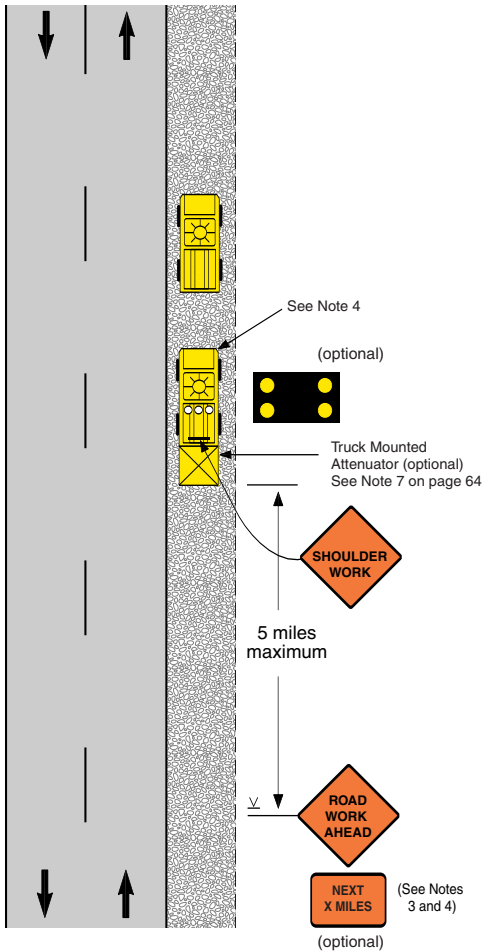
Flaggers may be used, but caution must be exercised so they are not exposed to unnecessary hazards.

Continuously Moving Mobile Operations – These mobile operations include work activities in which workers and equipment move along the road at slow speed without stopping, (e.g. pavement striping, mowing, street sweeping, or herbicide spraying).

On high volume roadways channelizing devices are required for moving operations such as pavement crack sealing. Usually these devices are set up in block-long sections and moved as the work progresses.

For some continuously moving operations where volumes are light and visibility is good, a well-marked and well-signed vehicle may suffice. If volumes or speeds are higher, a shadow or protection vehicle, equipped as a sign truck, should follow the work vehicle. The advance warning area moves with the work area.

Mobile Operation on the Shoulder



Mobile Operation on the Shoulder (cont.)

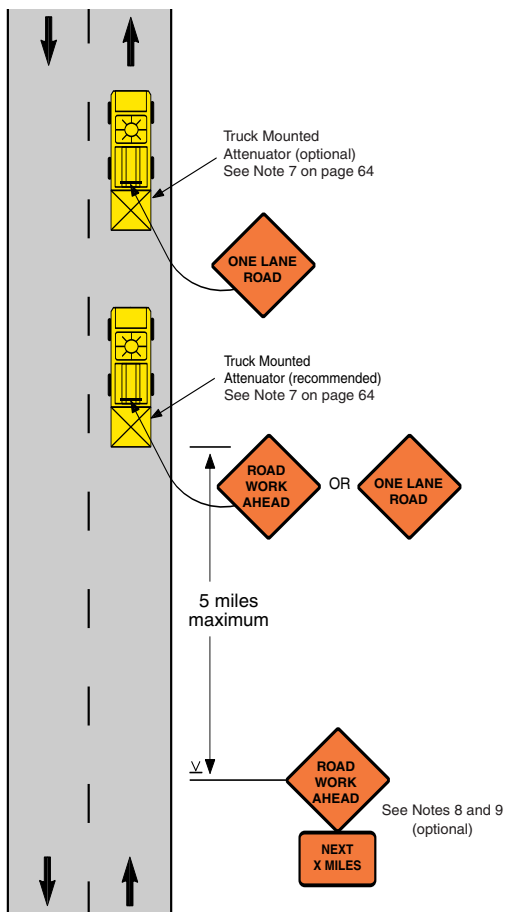
Notes

1. If the operation requires encroachment on the travelway, a mobile or stationary lane closure should be used, unless a 10-foot minimum lane width is maintained and the volume is less than 1500 ADT.
2. For operations that move slowly (less than 5 MPH) and in situations where multiple work locations in a limited distance make it practical to place stationary signs, the maximum spacing from the advanced warning sign to the beginning of the work is 5 miles.
3. The LENGTH OF WORK sign or a supplemental panel (Next x Miles) may be used for work zones of more than 2 miles in length.
4. A protection vehicle equipped with a SHOULDER WORK sign, optional Truck Mounted Attenuator and Arrow Display (in CAUTION mode) may be used, depending on availability and type of operation. Its use is recommended on high-volume roads, or roads with poor sight distance. If used, it is located behind the work vehicle to provide protection and advance warning for the operation. If the protection vehicle with sign is used, the stationary sign may be eliminated.
5. Warning signs are not required if the work vehicle displays a flashing or revolving yellow light, if the distance between work locations is one mile or more, and if the work vehicle travels at traffic speeds between locations.
6. Other acceptable advanced warning signs include SHOULDER WORK, UTILITY WORK AHEAD, MOWING, WORKER signs, and ROAD MACHINERY AHEAD.
7. Table below shows recommended roll-ahead distances between a protection vehicle with a truck-mounted attenuator (TMA) and the work area for both stationary and mobile operations. Roll-ahead distance for the protection vehicle may vary depending upon recommendations of the TMA manufacturer.

Roll-ahead Distances for TMAs

Speed	Stationary	Mobile
≤45 mph	100 ft	150 ft
50-55 mph	150 ft	200 ft
60-65 mph	200 ft	275 ft

Mobile Operation on a Two-Lane Road



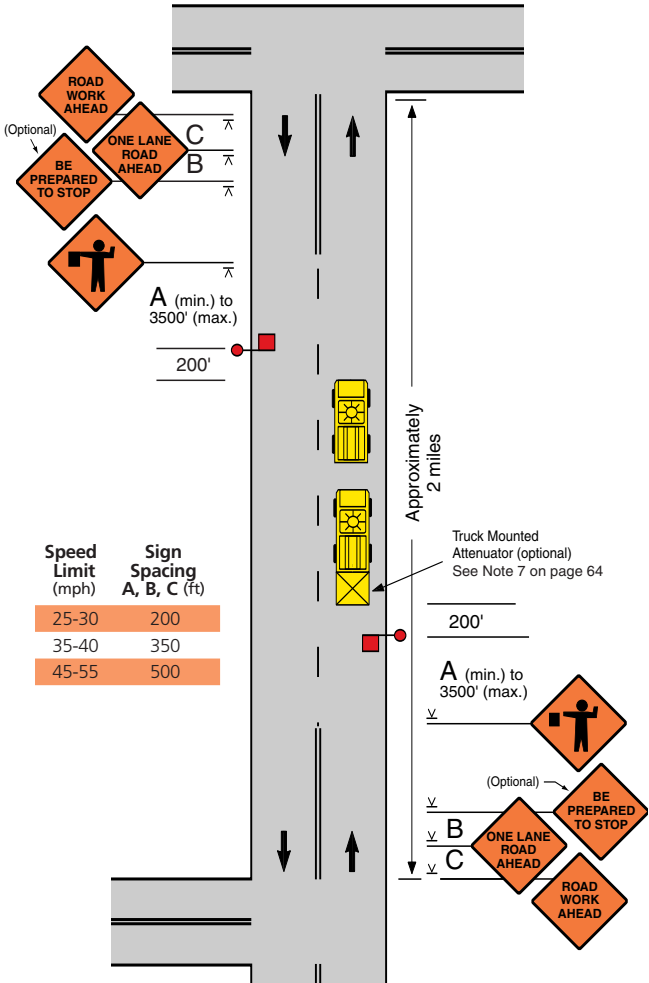
Mobile Operation on a Two-Lane Road (cont.)

Notes

1. Where practicable and when needed, the work and protection vehicles should pull over periodically to allow traffic to pass. If this can not be done frequently, as an alternative, a "DO NOT PASS" sign may be placed on the rear of the vehicle blocking the lane.
2. The distance between the work and protection vehicles may vary according to terrain, paint drying time, and other factors. Protection vehicles are used to warn traffic of the operation ahead. Whenever adequate stopping sight distance exists to the rear, the protection vehicle should maintain the minimum distance and proceed at the same speed as the work vehicle. The protection vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.
3. Additional protection vehicles to warn and reduce the speed of oncoming or opposing traffic may be used. Police patrol cars may be used for this purpose.
4. A truck-mounted attenuator (TMA) should be used on the protection vehicle and may be used on the work vehicle.
5. The work vehicle shall be equipped with beacons, and the protection vehicles shall be equipped with two high-intensity flashing lights mounted on the rear, adjacent to the sign. Protection and work vehicles should display flashing or rotating beacons both forward and to the rear.
6. Vehicle-mounted signs shall be mounted with the bottom of the sign, at a minimum height of 4 feet above the pavement. Sign legends shall be covered or turned from view when work is not in progress.
7. For roadways with volume less than 1500 ADT, especially if sight distance is good, the protection vehicle may not be practicable. For higher volume conditions the protection vehicle should be used.
8. Stationary advance warning signs similar to that on the protection vehicle may be used to provide additional advance warning for the operation. These signs might include: SLOW MOVING TRAFFIC, ROAD WORK AHEAD, PAINT CREW AHEAD, etc. These signs should be considered where speed or volumes are high, where sight distance is limited, or if a protection vehicle is not used. If stationary signs are not used, the sign on the protection vehicle should be the ROAD WORK AHEAD sign.
9. If stationary signs are used and the activity is spread out over a distance of more than 2 miles, the LENGTH OF WORK sign or a supplemental panel should be used.

Mobile Operation on a Two-Lane Road Using Flaggers

(15 minutes or less per work area and traveling at less than 5 mph)

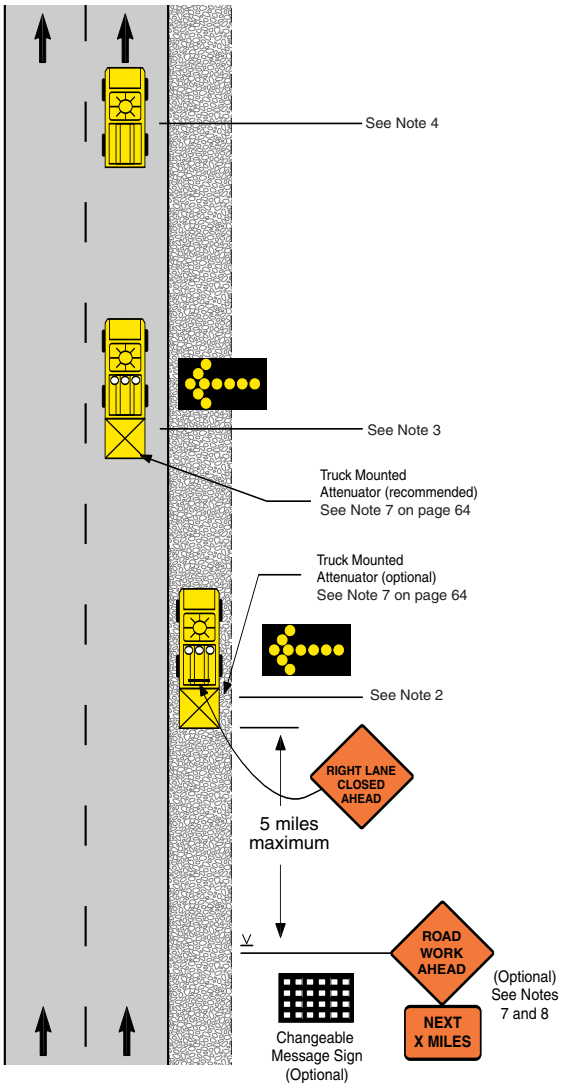


*Mobile Operation on a
Two-Lane Road Using Flaggers
(15 minutes or less per work area and
traveling at less than 5 mph) – (cont.)*

Notes

1. The distance between ROAD WORK AHEAD signs should not exceed approximately 2 miles.
2. Where feasible, well defined end points (e.g. intersections, major driveways, city limits, etc.) should be used to establish the limits of the work zone.
3. FLAGGER warning signs should be repositioned periodically as the operation moves.
4. Suggested protection vehicle configuration includes rotating beacons, flashers and a truck mounted attenuator.
5. If there is a sideroad intersection within the work area, additional traffic control, such as flaggers and appropriate signage, may be needed on the sideroad approaches.

Mobile Operation on a Multi-Lane Road



Mobile Operation on a Multi-Lane Road (cont.)

Notes

1. Vehicles used for these operations should be made highly visible with appropriate equipment, such as flashing lights, rotating beacons, flags, signs, or arrow displays.
2. Protection vehicle #1 should be equipped with a 60 x 30 Type B arrow board minimum and may be equipped with a truck mounted attenuator. An appropriate lane closure sign should be placed on protection vehicle #1 so as not to obscure the arrow display.
3. Protection vehicle #2 should be equipped with an arrow display and truck-mounted attenuator.
4. On high-speed roadways, a third protection vehicle #3 should be used in the closed lane.
5. Protection vehicle #1 should travel at a varying distance from the work operation so as to provide adequate sight distance for traffic approaching from the rear.
6. When adequate shoulder width is not available, protection vehicle #1 should be eliminated.
7. Stationary advance warning signs may be used to provide additional advance warning for the operation. These signs might include: SLOW MOVING TRAFFIC AHEAD, ROAD WORK AHEAD, PAINT CREW AHEAD, etc. These signs or a changeable message sign or both should be used where speeds and volumes are high, where sight distance is limited, or if protection vehicle #1 is not used.
8. If stationary signs are used and the activity is spread out over a distance of more than 2 miles, the LENGTH OF WORK sign or a supplemental panel should be used.
9. Work should normally be done during off-peak hours.

Acknowledgments

This pocket guide was adapted for use from a similar one produced by the Wisconsin Department of Transportation (WisDOT) and the Wisconsin Transportation Information Center (TIC). The Utah Chapter of the American Public Works Association (APWA), the Utah Chapter of the Associated General Contractors of America (AGC), and Utah Chapter of the Institute of Traffic Engineers (ITE) acknowledge and wish to thank WisDOT and TIC for the use of their document.

Information and Training

For further information, additional copies of this pocket guide, and training opportunities in basic work zone traffic control, flagging, and other street and highway design, operation, and maintenance topics contact the Utah Transportation Technology Transfer Center, a project of Utah State University, funded as a Local Transportation Assistance Program by the Federal Highway Administration, the Utah Department of Transportation, and USU-Extension Services. Their local address is as follows.

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435 797-1582 fax
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web site: <http://www.utaht2.usu.edu>

References

MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways, U. S. Department of Transportation, Federal Highway Administration, Washington, D. C. 20590. Revisions as adopted by the State of Utah Department of Transportation, 4501 South 2700 West, Salt Lake City, Utah 84119

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