STATE OF CALIFORNIA
BUSINESS, TRANSPORTATION AND HOUSING
DEPARTMENT OF TRANSPORTATION

TRAFFIC MANUAL

CHAPTER 5
TRAFFIC CONTROLS
for
Construction and Maintenance Work Zones

Caltrans Metric

January, 1996
(Revision 2)

MEANINGS

"Shall", "Should", and "May"

In this document the words "shall", "should", and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended by the use of these words, the following definitions apply:

1. **Shall** - A mandatory condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory when an installation is made that these requirements be met. Exceptions to these conditions on the State Highway System can be approved on a case by case basis by the Manager, Traffic Operations Program or his representative. Documentation shall be provided.

2. **Should** - An advisory condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.

3. **May** - A permissive condition. No requirement for design or application is intended.

Road Users

This Manual uses terms such as "traffic", "motorists", "vehicles", "drivers", and "road users." These terms are used interchangeably and all are intended to include operators of motor vehicles, including bicyclists, as well as pedestrians.

COLOR CODE

The following color code establishes general meanings for eight colors in a total of twelve colors that have been identified as being appropriate for use in conveying traffic control information. Central values and tolerance limits for each color are available.*

YELLOW - General Warning
RED - Stop or prohibition
BLUE - Motorist services guidance
GREEN - Indicated movements permitted, direction, guidance
BROWN - Recreational and cultural interest guidance
ORANGE - Construction and maintenance warning
BLACK - Regulation
WHITE - Regulation
PURPLE - Unassigned
STRONG YELLOW GREEN - Unassigned
LIGHT BLUE - Unassigned
CORAL - Unassigned

The four colors for which no meaning has been assigned are being reserved for future applications. The meanings described above are of a general nature. More specific assignments of colors are given in the individual parts of this Manual relating to each class of devices.

(*) Available from the Federal Highway Administration (HTO 20), Washington D.C. 20590

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CHAPTER 5

TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE WORK ZONES

General Information 5-01

5-01.1 Introduction

During any time the normal function of a roadway is suspended, temporary traffic control planning must provide for continuity of function (movement of traffic, pedestrians, bicyclists, transit operations, and access to property/utilities). The location where the normal function of the roadway is suspended is defined as the work space. The work space is that portion of the roadway closed to traffic and set aside for workers, equipment, and material. Sometimes there may be several work spaces within the project limits. This can be confusing to drivers because the work spaces may be separated by several miles. Each work space should be signed to inform drivers of what to expect.

Effective temporary traffic control enhances traffic operations and efficiency, regardless of whether street construction, maintenance, utility work, or roadway incidents are taking place in the work space. Effective temporary traffic control must provide for the workers, road users, and pedestrians. At the same time, it must provide for the efficient completion of whatever activity suspended normal use of the roadway.

No one set of signs or other traffic control devices can typically satisfy all conditions for a given project. At the same time, defining detailed standards that would be adequate to cover all applications is simply not practical. This Manual displays several diagrams that depict common applications of standard temporary traffic control devices. The traffic control selected for each situation should be based on type of highway, traffic conditions, duration of operation, physical constraints, and the nearness of the work space to traffic.

Traffic control plans may be adopted by the authority of a public body or official having jurisdiction for guiding traffic. The plans and devices should follow the principles set forth in this Manual but may deviate from the typical drawings to allow for conditions and requirements of a particular site or jurisdiction as determined by the engineer.

The criteria of this Manual are intended to apply to both rural and urban areas. Rural highways are normally characterized by lower volumes, higher speeds, fewer turning conflicts, and fewer conflicts with pedestrians and bicyclists. Urban street traffic is typically characterized by relatively low speeds, wide ranges in traffic volume, narrower roadway lanes, frequent intersections, significant pedestrian traffic, bicyclists and more roadside obstacles.

It is essential that concern for traffic accidents, worker safety and efficiency of traffic movement form an integral element of every temporary traffic control zone, from planning through completion of work activity. Simultaneously, the control selected must permit efficient maintenance/ construction of roadways and roadway appurtenances.

5-01.2 Fundamental Principles

All traffic control devices used on street and highway construction, maintenance, utility, or incident management (temporary traffic control) operations shall conform to the applicable specifications of this Manual.

Special plan preparation and coordination with transit and other highway agencies, police and other emergency units, utilities, schools, railroads, etc. may be needed to receive input and support for advising the motorists of the traffic operation situations.

During temporary traffic control activities, commercial vehicles may need to follow a different route from automobiles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials may need to follow a different route from other vehicles. Truck Route National Network and hazardous cargo signs are included in Chapter 4 of the Caltrans Traffic Manual.

Principles and procedures, which experience has shown to benefit the motorists, bicyclists, pedestrians, and workers in the vicinity of temporary traffic control areas, are included in the following listing. These principles and procedures provide a guiding philosophy, for the practitioner, of good temporary traffic control used in work zones. They do not establish specific standards and warrants (individually addressed in the succeeding sections of this Manual).

A. Traffic operations in temporary traffic control areas should be an integral and high-priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with motorists, pedestrians, bicyclists, and workers kept in mind at all times. Formulating specific plans for incident management traffic control is difficult because of the variety of situations that can arise. Nevertheless, plans should be developed in sufficient detail to provide for motorists, pedestrians, bicyclists, workers, and enforcement/emergency personnel and equipment.

   1. The basic principles governing the design of permanent roadways and roadsides should also govern the design of temporary traffic control zones. The goal should be to route traffic through such areas using geometrics and traffic control devices comparable to those for normal highway situations.

   2. A traffic control plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the traffic control plan shall be approved by an engineer.

B. Traffic movement should be disrupted as little as practicable.

   1. Traffic control in work and incident sites should be designed on the assumption that drivers will reduce their speeds only if they clearly perceive a need to do so. Reduced speed zoning should be avoided as much as practical.

   2. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions requiring rapid maneuvers should be avoided.

   3. Provisions should be made for operation of work or management vehicles, particularly on high-speed, high-volume roadways.

   4. Roadway occupancy and work completion time should be minimized to reduce exposure to potential conflicts.

5. Pedestrians and bicyclists should be provided with access and passage through, or around, the temporary traffic control zone at all times.

6 Construction or maintenance work on the roadway should be scheduled during off-peak hours and, if necessary, night work should be considered.

C. Drivers (including bicyclists) and pedestrians should be guided in a clear and positive manner while approaching and space traversing the temporary traffic control zone.

1. Adequate warning, delineation, and channelization by means of proper pavement marking, signs, or use of other devices that are effective under varying conditions of light and weather should be provided where appropriate to assure the driver and pedestrian have positive guidance before approaching and while passing through the traffic control zone.

2. Signs, pavement markings, channelizing devices, delineators, and other traffic control devices that are inconsistent with intended travel paths through long-term work spaces should be completely removed (see Section 5-05.7). In short-duration and mobile work spaces where retained permanent devices are inconsistent with intended travel paths, attention should be given to devices that highlight or emphasize the appropriate path.

3. Flagging procedures, when used, can provide positive guidance to drivers traversing the temporary traffic control zone. Flagging should be employed when all other methods of traffic control are inadequate to warn and direct drivers.

D. To ensure acceptable levels of operation, routine inspection of traffic control elements should be performed.

1. Only individuals who are trained and/or experienced in the principles of traffic control should be assigned that responsibility at work sites. The most important duty of these individuals is to ensure that all traffic control measures implemented on the project are necessary, conform to the traffic control plan, and are effective in providing for motorists, pedestrians, and workers.

2. Modification of traffic controls or working conditions may be required to expedite traffic movement and to promote worker safety. It is essential that the individual responsible for traffic control have the authority to control the progress of work on the project with the authority to modify conditions or halt work until applicable or remedial measures are taken.

3. Temporary traffic control zones should be carefully monitored under varying conditions of traffic volume, light, and weather to ensure that traffic control measures are operating effectively and that all devices used are clearly visible, clean, and in good repair.

4. When the need arises, an engineering analysis should be made (in cooperation with law enforcement officials) of all

accidents occurring in temporary traffic control zones. Temporary traffic control zones and collision records should be monitored to identify and analyze traffic collisions or conflicts. For example, skid marks or damaged traffic control devices may indicate the need for changes in the traffic control.

5. All traffic control devices should be removed when no longer needed. When work is suspended for short periods, advance warning signs that are no longer appropriate shall be removed, covered, or turned, and other inappropriate devices removed from the work zone so they are not visible to drivers.

E. The maintenance of temporary traffic control zones requires attention during its life because of the potential increase in conflicts.

1. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, it is desirable to provide an unencumbered roadside recovery area.

2. Channelization of traffic should be accomplished by pavement markings, signs, and/or lightweight channelizing devices that will yield when hit by errant vehicles.

3. Whenever practical, equipment, workers' private vehicles, materials, and debris should be stored in such a manner as to reduce conflicts with run-off-the-road vehicles.

4. When pedestrian paths traverse through the temporary traffic control zone, temporary pedestrian facilities should be developed to minimize pedestrian exposure to errant vehicles.

F. Each person whose actions affect temporary traffic control zone from upper-level management personnel through field personnel should receive training and/or experience appropriate to the job decisions each is required to make. Only those who are trained and/or experienced in traffic control practices, and who have a basic understanding of the principles established by applicable standards and regulations, should supervise the selection, placement, and maintenance of traffic control devices in work and incident management zones.

G. Maintaining good public relations is necessary. The cooperation of the various news media in publicizing the existence of and reasons for work sites can be of great assistance in keeping the motoring public well informed.

Temporary Traffic Control Elements 5-02

5-02.1 Traffic Control Plans

Traffic Control Plans (TCP's) play a vital role in providing continuity for efficient traffic flow, to the extent interruptions in normal flow are necessary for temporary traffic control operations or other events that must temporarily disrupt normal traffic flow. Important auxiliary provisions that cannot conveniently be specified on project plans can easily be incorporated into Special Provisions within the TCP. Also refer to the Caltrans Highway Design Manual Section 110.6.

A TCP describes traffic controls to be used for facilitating all traffic through a temporary traffic control zone. The plan may range in scope from being very detailed, to merely referencing typical drawings contained in this Manual, standard approved highway agency drawings and manuals, or specific drawings contained in contract documents. The degree of detail in the TCP depends entirely on the complexity of the situation, and TCP's should be prepared by persons knowledgeable about the principles of temporary traffic control and the work activities to be performed.

Traffic control planning requires forethought. Provisions may be incorporated into the project bid documents that enable contractors to develop alternate traffic control plans, which may be used only if the responsible agency finds they are as good as those provided in the plans/specifications. For maintenance and minor utility projects that do not require bidding, forethought must be given to selecting the best traffic control before occupying the temporary traffic control zone. Also, coordination must be made between projects to ensure that duplicate signing is not used and to ensure compatibility of traffic control between adjacent projects.

Modifications of TCP's may be necessary because of changed conditions or determination of even better ways of handling traffic efficiently, while permitting efficient temporary traffic control activities to progress.

5-02.2 Definitions of Temporary Traffic Control Zone Components

The temporary traffic control zone includes the entire section of roadway between the first advance warning sign through the last traffic control device, where traffic returns to its normal path and conditions. Most temporary traffic control zones can be divided into four areas: the advance warning area, the transition area, the activity area, and the termination area. Figure 5-1 illustrates these four areas.

The four components that constitute a temporary traffic control zone are described in the order that drivers encounter them. They include the following:

A. Advance Warning Area

In the advance warning area, drivers are informed of what to expect. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area. On freeways and expressways, where driver speed is generally in the higher range (70 km/h or more), signs may be placed from 150 m to 800 m or more before the temporary traffic control zone. The true test of adequacy of sign spacing is to evaluate how much time the driver has to perceive and react to the condition ahead. In this regard, the use of speed, roadway condition, and related driver expectancy must be considered in order to derive a practical sign spacing distance. Effective placement of warning signs for urban and rural locals is as follows:

1. Urban

   Warning sign spacings in advance of the transition area usually fall within the range of 1 to 2 times the speed (km/h) in meters, with the high end of the range being used when speeds are relatively high. When two or more advance signs are used on higher-speed streets such as major arterials, the advance warning area should extend a greater distance. (See Table 5-3.)

2. Rural

   Rural roadways are characterized by higher speeds. Spacing for the placement of warning signs is longer. Two or more advance warning signs are normally used in these conditions; the advance warning area should extend 300 m or more in open highway conditions. (See Table 5-3.) Advance warning is normally not needed when the activity area is 9 m or greater from the driver's path.

B. Transition Area

When redirection of the driver's normal path is required, traffic must be channelized from the normal path to a new path. This redirection is intended to occur at the beginning of the transition area. In mobile operations, this transition area moves with the work space. Transition areas usually involve strategic use of tapers, which are discussed in more detail in Section 5-02.3.

C. Activity Area

The activity area is an area of roadway where the work takes place. It is composed of the work space and the traffic space, and may contain one or more buffer spaces.

1. Work Space

   The work space is that portion of the roadway closed to traffic and set aside for workers, equipment, and material. Work space may be fixed or may move as work progresses. Long-term work spaces are usually delineated by channelizing devices or shielded by barriers to exclude traffic and pedestrians.

2. Traffic Space

   The traffic space is the portion of the roadway in which traffic is routed through the activity area.

3. Buffer Space

   The buffer space is an optional feature in the activity area that separates traffic flow from the work activity and provides recovery space for an errant vehicle. Neither work activity nor storage of equipment, vehicles, or material should occur in this space. Buffer spaces may be positioned longitudinally and laterally, with respect to the direction of traffic flow.

a. Longitudinal Buffer Space

The longitudinal buffer space may be placed in the initial portion of a closed lane in advance of the work space, as shown in Figure 5-1. When a protection vehicle is placed in advance of the work space, only the space upstream of the vehicle constitutes the buffer space.

The longitudinal buffer space, as depicted in Figure 5-2, should be used where a closed lane separates opposing traffic flows. Typically, it is formed as a traffic island and defined by channelizing devices.

A guide for the length of longitudinal buffer space is shown in Table 5-1. The length may be adjusted to satisfy individual agency needs.

b. Lateral Buffer Space

A lateral buffer space may be used to separate the traffic space from the work space, as shown in Figure 5-1, such as an excavation or pavement drop-off. A lateral buffer space also may be used between two travel lanes, especially those carrying opposing flows. The width of the lateral buffer space should be determined by engineering judgment.

4. Incident Management Vehicle Storage Space

When work occurs on a high-volume, highly congested facility in an urban area, it is optional to allow space to store emergency vehicles (e.g., tow trucks) to respond quickly to traffic incidents. The storage space is typically provided at the beginning or end of the activity area, or both. An emergency vehicle storage area should not extend into any portion of the buffer space.

D. Termination Area

The termination area is used to return traffic to the normal traffic path. The termination area extends from the downstream end of the work zone to the END ROAD WORK signs (C14), if posted. Conditions may be such that posting of END ROAD WORK signs is not helpful. For example, they should normally not be used if other temporary traffic control zones begin within 1500 m of the end of the work space in rural areas, or about 500 m within urban areas. For normal daytime maintenance operations, the END ROAD WORK sign is optional. See also Section 5-05.2, C3, END CONSTRUCTION/ROAD WORK sign.

5-02.3 Tapers

A common important element of a temporary traffic control zone is a roadway taper. Tapers may be used in both the transition and termination areas. Tapers are created using a series of channelizing devices or pavement markings placed to move traffic out of or into its normal path. Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be desirable to adjust the length of tapers. Longer tapers are not necessarily better than shorter tapers (particularly in urban areas characterized by short block lengths, driveways, etc.), because extended tapers tend to encourage

Figure 5-1
Component Parts of a Temporary Traffic Contol Zone

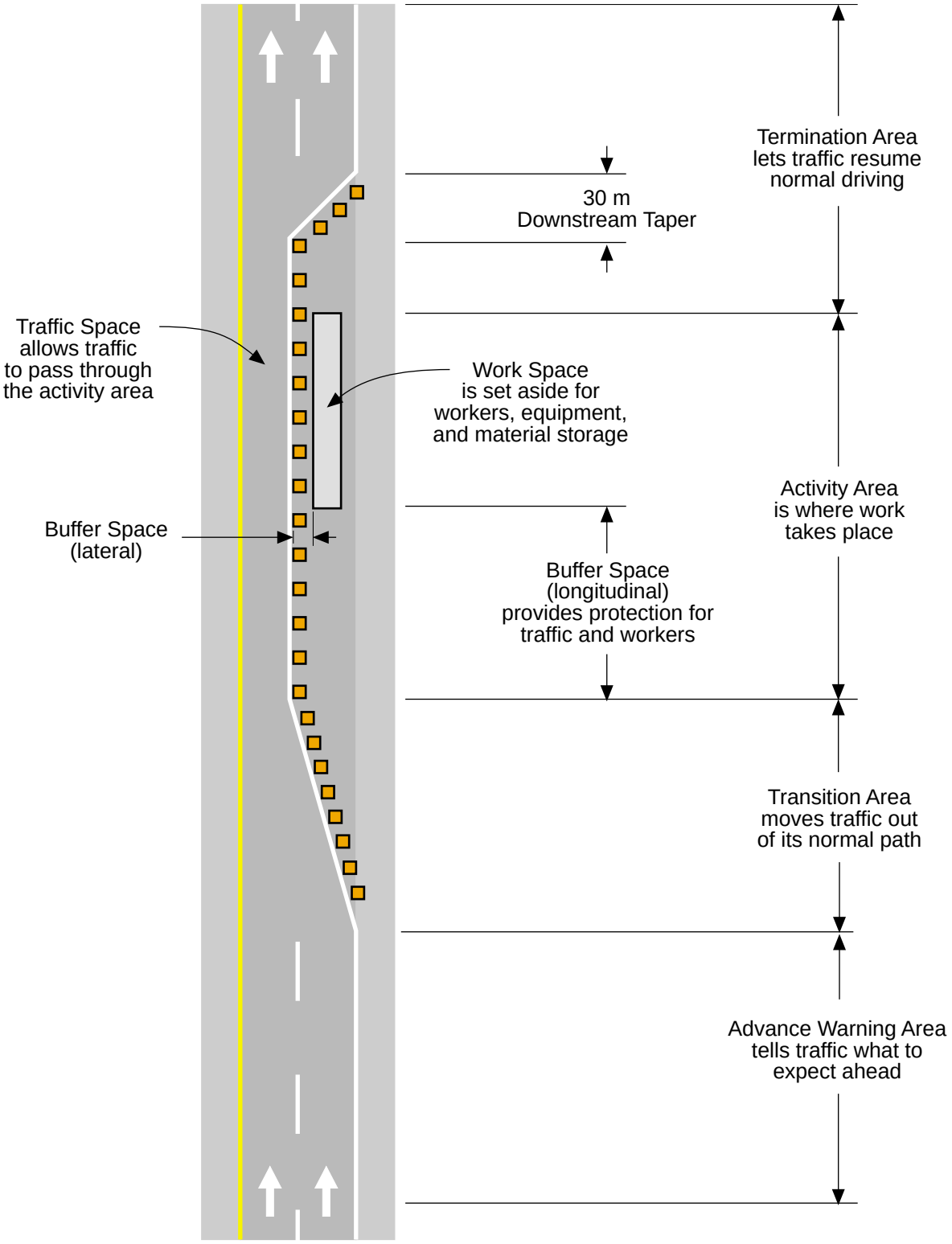


Figure 5-2
Tapers and Buffer Space

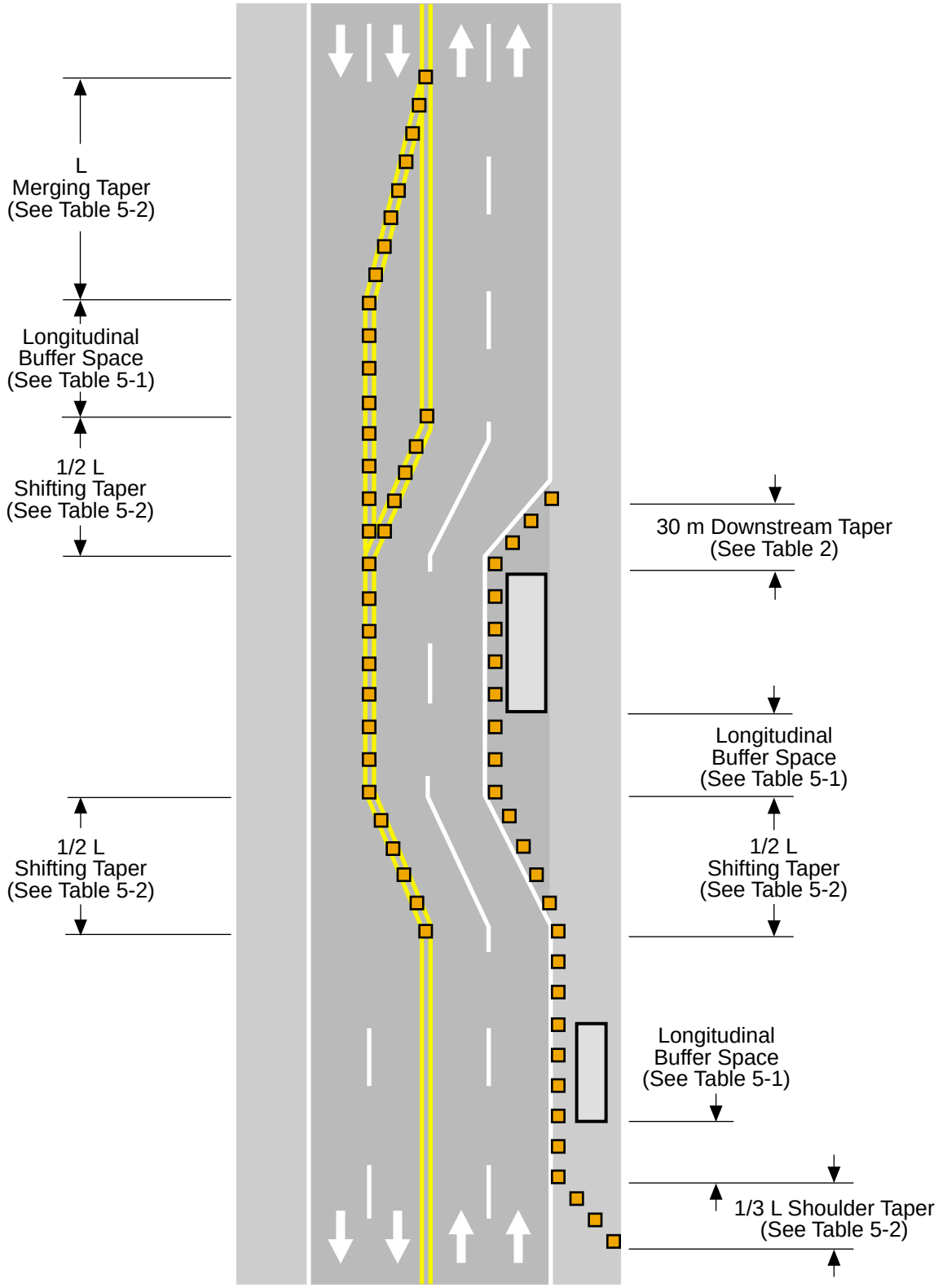


Table 5-1
Guidelines for Length of Longitudinal Buffer Space[1]

English Measurements

Speed in Miles Per Hour*	Length of Buffer Space (feet)
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335
60	415
65	485
70	585

Metric Measurements

Speed in Kilometers Per Hour*	Length of Buffer Space (meters)
30	10
40	17
50	28
60	43
70	62
80	84
90	106
100	136
110	170

*Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed.

[1]Based upon American Association of State Highway and Transportation Officials (AASHTO) braking distance portion of stopping sight distance for wet and level pavements. This AASHTO document also recommends adjustments for the effect of grade on stopping and variation for trucks.

Table 5-2
Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length
Upstream Tapers	
Merging Taper	L Minimum
Shifting Taper	1/2 L Minimum
Shoulder Taper	1/3 L Minimum
Two-Way Traffic Taper	30 meters (100 feet) Maximum
Downstream Tapers	
(Use is optional)	30 meters (100 feet) Minimum

Formula for Taper Length 'L'

(For State Highways, see Traffic Control Systems in the Caltrans Standard Plans.)

English	Metric*
$L = \frac{WS^2}{60}$ (40 mph or less)	$L = \frac{WS^2}{150}$ (65 km/h or less)
$L = WS$ (45 mph or greater)	$L = \frac{2\,WS}{3}$ (70 km/h or greater)
L = Taper Length in feet	L = Taper Length in meters
W = Width of Offset in feet	W = Width of Offset in meters
S = Speed in mph	S = Speed in km/h

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

* The metric formulas result in larger values due to a rounding off of the constant in coverting the English formula to a Metric formula.

sluggish operation and to encourage drivers to delay lane changes unnecessarily. The real test of taper length involves observation of driver performance after traffic control plans are put into effect. Types of taper lengths are presented in Table 5-2. The maximum space in meters between devices in a taper numerically approximates one-fifth the speed in kilometers per hour. Types of tapers are shown in Figure 5-2 and the two-way traffic taper is shown in Figure 5-3:

A. Merging Taper

A merging taper requires the longest distances because drivers are required to merge with an adjacent lane of traffic at the prevailing speed. The taper should be long enough to enable merging drivers to adjust their speeds and merge into a single lane before the end of the transition. For freeways, expressways, and other roadways having a speed of greater than 65 km/h, the minimum length for merging tapers should be computed by a formula $L = 2/3WS$. For residential, urban, and other streets with speeds of 65 km/h or less, the formula $L = (WS^2)/150$ should be used. Under either formula, L is the taper length in meters, W is the lateral shift of traffic due to the partially or fully closed lane (in meters), and S is the posted speed (in km/h), the off-peak 85th percentile speed prior to work starting or the anticipated operating speed. The formula $L = (WS^2)/150$ is used for speeds of 65 km/h or less because slower traffic can merge safely in a shorter distance.

B. Shifting Taper

A shifting taper is used when merging is not required, but a lateral shift is needed. Approximately one-half L has been found to be adequate. Where more space is available, it may be beneficial to use longer distances. Guidance for changes in alignment may also be accomplished by using horizontal curves designed for normal highway speeds.

C. Shoulder Taper

A shoulder taper may be beneficial on high-speed roadways with improved shoulders that may be mistaken for driving lanes (when work is occurring in, or near, the shoulder area). If used, shoulder tapers approaching the activity area should have a length of about one-third L. If a shoulder is used as a travel lane either through practice or during a temporary traffic activity, a normal merging or shifting taper should be used. An example of a shoulder taper is presented in Figure 5-2.

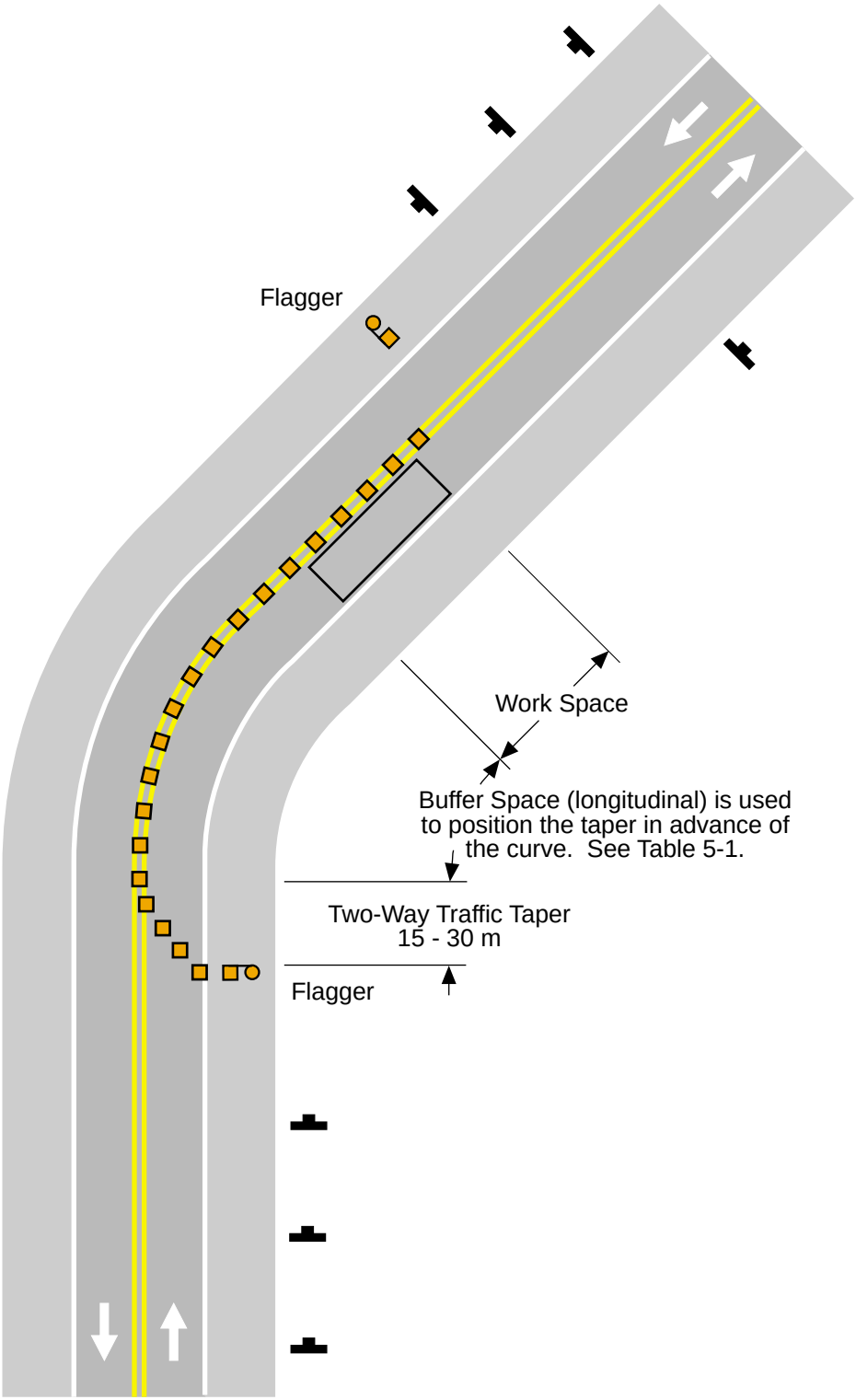
D. Downstream Taper

The downstream taper may be useful in termination areas to provide a visual cue to the driver that access is available to the original lane/path that was closed. When a downstream taper is used, it should have a maximum length of about (Rev. 1)30 meters per lane, with devices spaced about 6 meters apart. An example of a downstream taper is shown in Figure 5-2.

E. One-Lane, Two-Way Taper

The one-lane, two-way traffic taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. Typically, traffic is controlled by a temporary traffic signal or a flagger. A short taper having a

Figure 5-3
Example of a Two-Way Traffic Taper



proceeding through the section. The use of an official car eliminates the possibility of loss of the flag.

C. Pilot Car Method

A pilot car is normally used to guide a queue of vehicles through the more complex temporary traffic control zone or detour. Its operation must be coordinated with flagging operations or other controls at each end of the one-lane section.

The pilot car should have the name of the contractor or contracting authority prominently displayed. The PILOT CAR FOLLOW ME sign (C26) shall be mounted at a conspicuous location on the rear of the vehicle.

Two or more pilot cars may be used to guide two-way traffic through a particularly complex detour.

D. Temporary Traffic Signal Method

Traffic signals may be used to control vehicular traffic movements in temporary traffic control zones. Traffic signals should also be considered for half-width bridge reconstruction on low-to moderate-volume highways. Typical applications include highway or street intersections with a temporary haul road or equipment crossing and through areas requiring alternating one-way traffic operations.

E. Stop or Yield Control Method

A yield or stop sign may be installed on low volume, two-lane roads where one side of the roadway is closed and the other side must serve both directions. The side that is closed should yield to or stop for oncoming traffic on the side that is open. The approach to the side that is not closed must be visible (for a distance equal to the safe passing sight distance for that approach) to the driver who must yield or stop. See "No Passing Zones Markings" in Chapter 6 of the Caltrans Traffic Manual.

5-02.6 Transit Considerations

Provision for effective continuity of transit service needs to be incorporated into the temporary traffic control planning process. Often times, public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). On transit routes, the TCP shall provide for features such as temporary bus stops, pull-outs, and waiting areas for transit patrons.

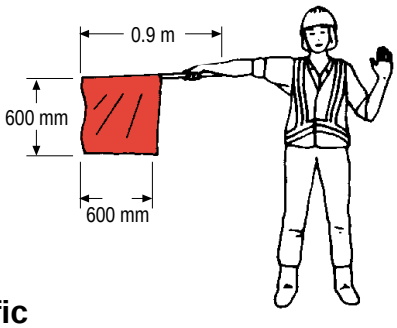
Figure 5-4
Use of Hand-Signaling Devices by Flaggers

PREFERRED METHOD

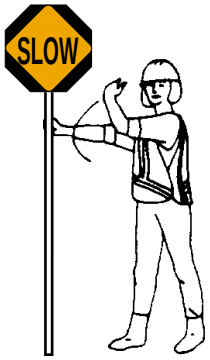
Paddle

EMERGENCY USE ONLY

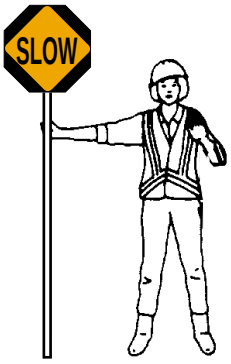
Flag

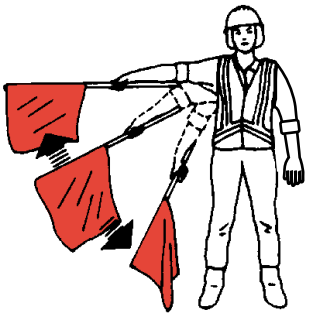


To Stop Traffic



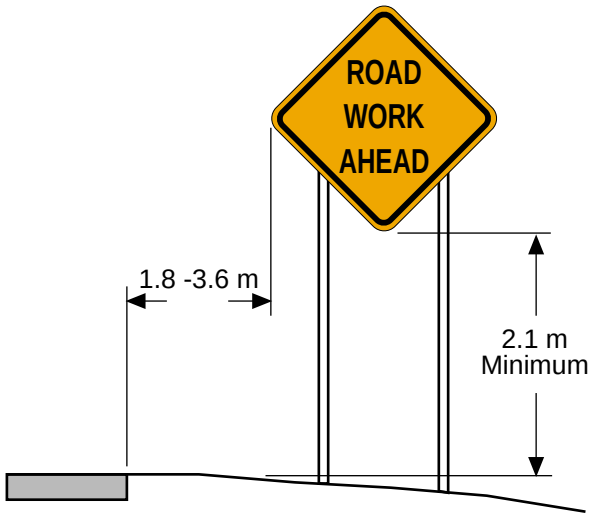
Traffic Proceed



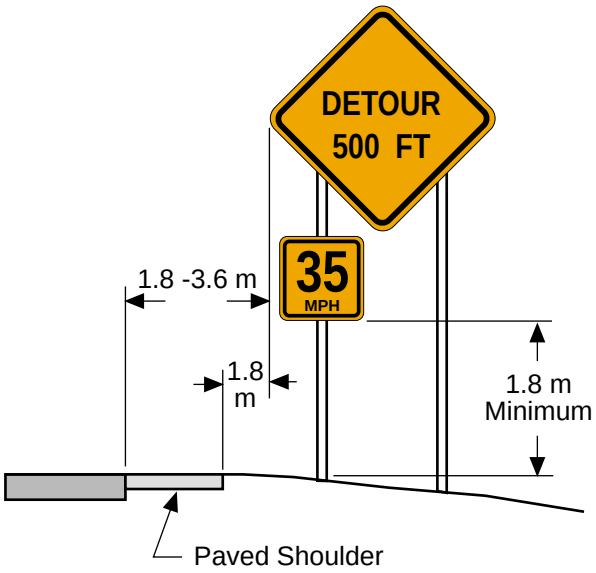


To Alert and Slow Traffic

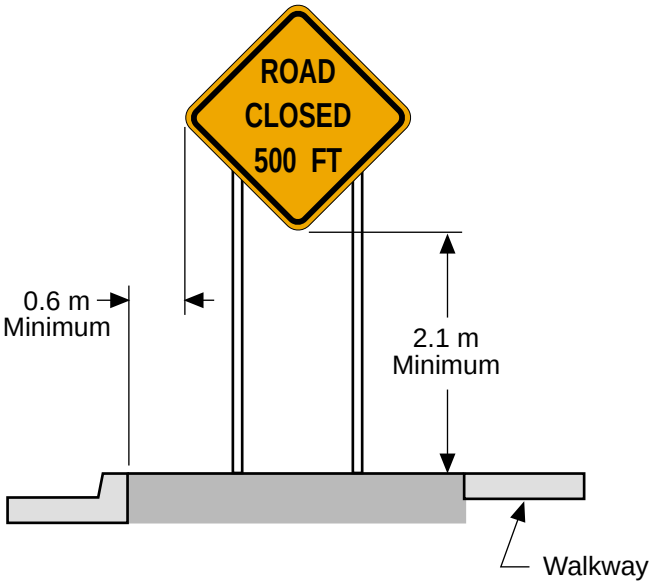
Figure 5-5
Height and Lateral Location of Signs
(Typical Installation)



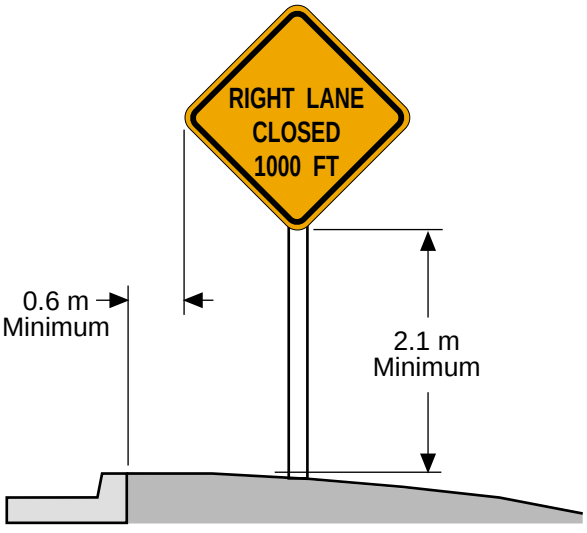
RURAL DISTRICT



RURAL DISTRICT WITH ADVISORY SPEED PLATE

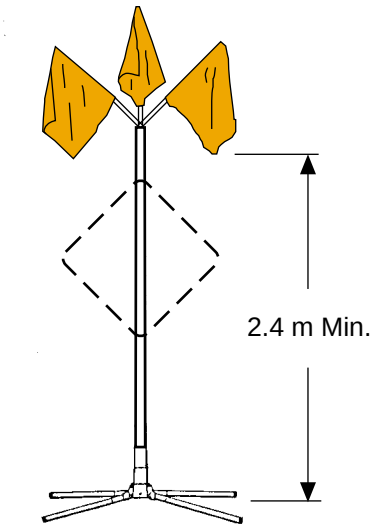


URBAN DISTRICT

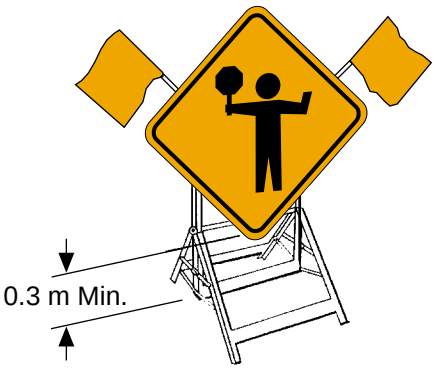


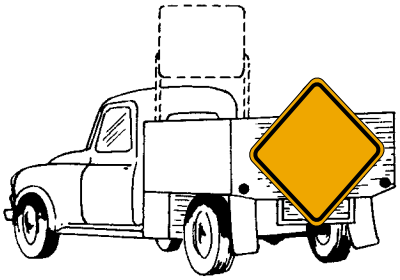
URBAN DISTRICT

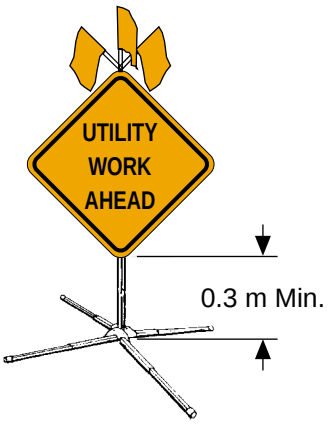
Figure 5-6
Methods of Mounting Signs Other Than on Posts



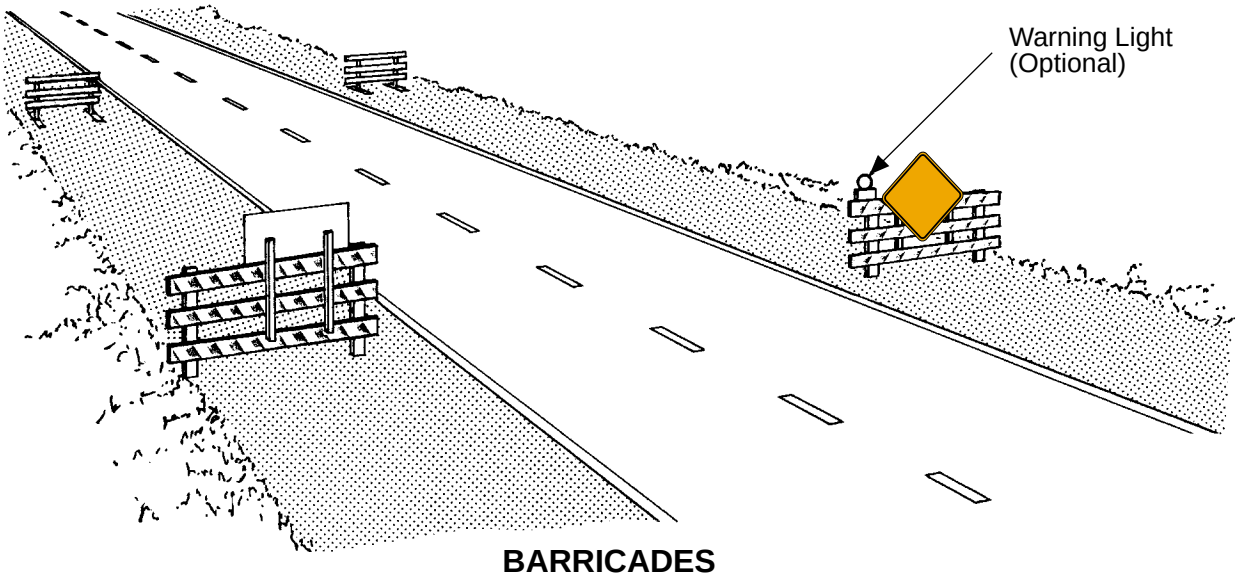
High Level Warning Device (Flag Tree/Sign Optional)







PORTABLE AND TEMPORARY MOUNTINGS



BARRICADES

a minimum size of 1200 mm by 750 mm. The words RAMP CLOSED or BRIDGE CLOSED may be substituted for ROAD CLOSED, where applicable. The ROAD CLOSED sign shall not be used where traffic is maintained or where the actual closing is some distance beyond this sign.

C2

5. LOCAL TRAFFIC ONLY Signs (C3, C3A)

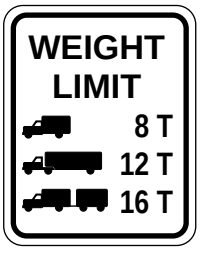
The LOCAL TRAFFIC ONLY signs should be used where through traffic must detour to avoid a closing some distance beyond the sign, but where local traffic can move up to point of closure. The sign shall carry the legend ROAD CLOSED [XX] MILES AHEAD–LOCAL TRAFFIC ONLY or, optionally for urban use, ROAD CLOSED TO THRU TRAFFIC, and should be accompanied by appropriate warning and detour signing. The words RAMP CLOSED or BRIDGE CLOSED may be substituted for ROAD CLOSED where applicable.

C3

C3A

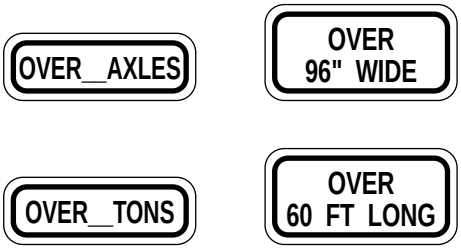
6. WEIGHT LIMIT Signs (R20, R20B R20D)

A WEIGHT LIMIT sign shows the gross weight or weight per axle that can be permitted on the roadway or bridge. Weight restrictions should be consistent with state or local regulations and shall not be imposed without the approval of the authority having jurisdiction over the highway. When weight restrictions are imposed, a marked detour should be provided for vehicles weighing more than the limit posted.



R20

R20B



R20D

Figure 5-7a
Commonly Used Regulatory Signs

R1

R1-2

R2

R2-4

R2-5

R3

R15

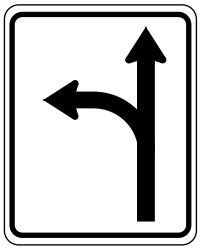

R16


R17

R18-2


R34

R59


R60A

R61-1.1

R63

R64

Figure 5-7b
Commonly Used Regulatory Signs

R7

R10

R10A

R11

R11A

R26D

R90

SR51

C42

C42
(Alternate Message)

Table 5-3
Suggested Advance Warning Sign Spacing

Road Type	Distance Between Signs in Meters (Feet)		
	A	B	C
Urban-40 km/h (25 mph) or less	60 (200)	60 (200)	60 (200)
Urban-50 km/h (30 mph) or more	100 (350)	100 (350)	100 (350)
Rural	150 (500)	150 (500)	150 (500)
Expressway/Freeway	300 (1000)	300 (1000)	300 (1000)

Note: These are suggested distances for Advance Warning Signs, adequate sight distances and proximity to other roadway features may dictate the need for adjustments when placed.

Maintenance or minor road work warning signs may be needed when traffic is permitted through such zones. Maintenance and minor road work signing and traffic control should be coordinated with appropriate authorities so that drivers are not confused or misled by additional traffic control devices.

6. ROAD CONSTRUCTION/WORK AHEAD Sign (C18/C23)

Either the C18 (CONSTRUCTION) or C23 (WORK) sign should be used in advance of a construction or maintenance project to serve as a general warning of the work zone.

The third line may be altered to read 500 ft., 1000 ft, etc., as appropriate, with a C29 plate.

The C23 sign is also available with the message RAMP WORK AHEAD.

C23

C29

7. DETOUR AHEAD Sign (C1)

The DETOUR AHEAD sign shall be used in advance of a point where traffic is diverted around the work zone over a temporary roadway or route. (See CVC 21363).

The second line may be altered to read 500 ft., 1000 ft, etc., as appropriate.

C1

8. ROAD CLOSED AHEAD Sign (C19)

The ROAD CLOSED AHEAD sign is used in advance of that point where a highway is closed to all traffic or to all but local traffic.

The third line may be altered to read 500 ft., 1000 ft., etc., as appropriate, with a C29 plate

The C19 sign is also available with the message RAMP CLOSED AHEAD.

C19

9. ONE LANE ROAD AHEAD Sign (C16)

The ONE LANE ROAD AHEAD sign should be used ahead of that point where traffic in both directions must use a common single lane. See Figure 5-3. If the affected one-lane roadway is not visible from one end to the other, or if the traffic is such that simultaneous arrivals at both ends occur frequently, flagging procedures or signal control should be used to control alternate traffic flows.

The third line may be altered to read 500 ft., 1000 ft., etc., as appropriate, with a C29 plate.

C16

10. RIGHT LANE CLOSED AHEAD Sign (C20)

The RIGHT LANE CLOSED AHEAD sign is used in advance of the point where one lane of a multiple-lane roadway is closed. A LEFT overlay plate (C20A) is available for left lane closures.

The third line may be altered to read 500 ft., 1000 ft., etc., as appropriate, with a C29 plate.

C20

11. FLAGGER Sign (C9A)

The FLAGGER symbol sign should be used before any point where a flagger is stationed to control traffic. The sign should be used in conjunction with appropriate other warning signs, such as the ROAD WORK AHEAD (C23) and the PREPARE TO STOP (C36).

The flagging sequence signs shall be removed, covered, or turned to face away from traffic when the flagger is not at the station.

The sign may be supplemented with an appropriate distance plate (C29) i.e. 500 ft., 1000 ft., etc., as appropriate.

C9A

12. TWO-WAY TRAFFIC Symbol Sign (W44)

When one direction of travel of a normally divided highway is closed, the TWO-WAY TRAFFIC symbol sign should be used at the beginning of the closing and at intervals to remind drivers that they are on a two-way highway with opposing traffic. The sign should also be used at locations where a divided highway illusion may cause motorists to think they are on a one-way roadway when, in fact, they are on a two-lane, two-way highway.

A typical situation is a construction site where a two-lane highway is being converted to an expressway or freeway and grading for the full width section has been completed.

W44

13. WORKERS Symbol Sign (C22B)

A WORKERS symbol sign may be used to alert drivers of workers in or near the roadway. The sign is normally used on utility type work on conventional low-speed highways. The C22C WORKERS educational plate may be used below the C22B sign.

C22B

C8

14. FRESH OIL Sign (C4)

The FRESH OIL sign should be placed to warn drivers that uncovered road oil or resurfacing has rendered the pavement temporarily slippery, and that splashing may occur.

C4

15. ROAD MACHINERY AHEAD Sign (C8)

The ROAD MACHINERY AHEAD sign may be used to warn of heavy equipment operating in or next to the roadway.

16. SHOULDER WORK AHEAD Sign (C24)

The SHOULDER WORK AHEAD sign may be used to warn of maintenance, reconstruction, or utility operations on the shoulder, where the traveled way is unobstructed.

C24

17. SURVEY CREW Sign (C25)

The SURVEY CREW sign may be used to warn of survey crews working in or next to the roadway.

C25

18. Signs for Blasting Areas

Radio frequency (RF) energy can cause the premature firing of electric detonators (blasting caps) used in temporary traffic control zones or blasting zones. Drivers must be warned to turn off mobile radio transmitters and cellular telephones. The Institute of Makers of Explosives publishes information on this hazard and guidelines for safe operations.[1]

A sequence of signs should be used to direct operators of mobile radio equipment to turn off transmitters in a blasting area. A minimum safe distance of 300 m should be used for warning sign placement. These signs shall be predominantly displayed and covered or removed when there are no explosives in the area, or the area is otherwise secured.

[1]Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Blasting Caps), Safety Library Publication No. 20. Institute of Makers of Explosives, 1120 19th St., N.W. Suite 310, Washington, D.C. 20036-3605. Telephone 202-429-9280.

18a. BLASTING ZONE 1000 FT Sign (C33)

The BLASTING ZONE 1000 FT sign should be used in advance of any work space where explosives are being used. The TURN OFF 2-WAY RADIOS AND CELLULAR TELEPHONES and END BLASTING ZONE signs shall be used in sequence with this sign.

C33

18b. TURN OFF 2-WAY RADIOS AND CELLULAR TELEPHONES Sign (C34 Revised)

The TURN OFF 2-WAY RADIOS AND CELLULAR TELEPHONES sign should follow the BLASTING ZONE AHEAD sign and is placed at least 300 m before the beginning of the blasting zone.

C34

18c. END BLASTING ZONE Sign (C35)

The END BLASTING ZONE sign shall be placed a minimum of 300 m past the blasting zone, either with or preceding the (C14) END ROAD WORK sign.

C35

19. LOW SHOULDER Sign (C31)

The LOW SHOULDER sign may be used when the elevation between the shoulder and traveled way exceeds 75 mm in height and is not protected by a portable barrier.

C31

20. UNEVEN LANES Sign (C41 & C41A)

The UNEVEN LANES sign may be used during operations that create a difference in elevation between adjacent lanes.

C41

C41A

21. NO CENTER STRIPE Sign (SC16) (Not for State Highway use)

The NO CENTER STRIPE sign may be used when the work obliterates the center stripe. This sign should be placed at the beginning of the zone and repeated at 3 km intervals in long zones to remind the motorist. It should also be used at major connections, traffic generators, and/or at appropriate intervals as determined by the engineer, to advise motorists entering within the zone.

SC16

22. Other Warning Signs

The signs pictured in Figures 5-8a, 5-8b, and 5-8c may also be used to provide sufficient advance warning, either by themselves or with other advance warning signs.

Besides the warning signs specifically related to temporary traffic control zones, several other warning signs, most of which have been standardized in Section 4-02 of the Caltrans Traffic Manual, may apply in these zones. When used in temporary traffic control zones, warning signs shall have a black legend on an orange background except for the W-47 which will always be black on yellow.

23. Advisory Speed Plate (W6)

In combination with a warning sign, an advisory speed plate may be used to indicate a recommended safe speed through the temporary traffic control zone. When used with orange temporary traffic control zone signs, this plate shall have a black legend on an orange background. It shall not be used with any sign other than a warning sign, nor shall it be used alone. The sign shall be at least 600 mm square in size when used with a sign 900 mm square or larger. Except in emergencies, an advisory speed plate (W6) should not be mounted until the recommended speed is determined by the highway authority. See Figures 5-7a and 7b for regulatory signing.

W6

C. Guide Signs

1. Function and Design of Guide Signs

Guide signs are essential along streets and roadways to give drivers information that will help them in the most simple, direct manner possible. The design of guide signs is given in Section 4-04 of the Caltrans Traffic Manual.

The following guide signs are required at temporary traffic control zones:

a. Standard route markings, where temporary route changes are necessary.

b. Directional signs such as motorist service signing, recreational and cultural interest area signs, tourist-oriented directional signs (TODS), civil defense signing, and street name signs. When used with detour routing, these signs may have a black legend on an orange background.

c. Special information signs relating to work being done. These signs shall have a black legend on an orange background.

Figure 5-8a
Warning Signs Used in Temporary Traffic Control Zones

Figure 5-8b
Warning Signs Used in Temporary Traffic Control Zones

W34

W36

W37


W41


W42

W47

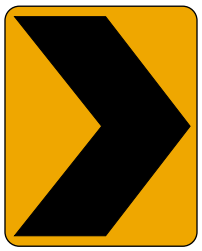

W57


W58


W59


W60

W75


W81

SW40

C6

C36

Figure 5-8c
Warning Signs Used in Temporary Traffic Control Zones

Fed. No. W5-2a*

Fed. No. W9-1*

Fed. No. W14-3*

*Not to be used on State Highways.

2. Length of Work Sign (C11)

The Length of Work sign should be erected in advance of any temporary traffic control zone of more than 3.2 km in length; it carries the legend ROAD WORK NEXT ____ MILES. The distance shall be stated to the nearest whole mile.
The C11 sign is also available with the message STATE HIGHWAY CONSTRUCTION NEXT ____ MILES.

C11

3. END CONSTRUCTION/ROAD WORK Sign (C13, C14)

The END CONSTRUCTION (ROAD WORK) sign should be placed about 150 past the work zone. The sign is not required if the end of the work zone is obvious to motorists.

C14

4. DETOUR Signs and Markers

The DETOUR ARROW sign (C5) should be used where a detour route has been established because of the closing of a street or highway to through traffic. The sign should normally be mounted just below the ROAD CLOSED (C2, C3, or C3A) sign. The DETOUR ARROW sign has a horizontal arrow pointed to the right or left, as required.

Each detour shall be adequately marked with standard temporary route markers and destination signs. The DETOUR marker sign (C5A), mounted at the top of a route marker assembly, marks a temporary route that branches from a highway, bypasses a section closed by a temporary traffic control zone, and rejoins the highway beyond the temporary traffic control zone.

The DETOUR signs (C5, C5A) should be used for detoured highways, for emergency situations, for periods of short durations, or where, over relatively short distances, traffic may be guided along the detour and back to the desired highway. When the detour is a numbered highway, route shields should be included on the sign assembly. A street name sign may be placed above or incorporated in the DETOUR sign to indicate the name of the street being detoured.

C5

C5A

The END DETOUR sign (C7) may be used to indicate that the detour has ended. When the END DETOUR sign is used on a numbered highway, the sign should be mounted above a route shield.

C7

5. PILOT CAR FOLLOW ME Sign (C26)

The PILOT CAR FOLLOW ME sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way traffic through or around a work space. A flagger shall be stationed at each end of the controlled section of highway. A TRAFFIC CONTROL—WAIT FOR PILOT CAR sign (C37) should be used at intersecting approaches to the pilot car controlled section.

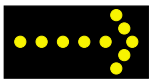
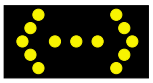
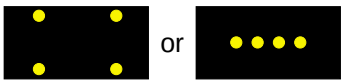
C26

5-05.3 Portable Changeable Message Signs

A. Design

Portable Changeable Message Signs (PCMS) are traffic control devices with the flexibility to display a variety of messages to fit the needs of road and street authorities. Each message consists of one or more displays. Portable Changeable Message signs are used most frequently on high-density, urban freeways, but have applications on all types of highways where highway alignment, traffic routing problems or other pertinent conditions require advance warning and information.

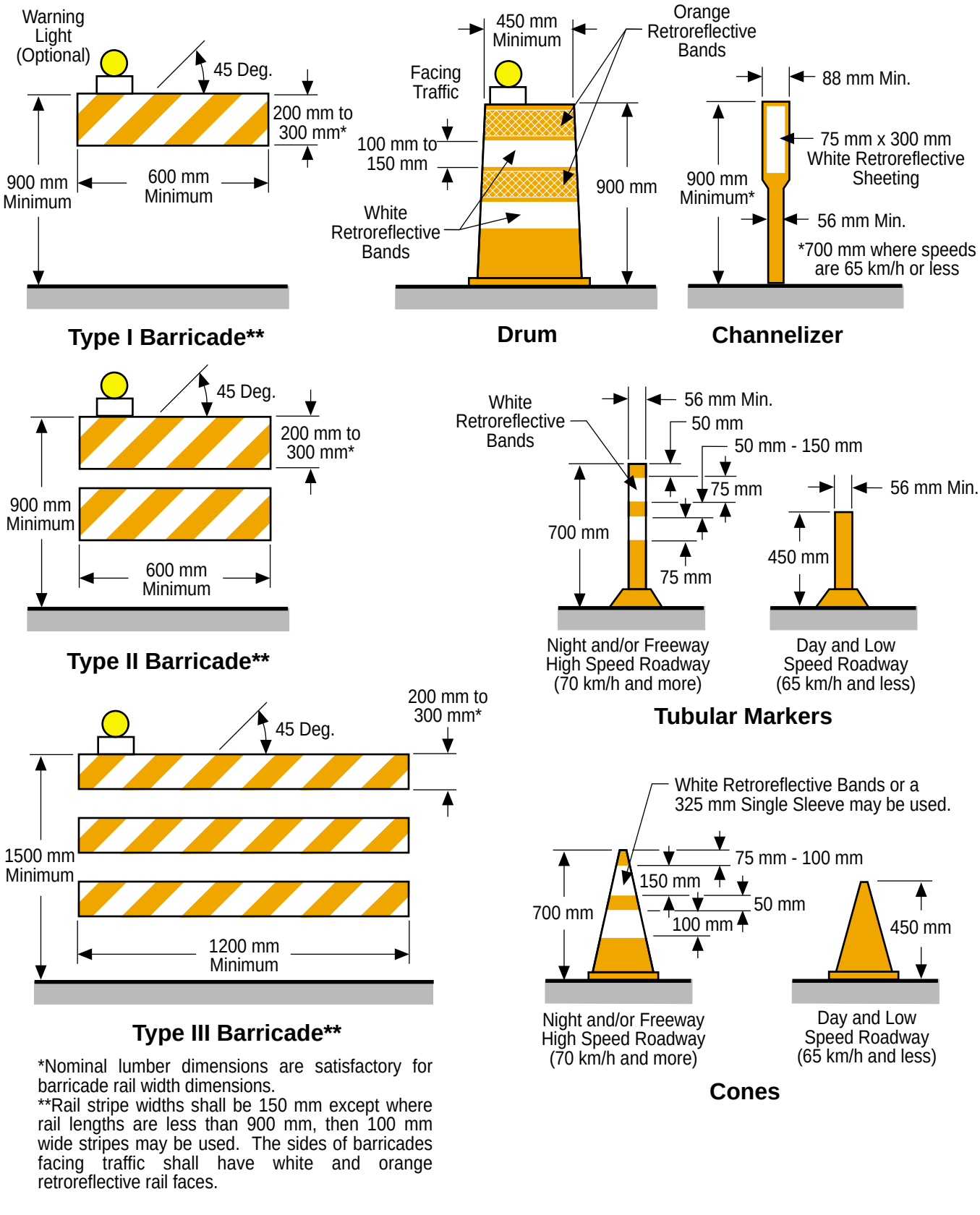
Figure 5-9
Flashing Arrow Sign Specifications

Operating Mode	Panel Display* (Right shown; left similar)
I. At least one of the three following modes shall be provided:	
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. The following mode shall be provided:	
Flashing Caution	 Caution

*Element layout for Type I FAS shown.

Panel Types	Minimum Size (mm)	Minimum Legibility Distance (km)	Minimum Number of Elements
A	1200 x 600	0.8	12
II	1800 x 900	1.2	13
I	2400 x 1200	1.6	15

Figure 5-10
Barricades and Channelizing Devices



*Nominal lumber dimensions are satisfactory for barricade rail width dimensions.
**Rail stripe widths shall be 150 mm except where rail lengths are less than 900 mm, then 100 mm wide stripes may be used. The sides of barricades facing traffic shall have white and orange retroreflective rail faces.

Table 5-4
Taper Length, Buffer Space and Advance Warning Sign Spacing Used in Typical Application Diagrams

English Measurements

Length of Taper 'L' in Feet

Speed in Miles Per Hour*	Width of Offset**	
	11 Feet	12 Feet
20	73	80
25	115	125
30	165	180
35	225	245
40	293	320
45	495	540
50	550	600
55	605	660
60	660	720
65	715	780
70	770	840

Metric Measurements

Length of Taper 'L' in Meters

Speed in Kilometers Per Hour*	Width of Offset**	
	3.3 Meters	3.6 Meters
30	20	22
40	35	38
50	55	60
60	79	86
70	154	168
80	176	192
90	198	216
100	220	240
110	242	264

*Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operation speed.
**For other offset widths, apply the formula in Table 5-2.
For State highways, see Traffic Control Systems in the Caltrans Standard Plans.

Length of Longitudinal Buffer Space

Speed in Miles Per Hour*	Length of Buffer Space in Feet
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335
60	415
65	485
70	585

Length of Longitudinal Buffer Space

Speed in Kilometers Per Hour*	Length of Buffer Space in Meters
30	10
40	17
50	28
60	43
70	62
80	84
90	106
100	136
110	170

*Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operation speed.

Advance Warning Sign Spacing 'A'

Road Type	Distance Between Signs in Feet*
Urban - 25 mph or less	200
Urban - 30 mph or more	350
Rural	500
Expwy/Fwy	1000

Advance Warning Sign Spacing 'A'

Road Type	Distance Between Signs in Meters*
Urban - 40 km/h or less	60
Urban - 50 km/h or more	100
Rural	150
Expwy/Fwy	300

*These are suggested distances for Advance Warning Signs, adequate sight distances and proximity to other roadway features may dictate the need for adjustments when placed.

Table 5-5a
Index to Typical Application Diagrams

Type of Application	Duration of Work	
	Stationary* / Short Duration***	Mobile**
Roadside (Outside of Shoulder) - All Roadways		
Work Beyond the Shoulder	TA-1	
Blasting Zone	TA-2	
Shoulder - All Roadways		
Work on Shoulders	TA-3	
Mobile Operation on Shoulder		TA-4
Shoulder Closed on Limited Access Highway	TA-5	
Shoulder Work with Minor Encroachment	TA-6	
Within Traveled Way - Rural Two-Lane		
Road Closed with On-Site Detour	TA-7	
Road Closed with Off-Site Detour	TA-8	
Roads Opened and Closed with Detour	TA-9	
Lane Closure on Two-Lane Road Using Flaggers	TA-10	
Lane Closure on Low-Volume, Two-Lane Road	TA-11	
Lane Closure on Two-Lane Road Using Trafic Signals	TA-12	
Temporary Road Closure	TA-13	
Haul Road Crossing	TA-14	
Work in Center of Low-Volume Road	TA-15	
Surveying Along Centerline of Low-Volume Road	TA-16	
Mobile Operations on Two-Lane Road		TA-17
Urban Streets		
Lane Closure on Minor Street	TA-18	
Detour for One Travel Direction	TA-19	
Detour for Closed Street	TA-20	
Intersections and Walkways		
Lane Closure Near Side of Intersection	TA-21	
Right Lane Closure Far Side of Intersection	TA-22	
Left Lane Closure Far Side of Intersection	TA-23	
Half Road Closure Far Side of Intersection	TA-24	
Multiple Lane Closures at Intersection	TA-25	

Table 5-5b
Index to Typical Application Diagrams

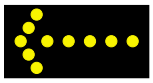
Type of Application	Duration of Work	
	Stationary* / Short Duration***	Mobile**
Closure in Center of Intersection	TA-26	
Closure at Side of Intersection	TA-27	
Sidewalk Closures and Bypass Walkway	TA-28	
Crosswalk Closures and Pedestrian Detours	TA-29	
Multilane Undivided		
Interior Lane Closure on Multilane Street	TA-30	
Lane Closure on Streets with Uneven Directional Volumes	TA-31	
Half Road Closure on Multilane High Speed Highways	TA-32	
Multilane Divided		
Lane Closure on Divided Highway	TA-33	
Lane Closure with Barrier	TA-34	
Mobile Operation on Multilane Road		TA-35
Freeways		
See Standard Plans		

* Long-term Stationary: More than 3 days; Intermediate-term Stationary: Overnight up to 3 days; Short-term Stationary: Anytime, more than 60 minutes.

** Mobile: Intermittent and continuous moving.

*** Short-duration: Up to 60 minutes

Figure 5-11
Legend of Symbols Used in Typical Application Diagrams


Flashing Arrow Sign (FAS)

FAS Support or Trailer

Channelizing Device


Direction of Traffic


Direction of Temporary Traffic or Detour

Flagger


High Level Warning Device (Flag Tree)


Luminaire


Pavement Markings that shoud be removed for a Long Term Project

Sign (Shown Facing Left)

Portable Barrier


Surveyor


Traffic or Pedestrian Signal


Truck Mounted Crash Cushion

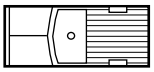

Type III Barricade


Changeable Message Sign (CMS)

CMS Support or Trailer


Warning Light


Work Space


Work Vehicle


Portable Barrier with Warning Lights

Work Beyond the Shoulder

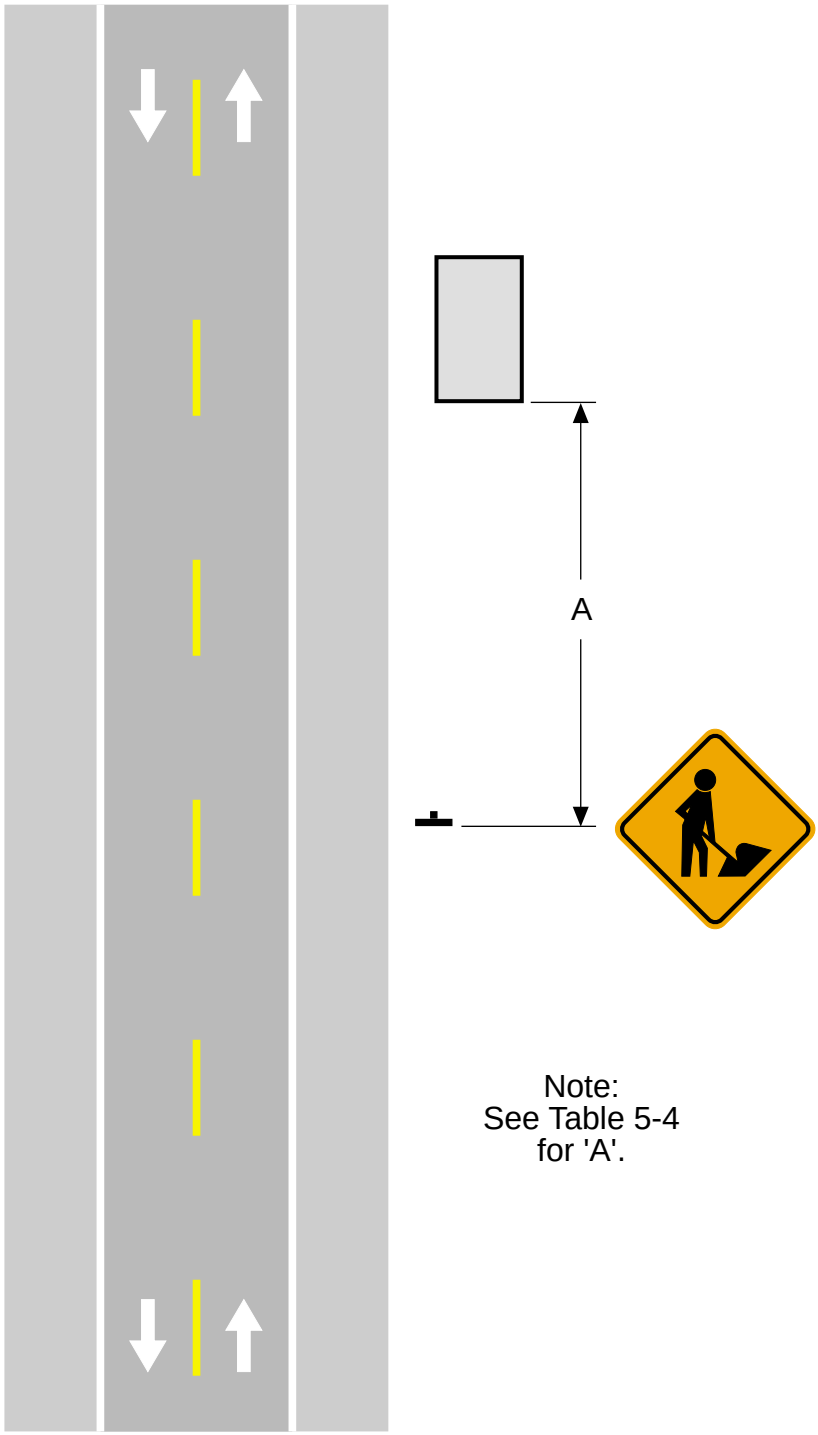
1. The signs illustrated in this figure are not required if the work space is behind a barrier, more than 0.6 m behind the curb, or 4.6 m or more from the edge of any roadway.

2. The C-22B WORKER symbol sign may be replaced with other appropriate signs, such as the SHOULDER WORK AHEAD sign. The SHOULDER WORK AHEAD sign may be used for work adjacent to the shoulder.

3. If the work space is in the median of a divided highway, an advance warning sign should also be placed on the left side of the directional roadway.

4. For short-term, short-duration, or mobile operation, all signs and channelizing devices may be eliminated if a vehicle with an activated flashing or revolving yellow light is used.

Typical Application 5-1
Work Beyond the Shoulder



Note:
See Table 5-4
for 'A'.

Blasting Zone

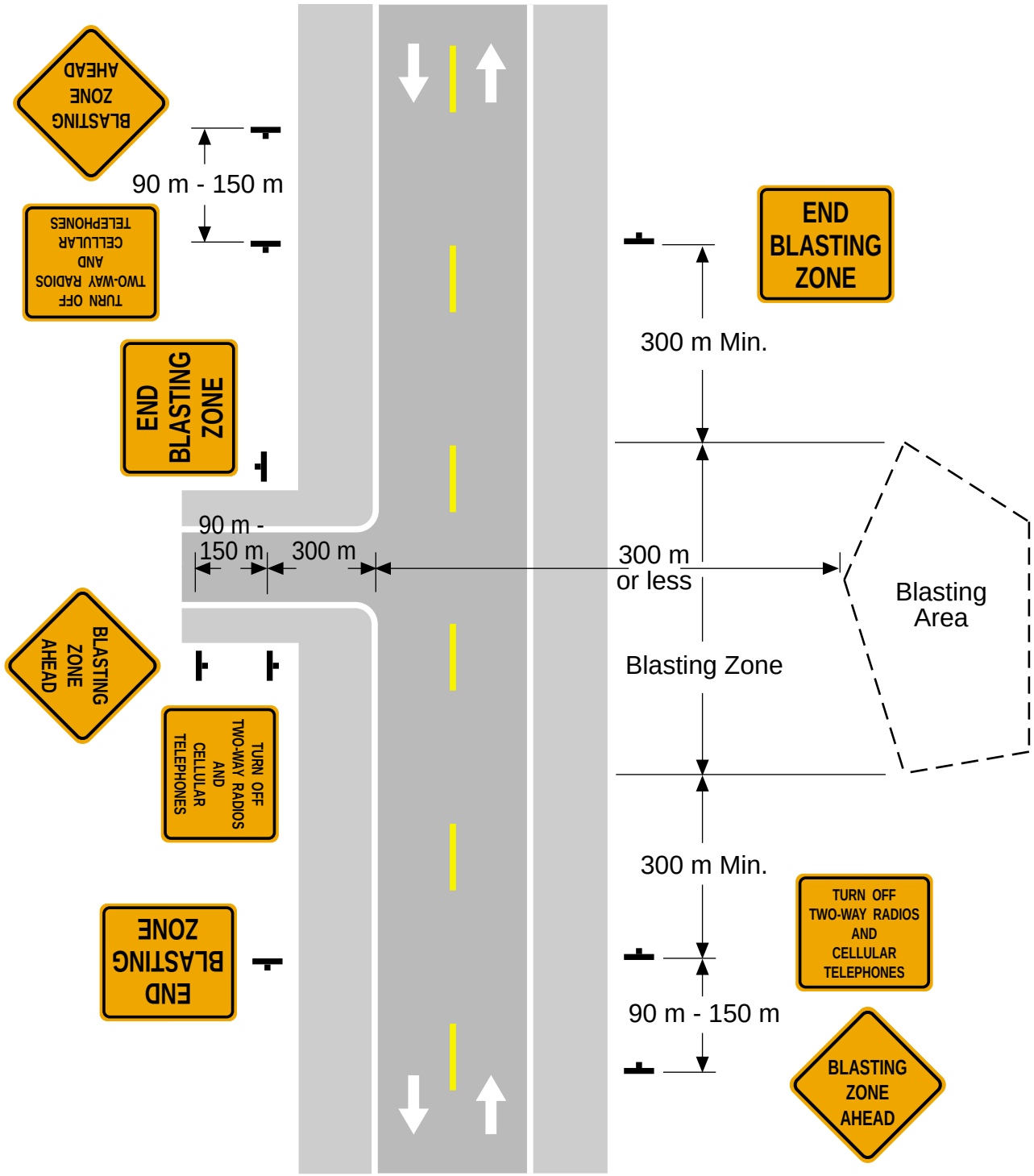
1. Whenever blasting caps are used within 300 m of a roadway, the signing shown is required. On a divided highway, the signs should be mounted on both sides of the directional roadways.

2. The signs shall be covered or removed when there are no explosives in the area or when the area is otherwise secure.

3. Whenever a side road intersects the roadway between the BLASTING ZONE AHEAD (300 m) sign and the END BLASTING ZONE sign, or a side road is within 300 m of any blasting cap, similar signing, as on the mainline, shall be erected on the side road.

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 shall not be permitted to pass through the blasting zone during blasting operations.

Typical Application 5-2
Blasting Zone



Work on Shoulders

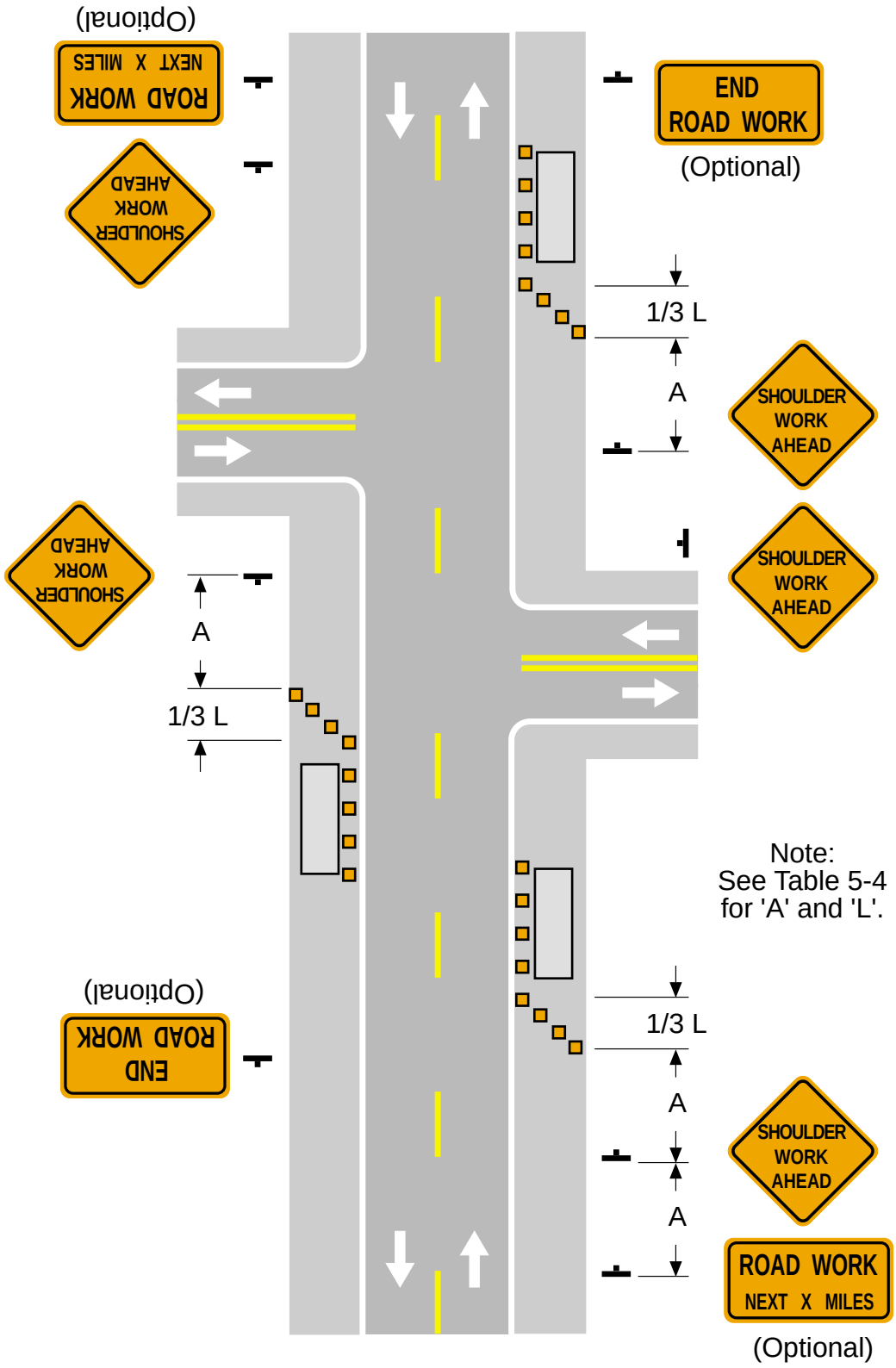
1. The ROAD WORK AHEAD sign on an intersecting roadway is not required if drivers emerging from that roadway will encounter another advance warning sign before they reach this activity area.

2. A SHOULDER WORK AHEAD sign should be placed on the left side of a divided or one-way roadway only if the left shoulder is affected.

3. For short-duration operations 60 minutes or less, all signs and channelizing devices may be eliminated if a vehicle with an activated flashing or revolving yellow light is used.

4. WORKER signs may be used instead of SHOULDER WORK AHEAD signs.

Typical Application 5-3
Work on Shoulders



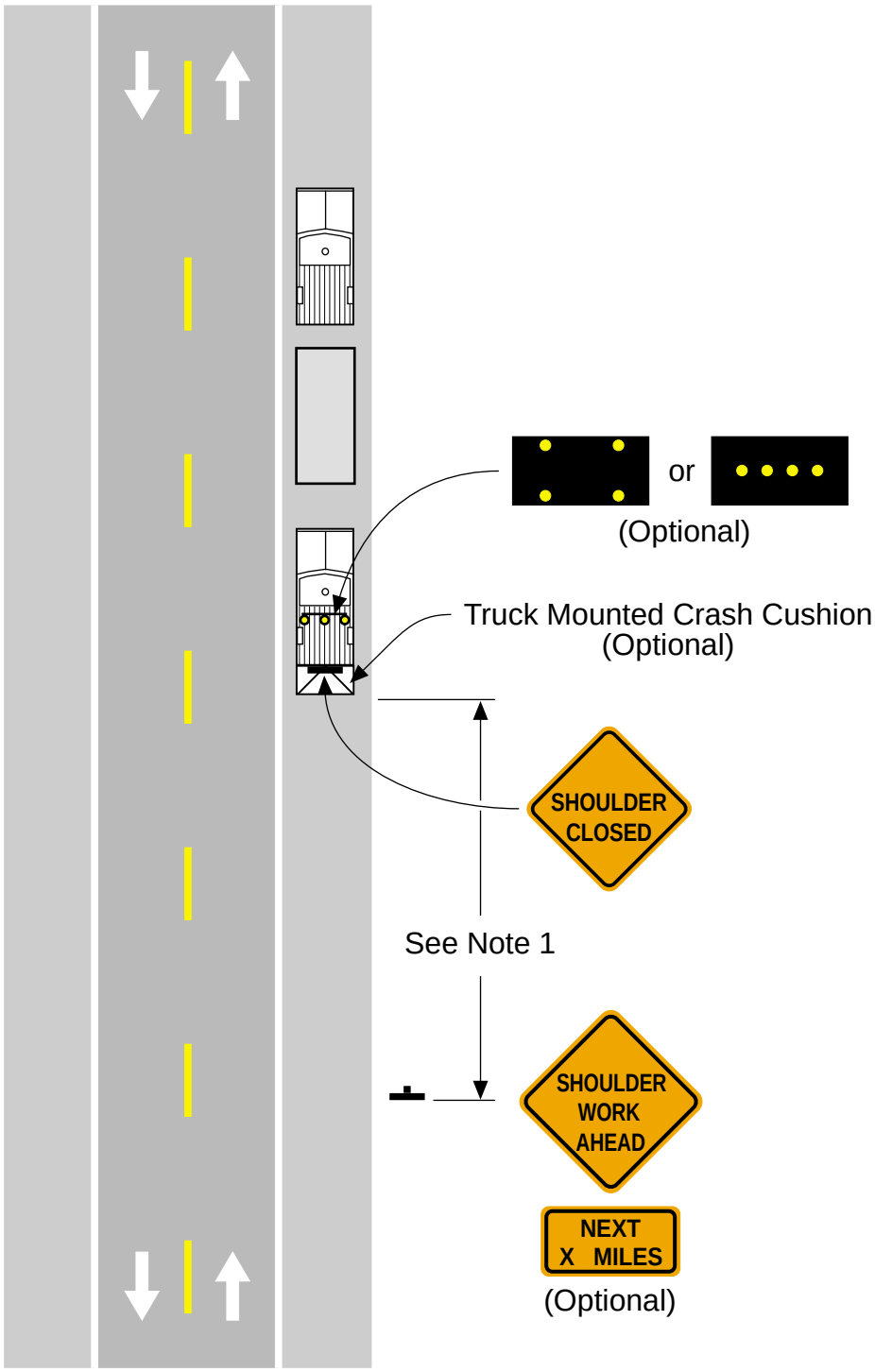
Mobile Operation on Shoulder

1. In situations where multiple work locations in a limited distance make it practicable to place stationary signs, the maximum spacing for the advance warning sign is 8 km in advance of the work.

2. The length of activity area sign may be used as the stationary advance warning sign if the work locations occur over a distance of more than 3.2 km.

3. Warning signs are not required if the work vehicle displays a flashing or revolving yellow light, if the distance between work locations is 1.6 km or more, and if the work vehicle travels at traffic speeds between locations.

Typical Application 5-4
Mobile Operation on Shoulder



Shoulder Closed on Limited Access Highway

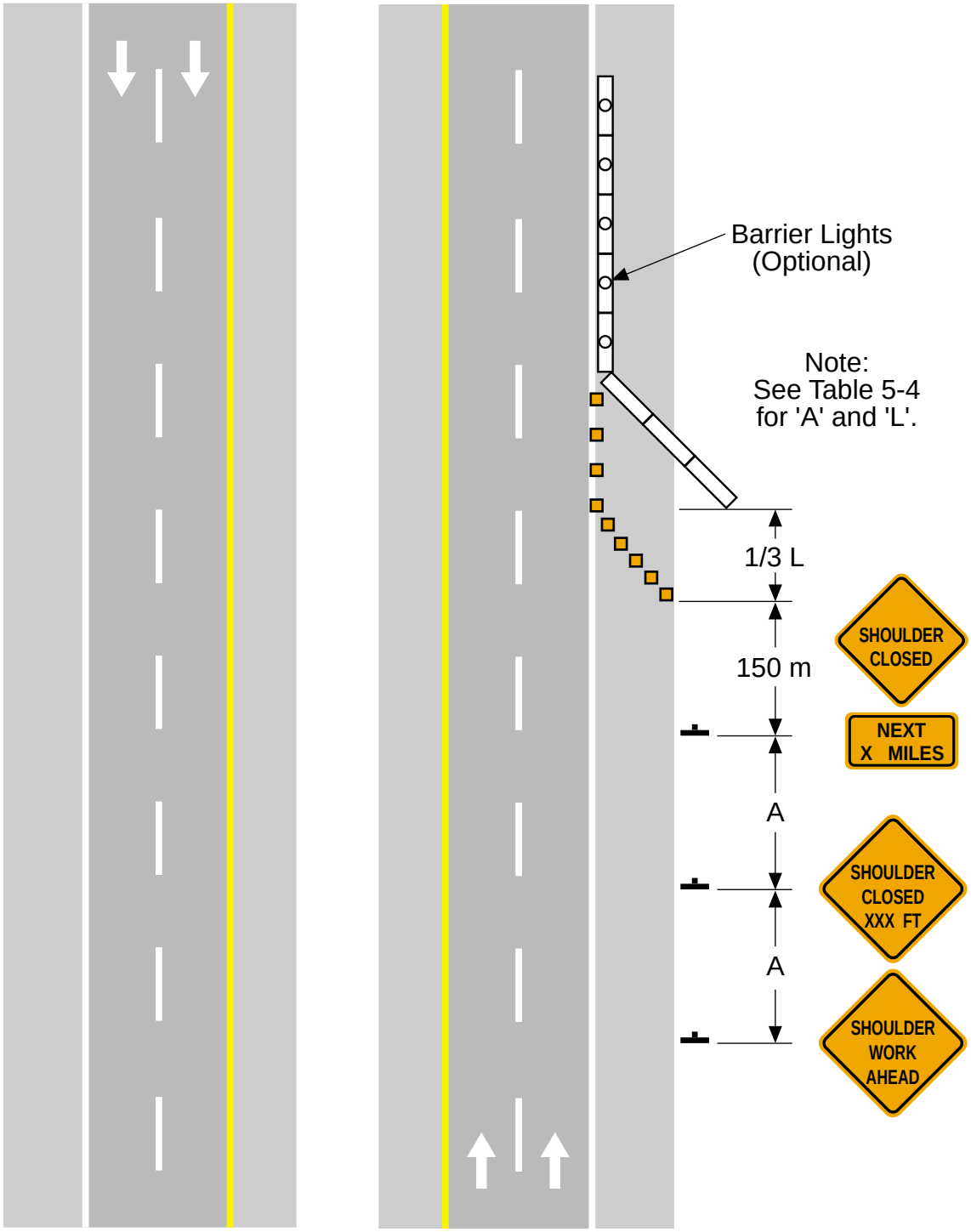
1. SHOULDER CLOSED signs should be used on limited-access highways where there is no opportunity for disabled vehicles to pull off the traveled way.

2. If motorists cannot see a pull-off area beyond the closed shoulder, information regarding the length of the shoulder closure should be provided in meters or kilometers, as appropriate.

3. The barrier in this diagram shows one method that may be used to close a shoulder of a long-term project. The use of a barrier should be based on the need determined by an engineering analysis. The warning lights shown on the barrier are optional.

4. Barriers should be flared beyond the clear zone to prevent vehicles from impacting their leading ends. An alternative procedure is to place a crash cushion to protect traffic from the end of the barrier.

Typical Application 5-5
Shoulder Closed on Limited Access Highway



Shoulder Work with Minor Encroachment

1. The treatment shown may be used on a minor road having low speeds. For higher speed traffic conditions, a lane closure should be considered.

2. The procedure shown should be adequate to carry bidirectional traffic at reduced speed through the activity area, provided the lanes are at least 3 m wide.

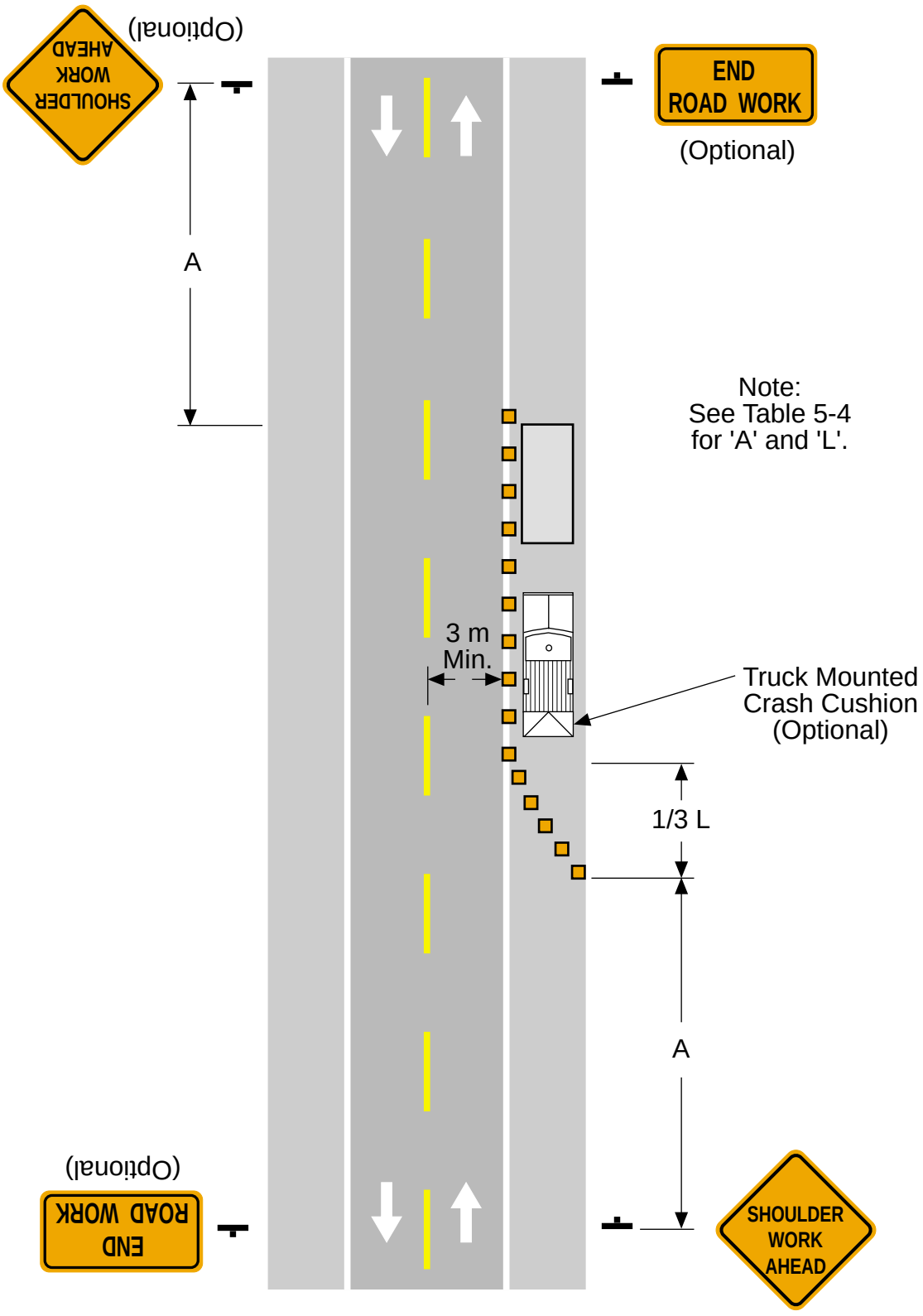
3. Where the opposite shoulder is suitable for carrying traffic and of adequate width, traffic lanes may be shifted by use of closely spaced channelizing devices, provided 3 m wide lanes are maintained.

4. Additional advance warning may be appropriate, such as a ROAD (LANE) NARROWS sign.

5. Approved portable barriers may be used along the work space.

6. The protection vehicle is optional if a taper and channelizing devices are used. For short-duration work, the taper and channelizing devices are optional if the protection vehicle with an activated flashing yellow light is used.

Typical Application 5-6
Shoulder Work with Minor Encroachment



Road Closed with On-Site Detour

1. Signs shown are for one direction of travel only.

2. Flashing warning lights and/or flags may be used to call attention to the initial warning signs.

3. Where the temporary pavement and old pavement are different colors, the temporary pavement should start on the tangent of the existing pavement and end on the tangent of the existing pavement.

4. Pavement markings that are no longer applicable shall be removed or obliterated as soon as practicable.

5. Delineators or channelizing devices may be needed along the bypass roadway.

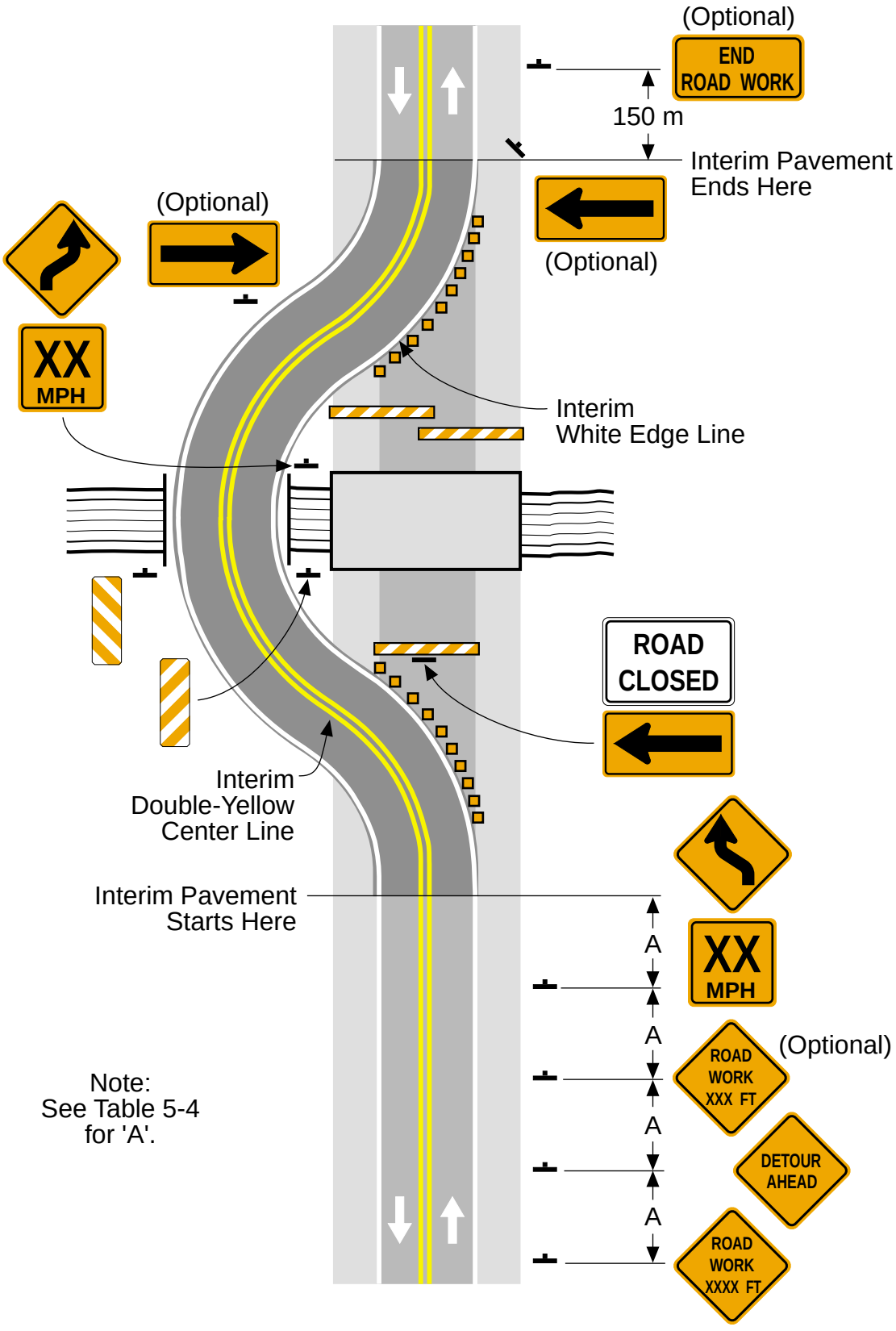
6. If the detour is short and has sharp curves (50 km/h or less), REVERSE TURN signs should be used with appropriate speed advisory plate. In addition, LARGE ARROW signs may be desirable on sharp curves.

7. For the second reverse curve, when there is insufficient advance warning distance to place a REVERSE CURVE or TURN sign, LARGE ARROW signs should be used on both curves.

8. If the tangent distance along the temporary bypass roadway is short and the curvature is sharp, two LARGE ARROW signs may be required for the second reverse curve.

9. W 81 signs may be used to delineate the curve.

Typical Application 5-7
Road Closed with On-Site Detour



Road Closed with Off-Site Detour

1. Regulatory traffic control devices are to be modified as needed for the duration of the detour.

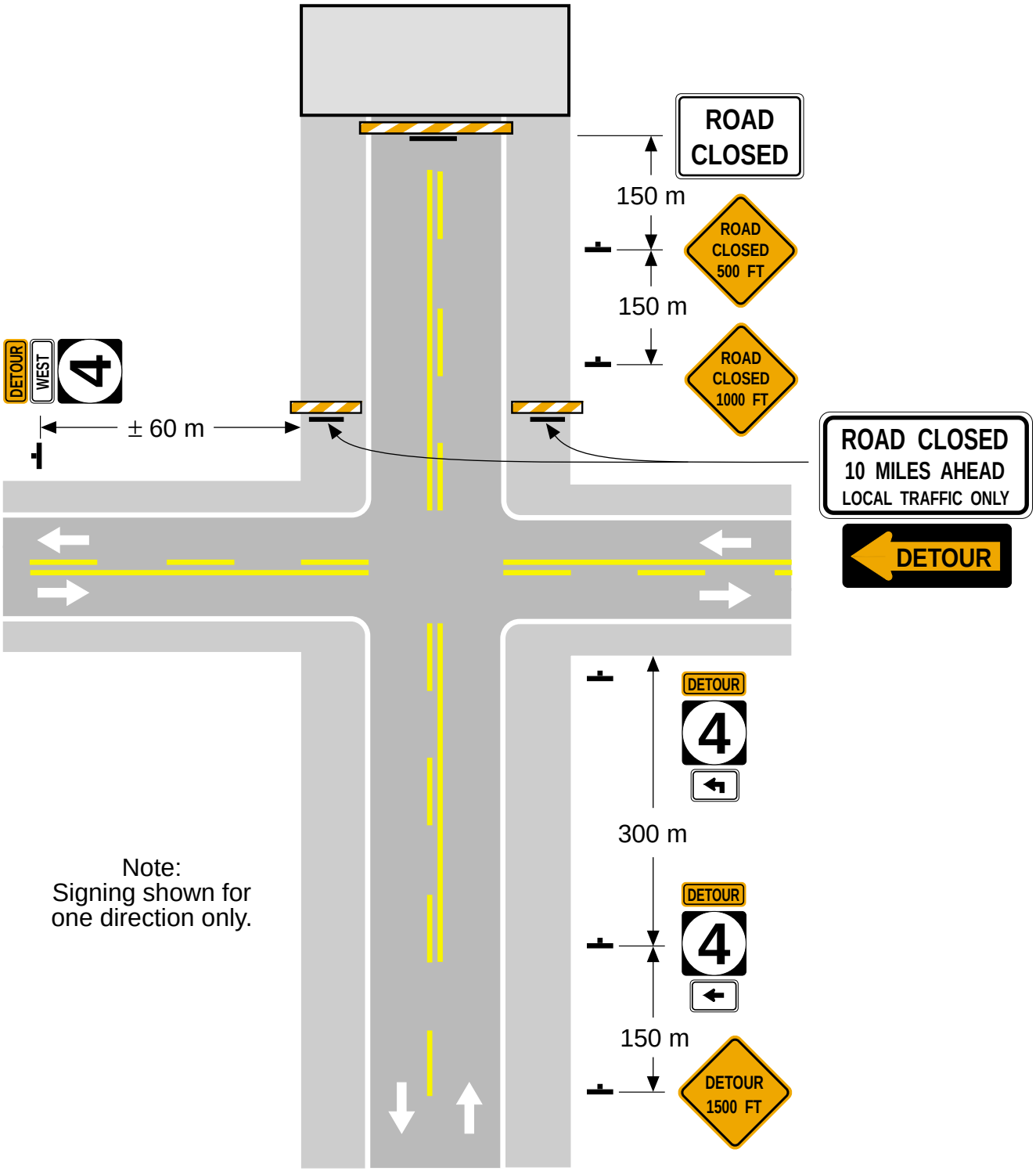
2. If the road is opened for some distance beyond the intersection and/or there are significant origin/ destination points beyond the intersection, place the ROAD CLOSED and DETOUR signs on Type III barricades located at the edge of the traveled way.

3. If the road is closed a short distance beyond the intersection and there are few origin/destination points beyond (e.g., a few residences), the ROAD CLOSED and DETOUR sign may be placed on a Type III barricade placed in the center of the roadway.

4. A route marker directional assembly may be placed on the far left corner of the intersection to augment or replace the one shown on the near right corner.

5. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

Typical Application 5-8
Road Closed with Off-Site Detour



Note:
Signing shown for one direction only.

Roads Opened and Closed with Detour

1. Similar signs and devices shall be erected for the opposite direction.
2. STOP signs displayed to side roads should be erected along the temporary route.
3. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.
4. Flashing warning lights may be used on Type III barricades.

Lane Closure on Two-Lane Road Using Flaggers

1. Floodlights should be provided to mark flagger stations at night as needed.

2. For low-volume applications, a single flagger may be adequate. Where one flagger can be used, such as for short work zones on straight roadways, the flagger must be visible to approaching traffic from both directions.

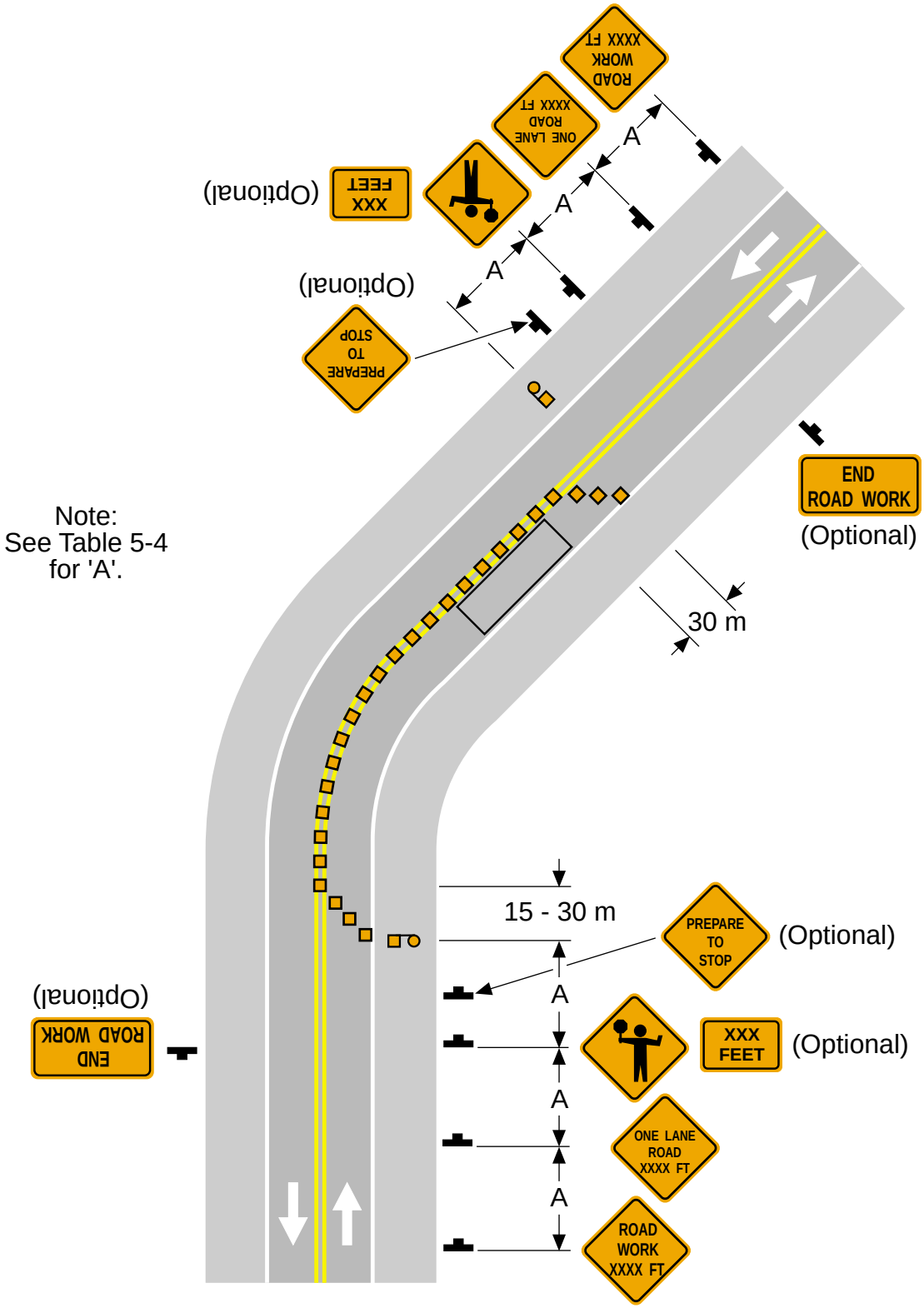
3. Channelizing devices are to be extended to a point where they are visible to approaching traffic.

4. The ROAD WORK AHEAD sign may be omitted for short-duration operations or when the end of the work zone is obvious.

5. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

6. For State highways, see Caltrans Standard Plan T13.

Typical Application 5-10
Lane Closure on Two-Lane Road Using Flaggers



Lane Closure on Low-Volume, Two-Lane Road

1. This temporary application may be used as an alternate traffic control plan to the lane closure with flaggers (TA 5-10), when the following conditions exist.

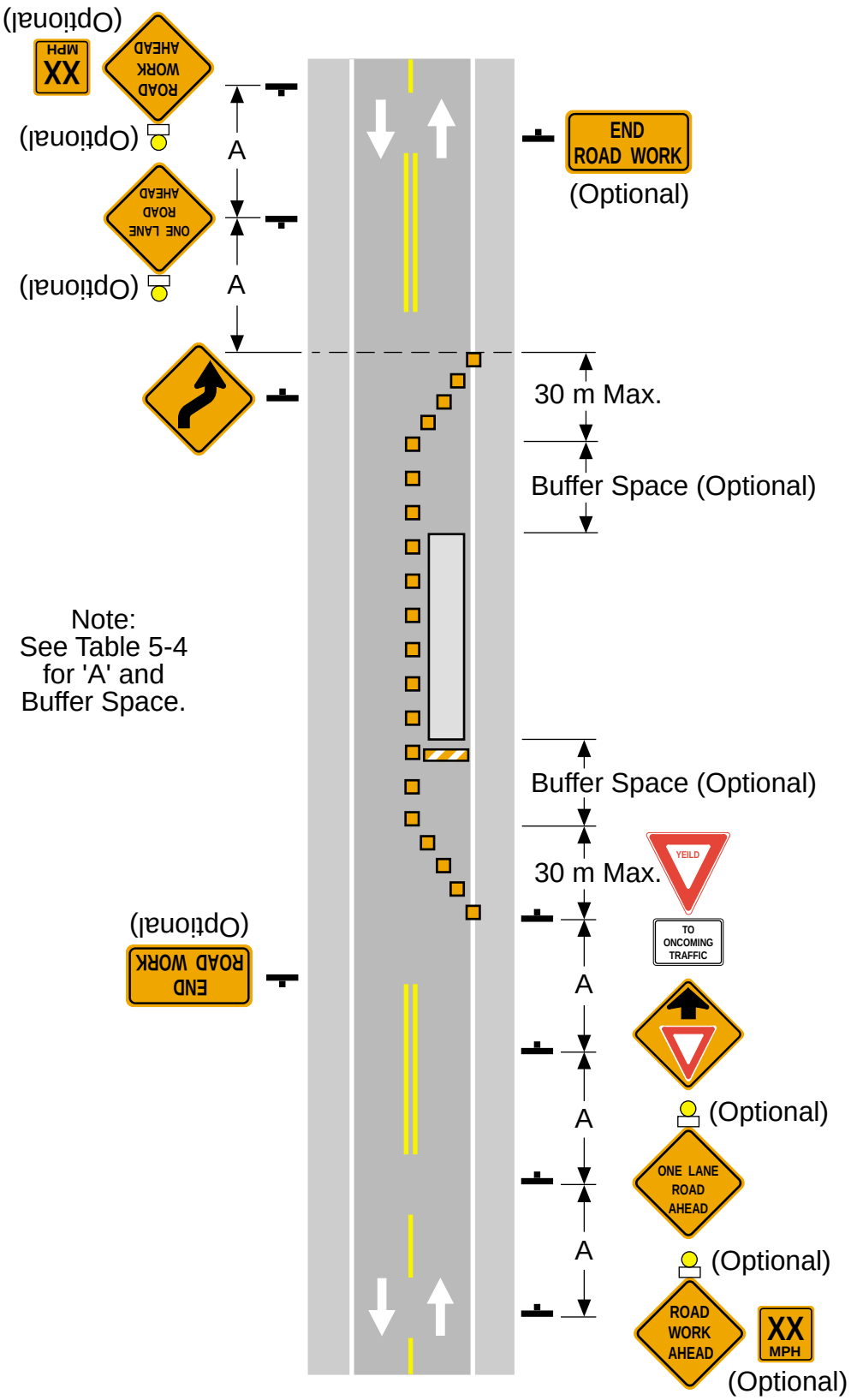
   a. Traffic volume is such that sufficient gaps exist for traffic that must yield.

   b. Drivers from both directions must be able to see approaching traffic through and beyond the work site.

2. The YIELD sign and YIELD AHEAD sign may be covered and flaggers used, as needed, during daylight working hours to control the flow of traffic through the work space. When flaggers are used, the FLAGGER sign shall be used in place of the YIELD AHEAD sign.

3. The Type A flashing warning lights may be placed on the ROAD WORK AHEAD and the ONE LANE ROAD AHEAD signs, whenever a night lane closure is necessary.

Typical Application 5-11
Lane Closure on Low-Volume, Two-Lane Road



Lane Closure on Two-Lane Road Using Traffic Signals

1. Temporary traffic signals are preferable to flaggers for long-term projects and other activities that would require flagging at night.

2. The maximum length of activity area for one-way traffic signal control is determined by the capacity required to handle the peak hour demand. Practical maximum length is 120 m. Signal timing shall be established by qualified personnel.

3. Signals shall be installed and operated in accordance with the requirements of Chapter 9 of the Caltrans Traffic Manual. Temporary traffic control signals shall meet the physical display and operational requirements of conventional traffic signals.

4. Adequate area illumination to clearly identify both ends of the work space at night for long-term operations should be provided.

5. Stop lines 300 to 600 mm wide shall be installed. Add "no-passing" lines when necessary. Removable pavement markings may be used. Conflicting pavement markings and raised pavement marker reflectors between the activity area and the stop line shall be removed. After completion of the work, the stop lines and other temporary inapplicable pavement markings shall be removed.

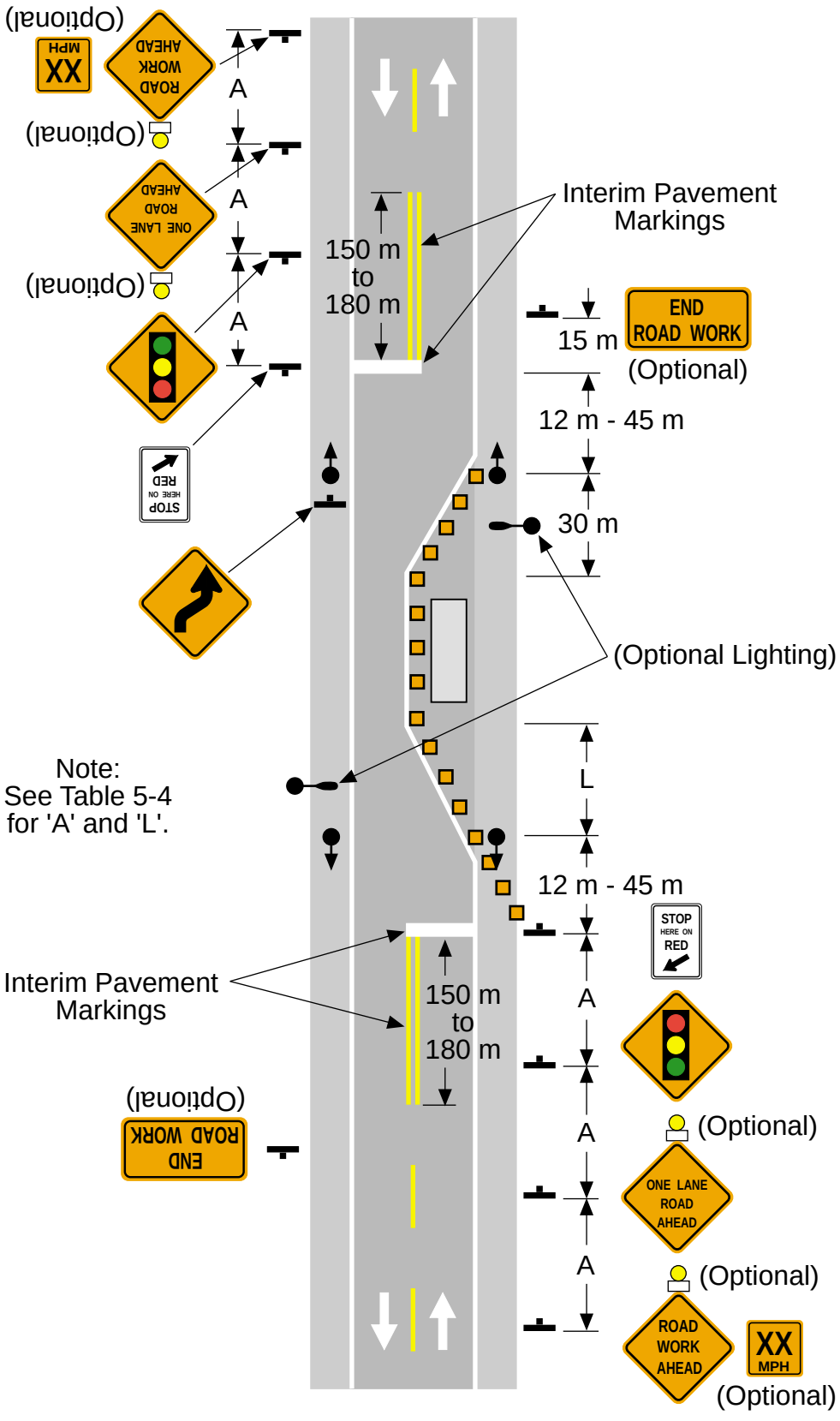
6. The Type A flashing warning lights shown on the ROAD WORK AHEAD and the ONE LANE ROAD AHEAD signs may be used whenever a night lane closure is necessary. Type B lights may be used to also increase the daytime target value of the signs.

7. The horizontal or vertical alignment of the roadway may require adjustments in the location of the advance warning signs (the distances shown for advance warning sign spacings are minimums). The vertical alignment of the roadway may require adjustments in the height of the signal heads.

8. When the signal is changed to a flash condition either manually or automatically, red shall be flashed to both approaches.

9. CMS may be used to supplement this sign package.

Typical Application 5-12
Lane Closure on Two-Lane Road Using Traffic Signals



Temporary Road Closure

1. Conditions represented are for work that requires closures during daytime hours only.

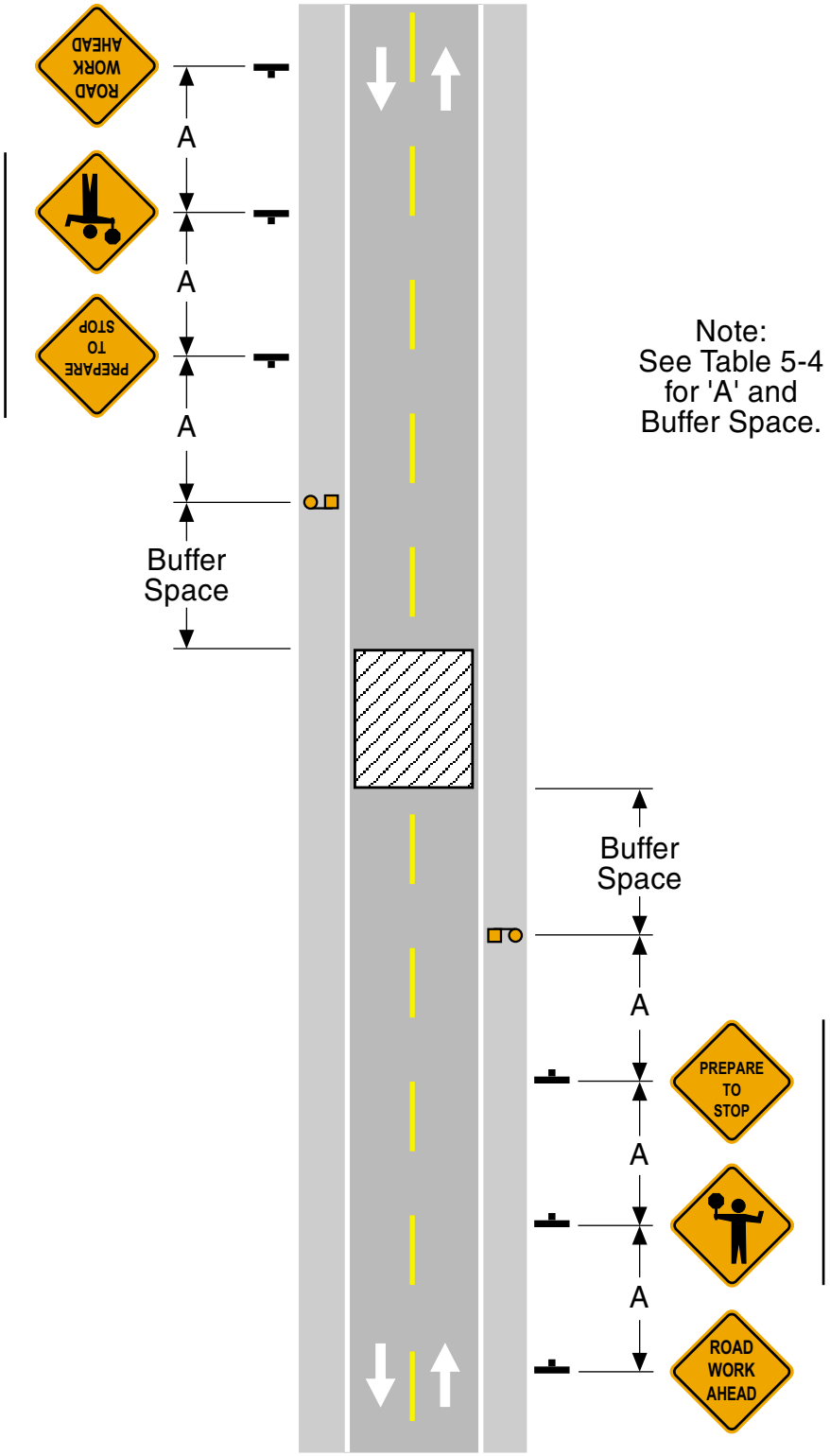
2. This application is intended for a planned temporary closure not to exceed 15 to 20 minutes.

3. The flaggers shall stop the first vehicle from the position shown, then move to the centerline to stop approaching traffic.

4. For high-volume roads, a police patrol car and/or a changeable message sign may be added.

5. A portable changeable message sign may be used in addition to the initial warning sign, per Section 5-05.3B, Application.

Typical Application 5-13
Temporary Road Closure



Note:
See Table 5-4 for 'A' and Buffer Space.

Haul Road Crossing

This diagram shows two different methods of traffic control; flagging and a temporary traffic signal. The method selected is to be used in both directions.

Unsignalized Crossing

1. This typical application diagram as shown is intended for short-term use during daylight hours.

2. When the haul road is not in use, Type III barricades shall be in place. The FLAGGER signs shall be covered.

3. The flagger shall stop the first vehicle from the position shown, then move to the centerline to stop approaching traffic.

Signalized Crossing

1. Dashed yellow centerline, if existing, between the stop lines shall be removed before the beginning of roadwork and replaced before opening to normal traffic.

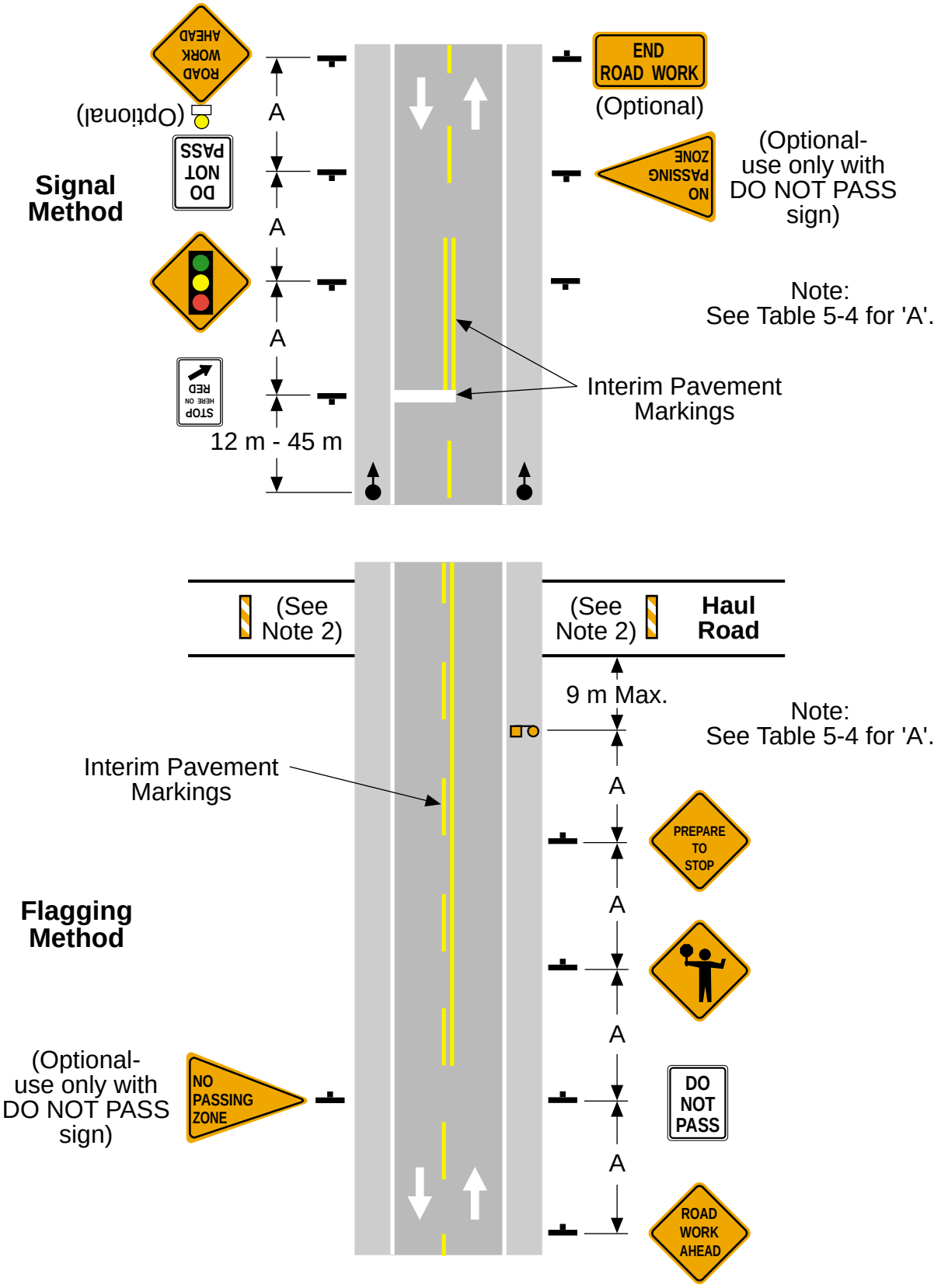
2. When the haul road is not in use, Type III barricades shall be in place. The Signal Ahead symbol sign and STOP HERE ON RED sign, and traffic signals, shall be covered or hidden from view.

3. Traffic signals shall be two-direction type with push-button activation. The temporary traffic control signals shall meet the physical display and operational requirements of conventional traffic signals as described in Chapter 9 of the Caltrans Traffic Manual.

Floodlighting

1. When hauling during hours of darkness and existing lighting is inadequate, floodlights should be used to illuminate haul road crossings.

Typical Application 5-14
Haul Road Crossing



Work in Center of Low-Volume Road

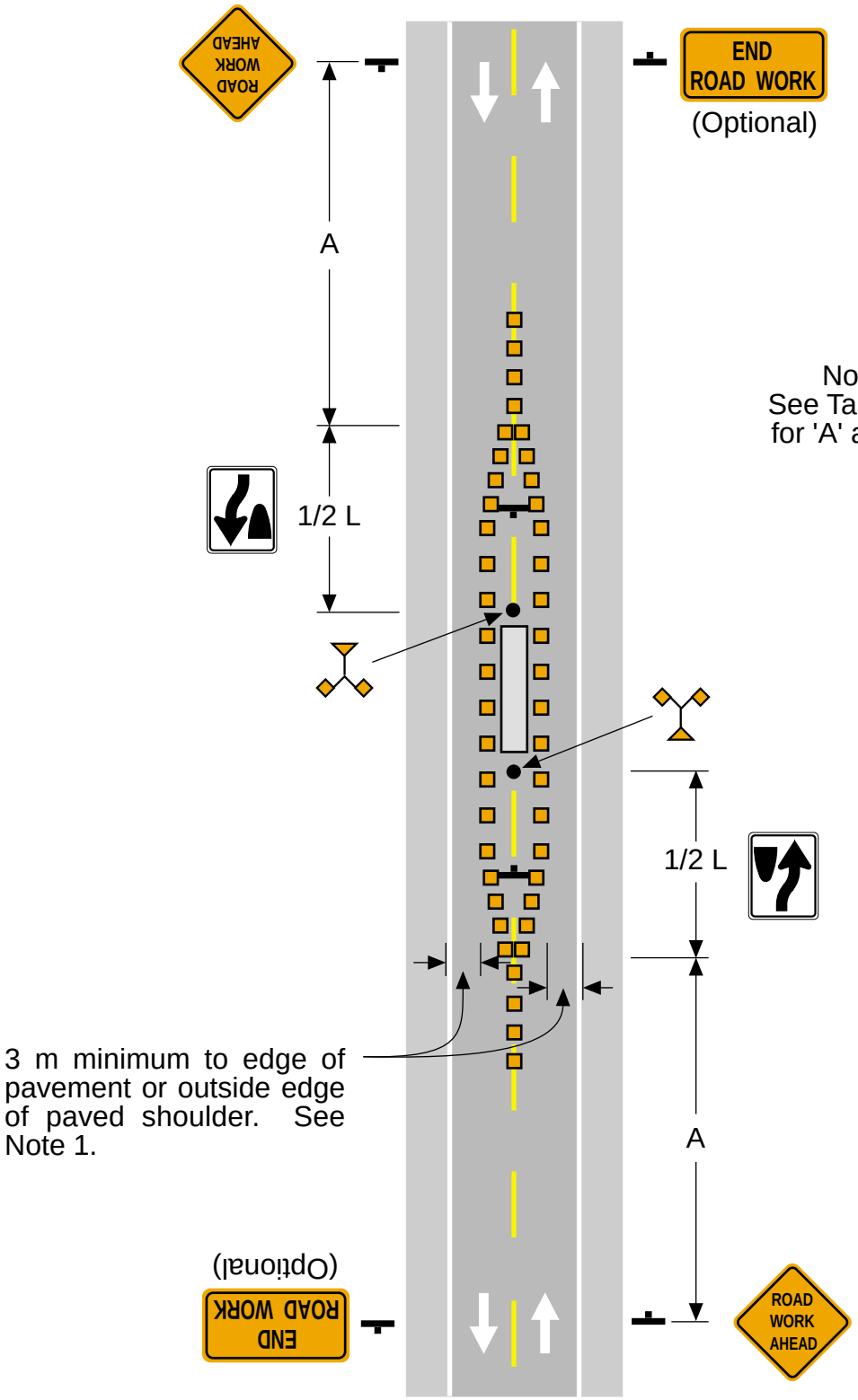
1. The lanes on either side of the center work space should have a minimum width of 3 m, as measured from the near edge of the channelizing devices to the edge of pavement, or the outside edge of paved shoulder.

2. A minimum of six channelizing devices should be used for each taper. However, a work vehicle displaying a flashing or revolving yellow light may be used instead of the tapers.

3. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

4. If the closure continues overnight, warning lights may be used to mark channelizing devices.

Typical Application 5-15
Work in Center of Low-Volume Road



Surveying Along Centerline of Low-Volume Road

1. The same treatment is required in both directions.

2. Cones should be placed 150 to 300 mm on either side of the center line.

3. Maximum spacing between cones is 30 m.

4. For a survey along the edge of the road or along the shoulder, the advance signing remains the same. For this situation, place cones along the edge line. A flagger is not required for work along the shoulder.

5. Cones may be omitted for a cross-section survey.

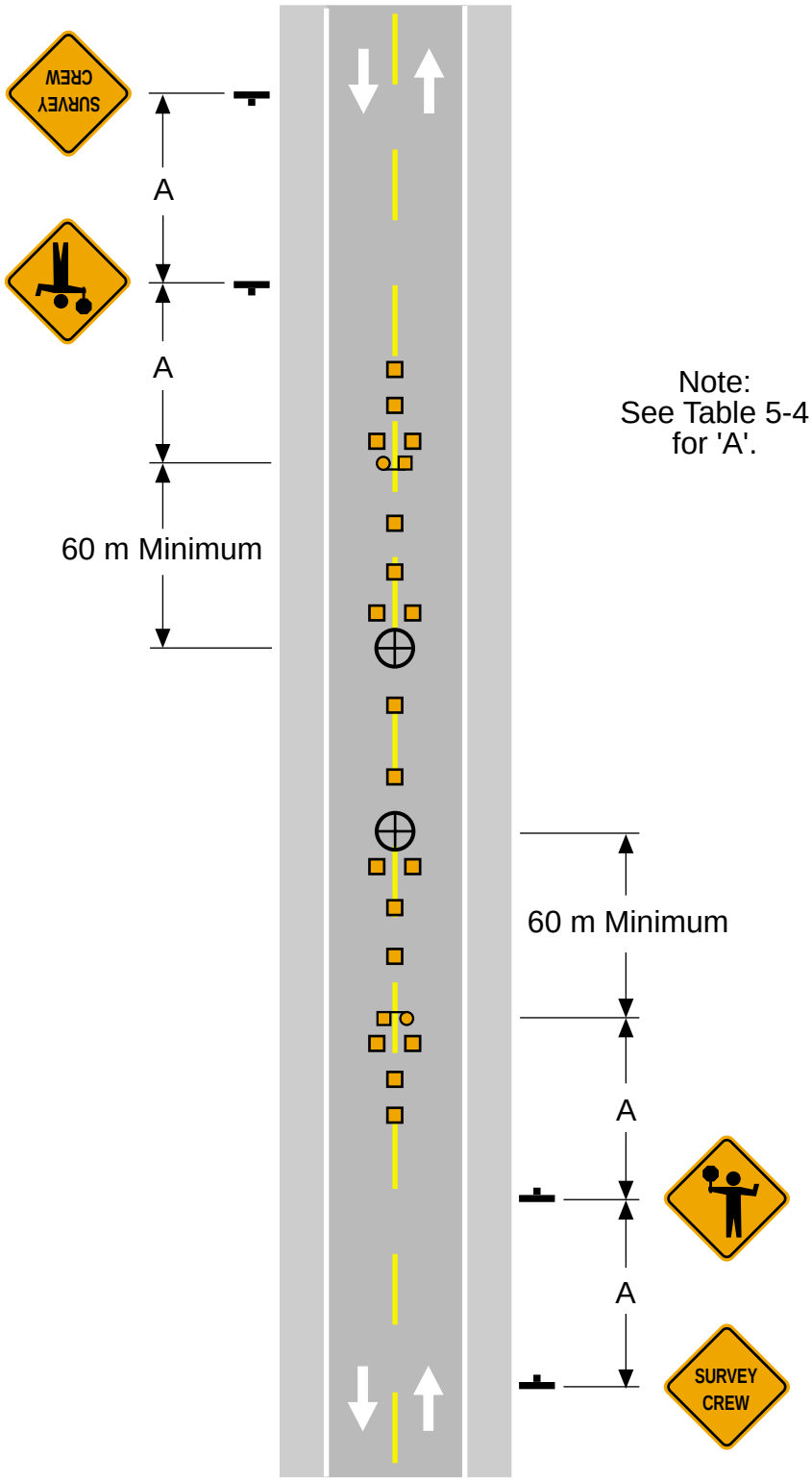
6. For surveying on the centerline of a high-volume road, close one lane, using the procedure illustrated in Figure TA-10.

7. ROAD WORK AHEAD signs may be used in place of SURVEY CREW signs.

8. A flagger should be used to protect people who must work with their backs to traffic. A high-level warning device may be used to protect a surveying device, such as a target on a tripod. Workers in the roadway should wear high-visibility clothing.

9. Flags may be used to call attention to the advance warning signs.

Typical Application 5-16
Surveying Along Centerline of Low-Volume Road



Mobile Operations on Two-Lane Road

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.

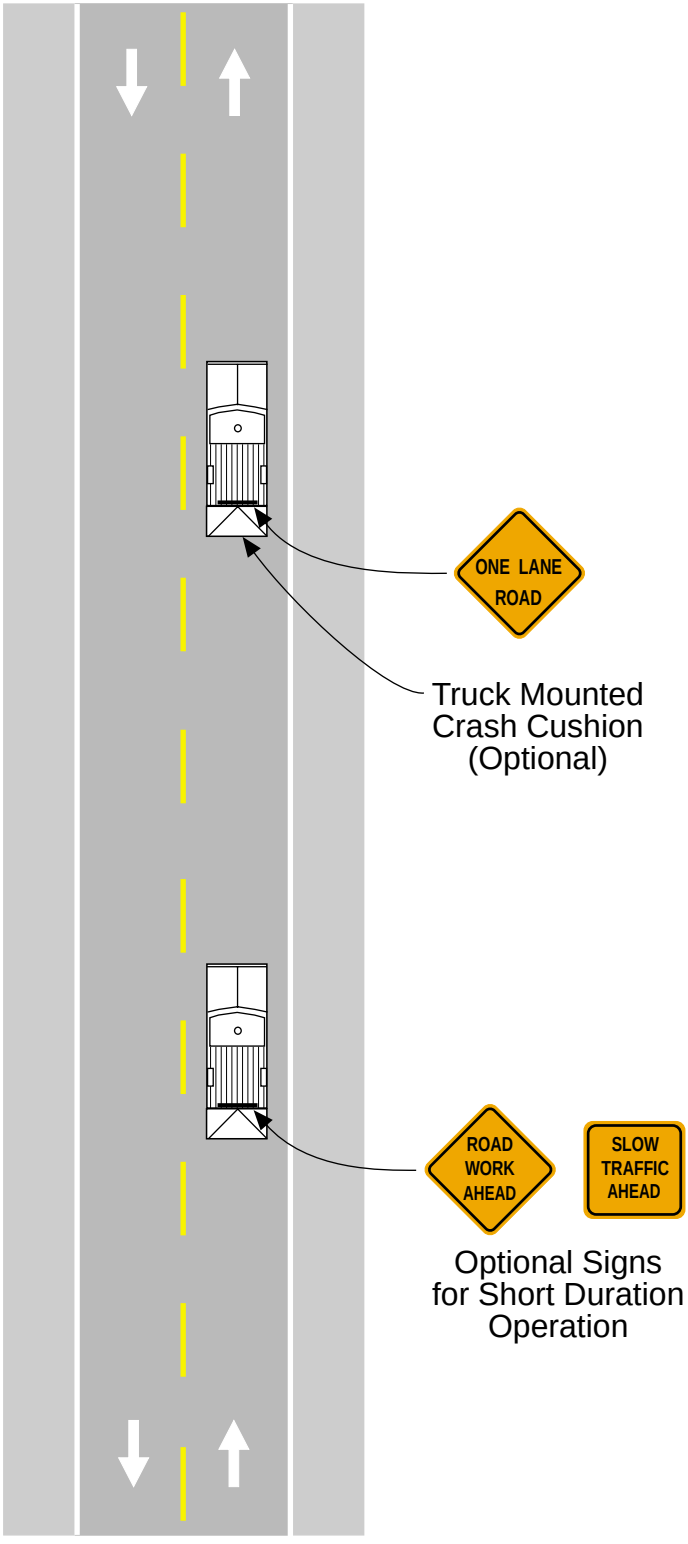
3. Additional protection vehicles to warn and reduce the speed of oncoming or opposing traffic may be used. Police patrol cars may be used for this purpose.

4. A truck-mounted crash cushion (TMCC) 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 1.2 m above the pavement. Sign legends shall be covered or turned from view when work is not in progress.

Typical Application 5-17
Mobile Operations on Two-Lane Road



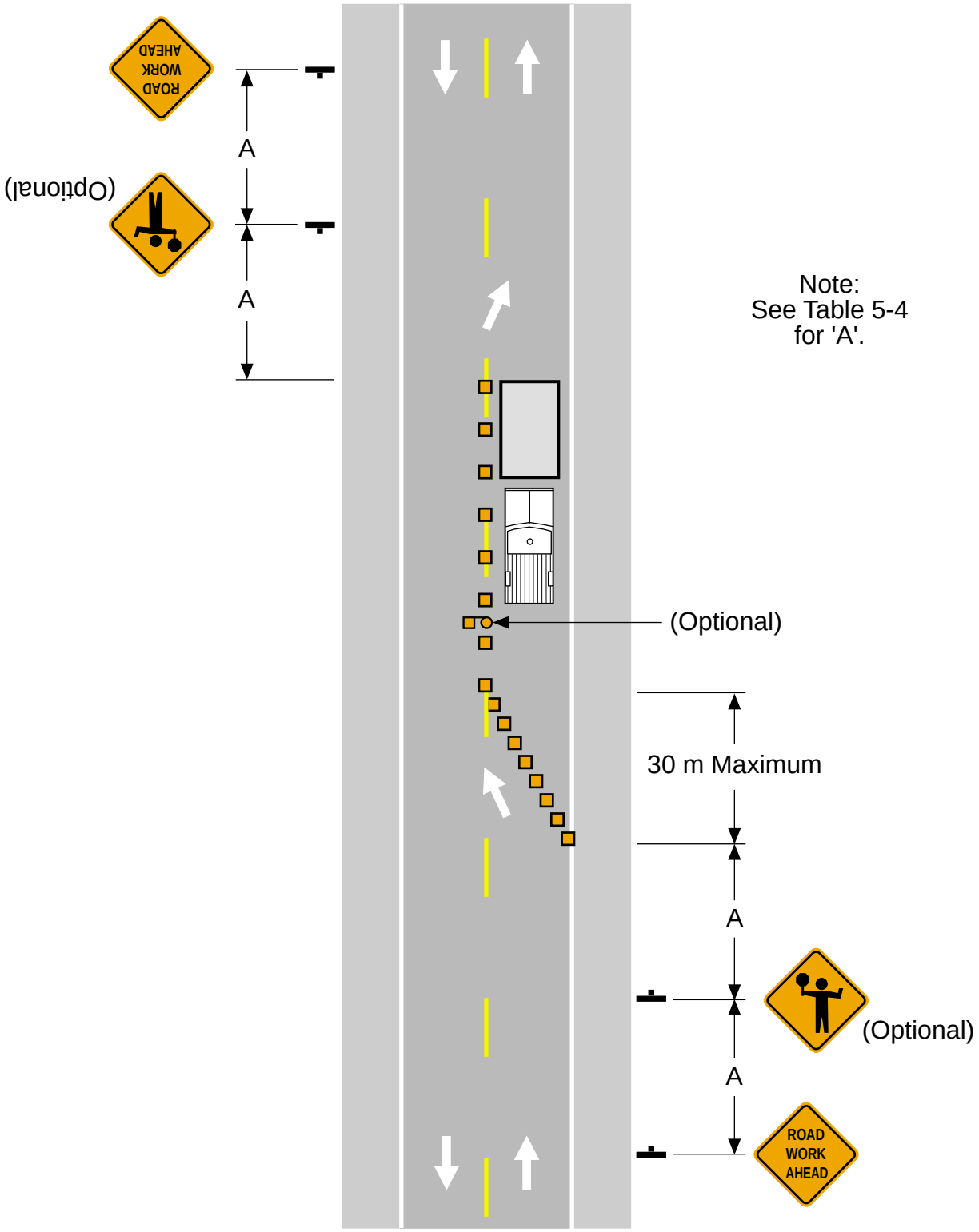
Lane Closure on Minor Street

1. The traffic control procedure shown is appropriate only for low-volume, low-speed facilities, such as local residential streets. With few exceptions, this procedure is not to be used in rural areas. Typical applications of traffic control devices on other roadways are shown in Typical Applications 5-21, 5-22, and 5-23.

2. Traffic can regulate itself when volumes are low and the length of the work space is short, thus enabling drivers to readily see the roadway beyond.

3. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

Typical Application 5-18
Lane Closure on Minor Street



Detour for One Travel Direction

1. A STREET CLOSED plate may be used in place of ROAD CLOSED.

2. The use of a street name sign mounted with the DETOUR sign is optional. When used, the street name plate is placed above the DETOUR sign. The plate may have either a white-on-green or a black-on-orange legend.

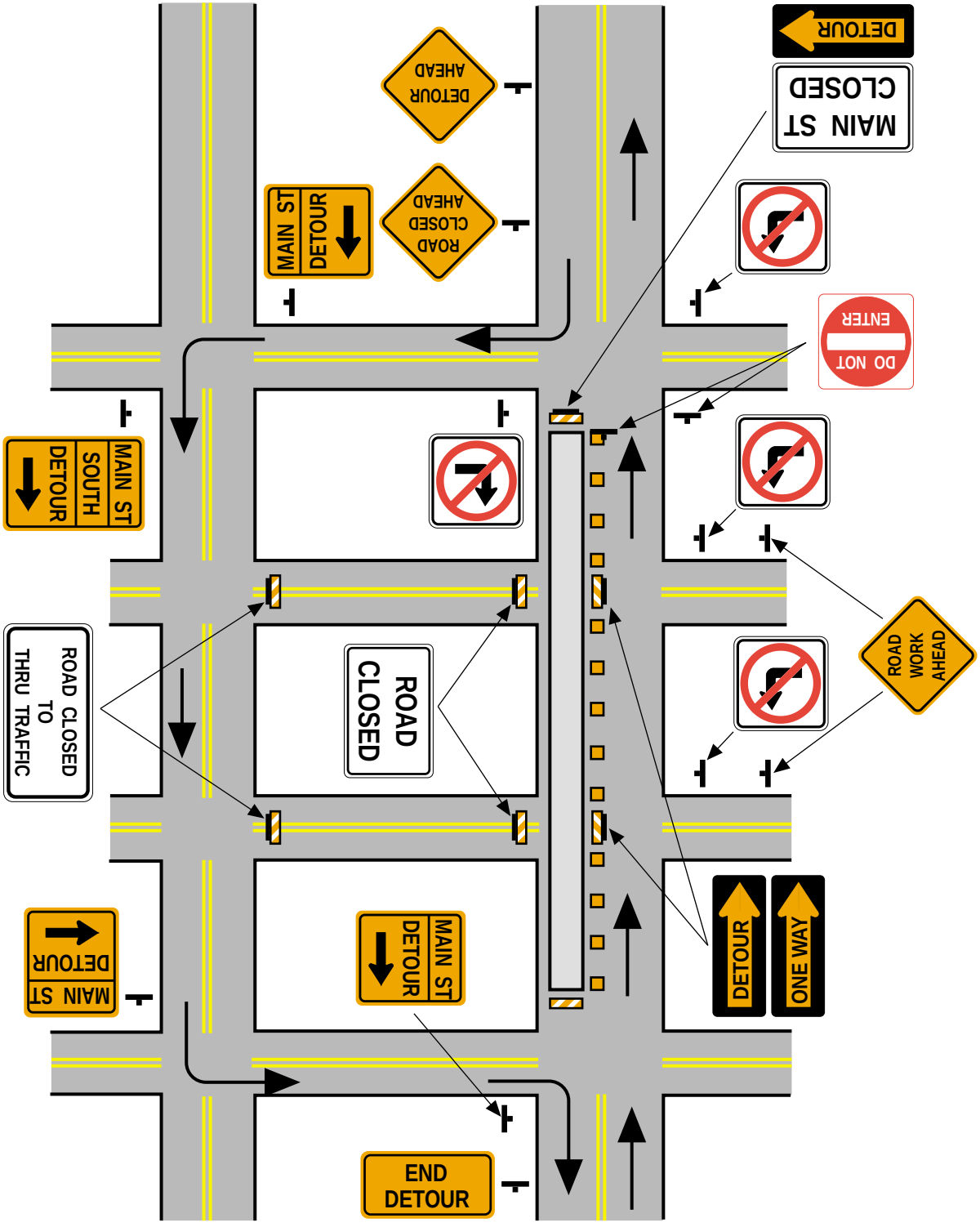
3. Additional DO NOT ENTER signs may be desirable at intersections with intervening streets.

4. Warning lights may be used on Type III barricades.

5. DETOUR signs may be located on the far side of intersections.

6. Reassurance DETOUR signs should be placed at 400 m + intervals and at major intersections.

Typical Application 5-19
Detour for One Travel Direction



Detour for Closed Street

1. Display similar signs and devices for the opposite movement.

2. Use this plan for city streets and for county roads. See Figure TA5-9 for the procedure for detouring a numbered highway.

3. The use of a street name plate mounted with the DETOUR sign is optional. When used, the street name plate is placed above the DETOUR sign. The plate may have either a white-on-green or a black-on-orange legend.

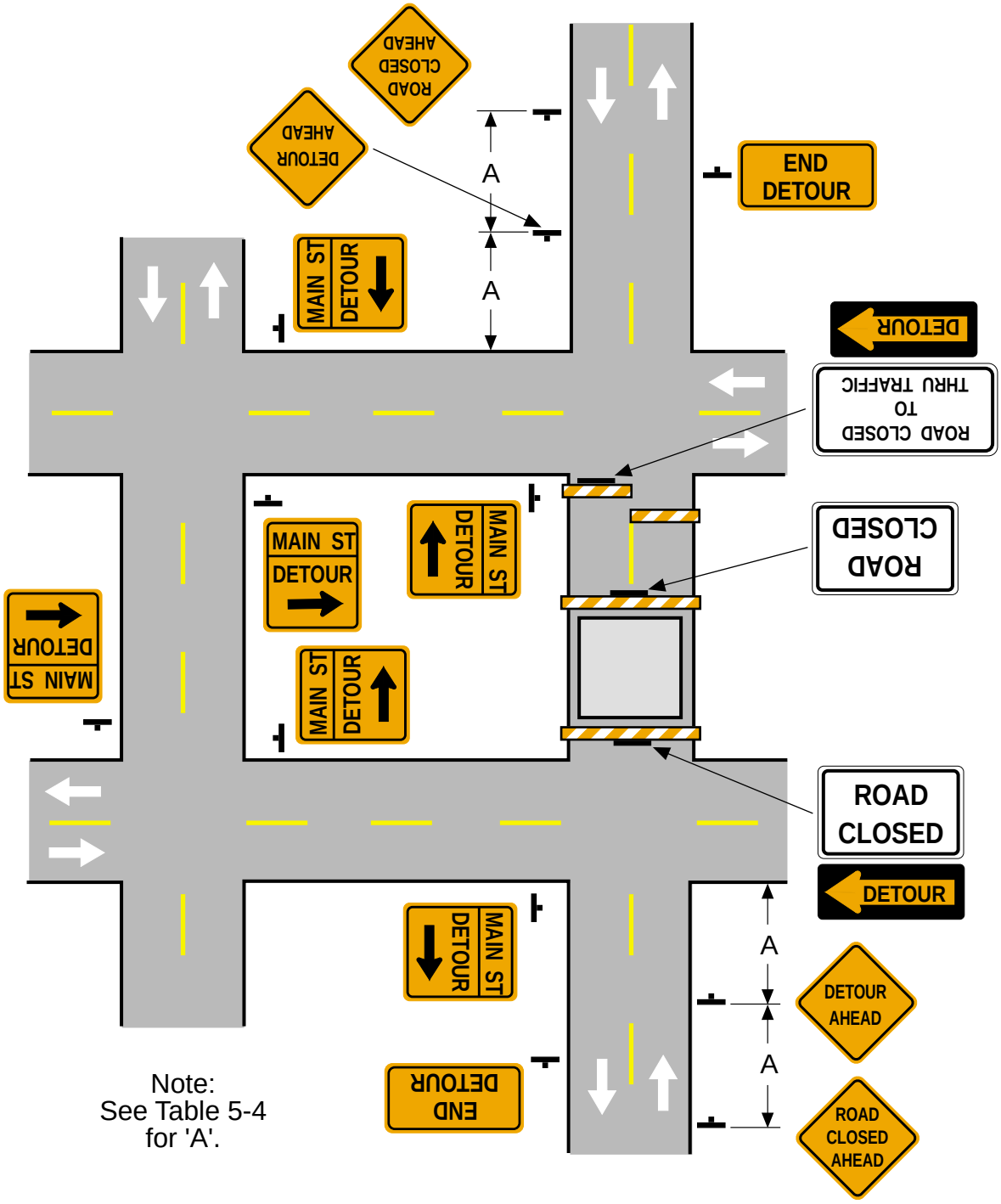
4. A DETOUR sign with an advance turn arrow may be used in advance of a turn. On multilane streets, such signs should be used.

5. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

6. Warning lights may be used on Type III barricades.

7. DETOUR signs may be located on the far side of the intersections.

Typical Application 5-20
Detour for Closed Street



Note:
See Table 5-4
for 'A'.

Lane Closure Near Side of Intersection

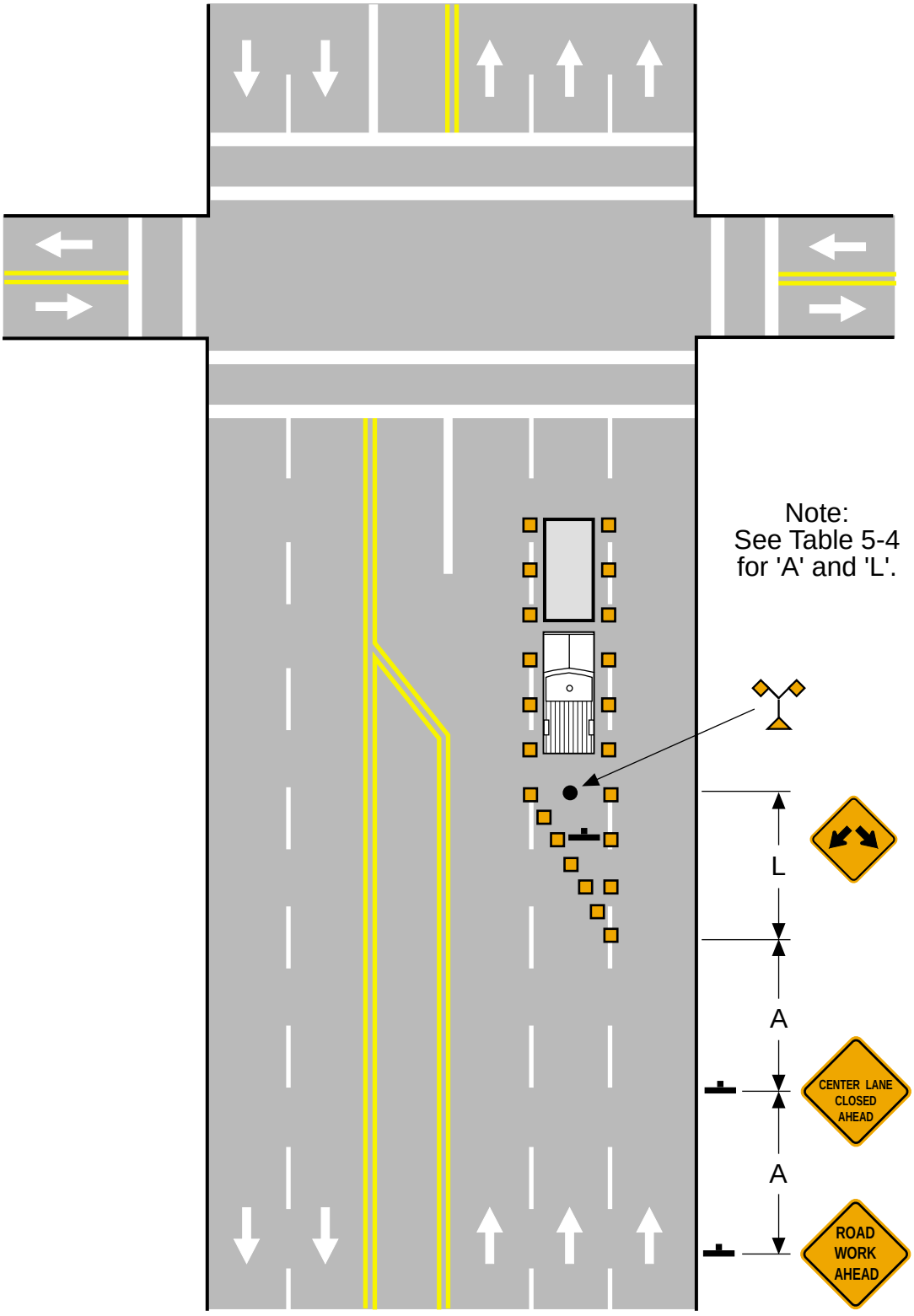
1. If the work space extends across the crosswalk, then close the crosswalk using the procedure and devices shown in Typical Application 5-29.

2. The merging taper may direct traffic into either the right or left lane, but not both. In this typical, a left taper should be used so that right-turn movements will not impede traffic.

3. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

4. Truck mounted FAS may be used to supplement this package.

Typical Application 5-21
Lane Closure Near Side of Intersection



Right Lane Closure Far Side of Intersection

1. For intersection approaches reduced to a single lane, left-turning movements may be prohibited to maintain capacity for through traffic.

2. The standard procedure is to close on the near side of the intersection any lane that is not carried through the intersection. However, when this results in the closing of a right lane having significant right-turning movements, then the right lane may be restricted to right turns only, as shown. This procedure increases the through capacity by eliminating right turns from the open through lane.

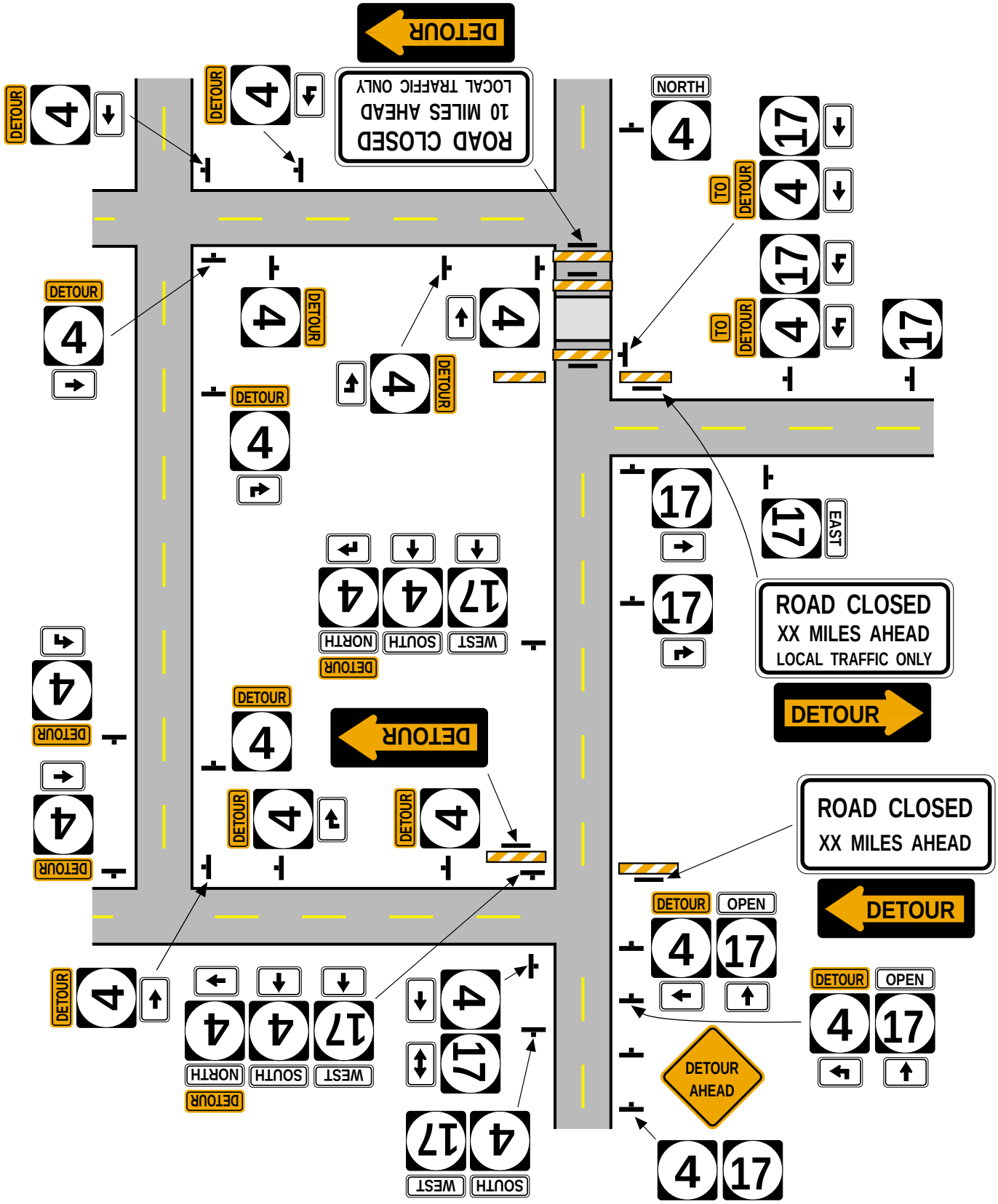
3. Where the turning radius is large, it may be possible to create a right turn island using channelizing devices, as shown. This procedure reinforces the nature of the temporary exclusive right-turn lane and enables a second RIGHT LANE MUST TURN RIGHT sign to be placed in the island.

4. If the work space extends across a crosswalk, then close the crosswalk using the procedure and devices shown in Typical Application 5-29.

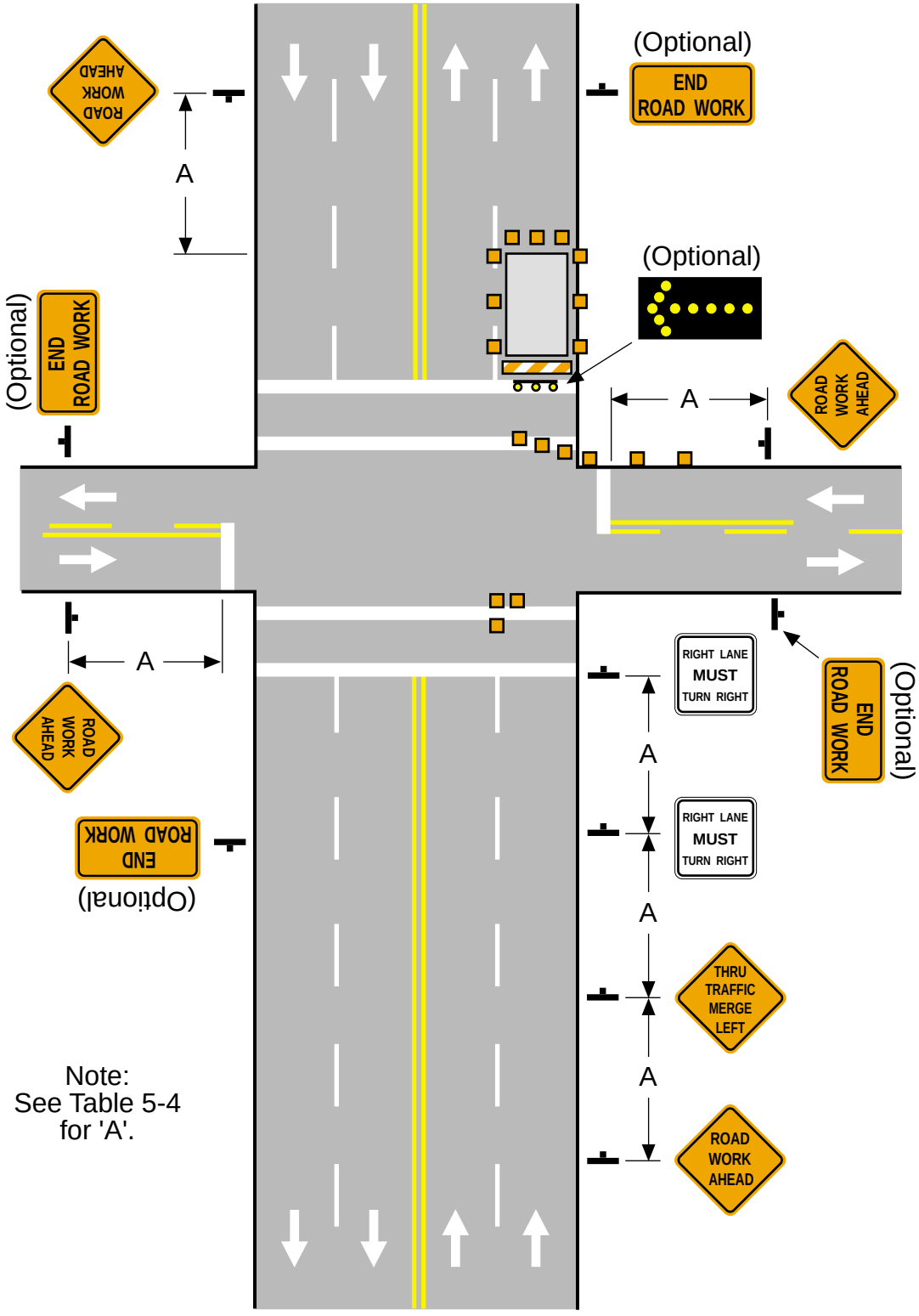
5. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

6. Optional treatment see Typical Application 5-23.

Typical Application 5-9
Roads Opened and Closed with Detour



Typical Application 5-22
Right Lane Closure Far Side of Intersection



Left Lane Closure Far Side of Intersection

1. The standard procedure is to close, on the near side of the intersection, any lane that is not carried through the intersection. However, when this results in the closure of a left lane having significant left-turning movements, then the left lane may be converted to a turn bay for left turns only, as shown. By first closing off the left lane and then reopening it as a turn bay, an island is created with channelizing devices that allow the LEFT LANE MUST TURN LEFT sign to be repeated on the left, adjacent to the lane that it controls.

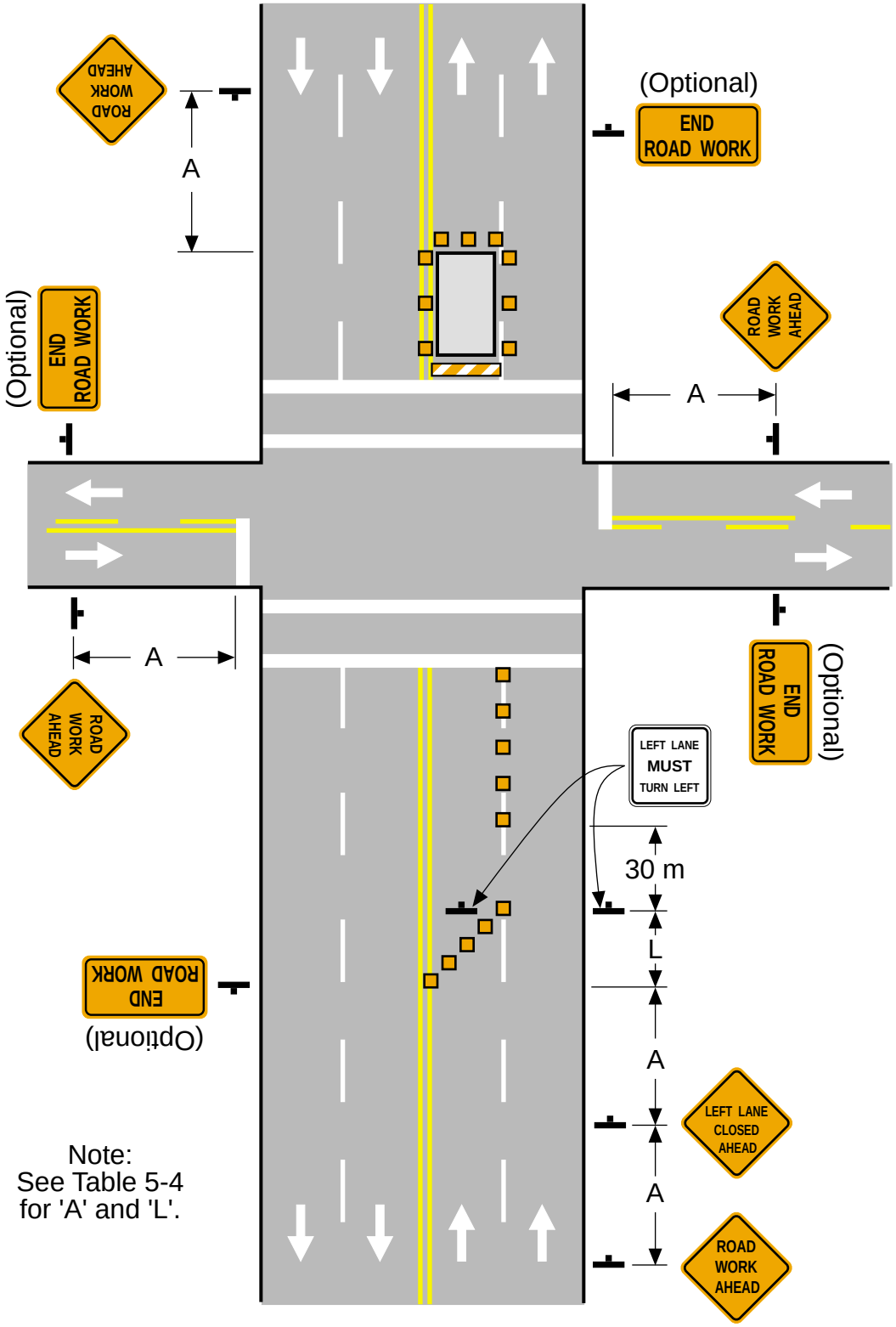
2. If the work space extends across a crosswalk, then close the crosswalk using the procedure and devices shown in Typical Application 5-29.

3. Care should be taken to warn drivers of vision obstructions for left-turning vehicles caused by equipment, material, and work operations in the work zone.

4. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

5. Optional see Typical Application 5-22.

Typical Application 5-23
Left Lane Closure Far Side of Intersection



Half Road Closure Far Side of Intersection

1. For intersection approaches reduced to a single lane, left-turning movements may be prohibited to maintain capacity for through traffic.

2. The standard procedure is to close on the near side of the intersection any lane that is not carried through the intersection. Therefore, the right lane should be closed on the near-side approach. However, if there is a significant right-turning movement, then the right lane may be restricted to right turns only, as shown. This procedure increases the through capacity by eliminating right turns from the open through lane.

3. Where the turning radius is large, it may be possible to create a right-turn island using channelizing devices, as shown. This procedure reinforces the nature of the temporary exclusive right-turn lane and enables a second RIGHT LANE MUST TURN RIGHT sign to be placed in the island.

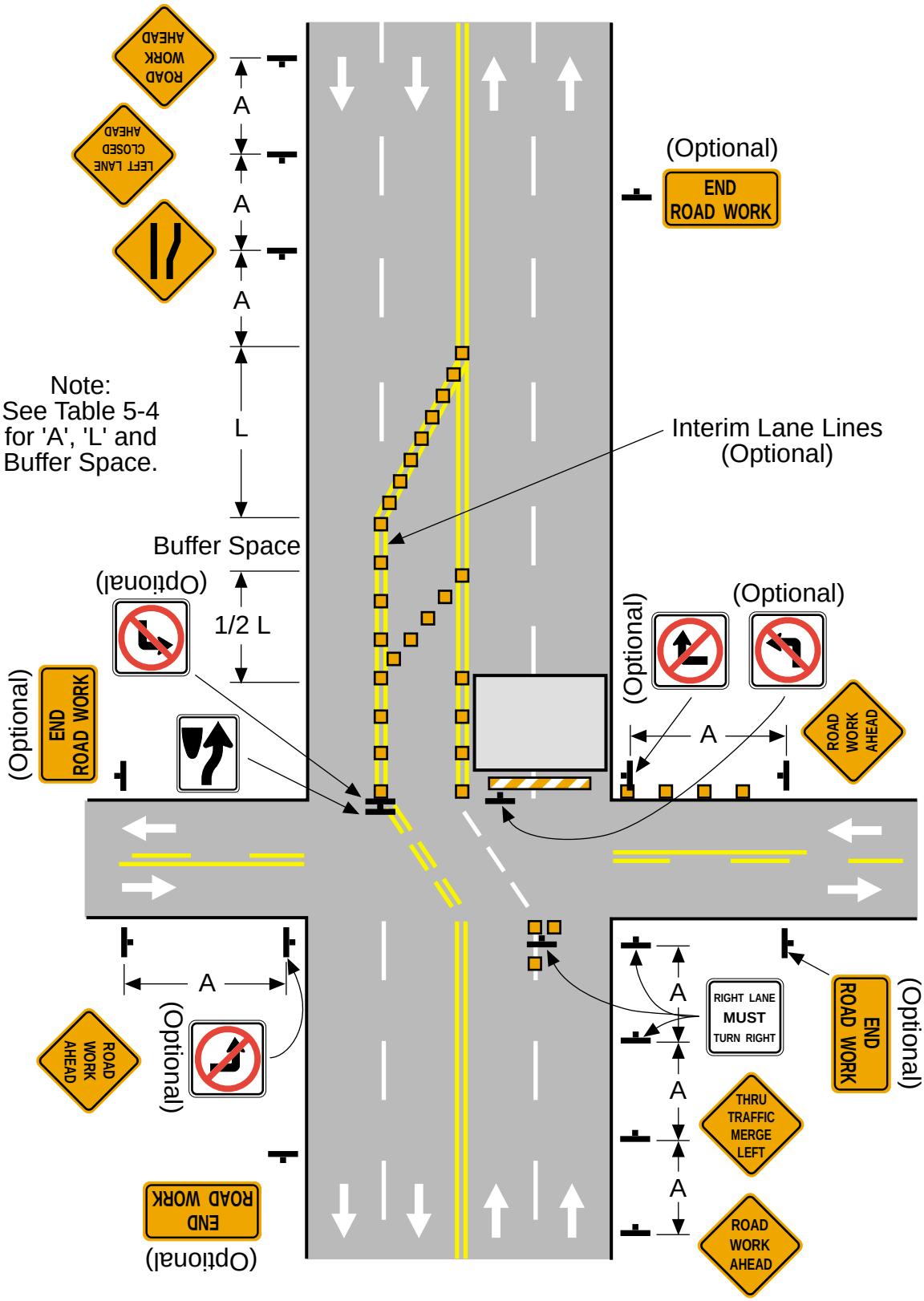
4. If the work space extends across a crosswalk, then close the crosswalk using the procedure and device shown in Typical Application 5-29.

5. A buffer space should be used between opposing directions of traffic as shown in this application.

6. There may be insufficient space to place the back-to-back KEEP RIGHT sign and NO LEFT TURN symbol signs at the end of the row of channelizing devices separating opposing traffic flows. In this situation, place the no left turn symbol sign on the right and omit the KEEP RIGHT sign.

7. Flashing warning lights and/or flags may be used to call attention to advanced warning signs.

Typical Application 5-24
Half Road Closure Far Side of Intersection



Multiple Lane Closures at Intersection

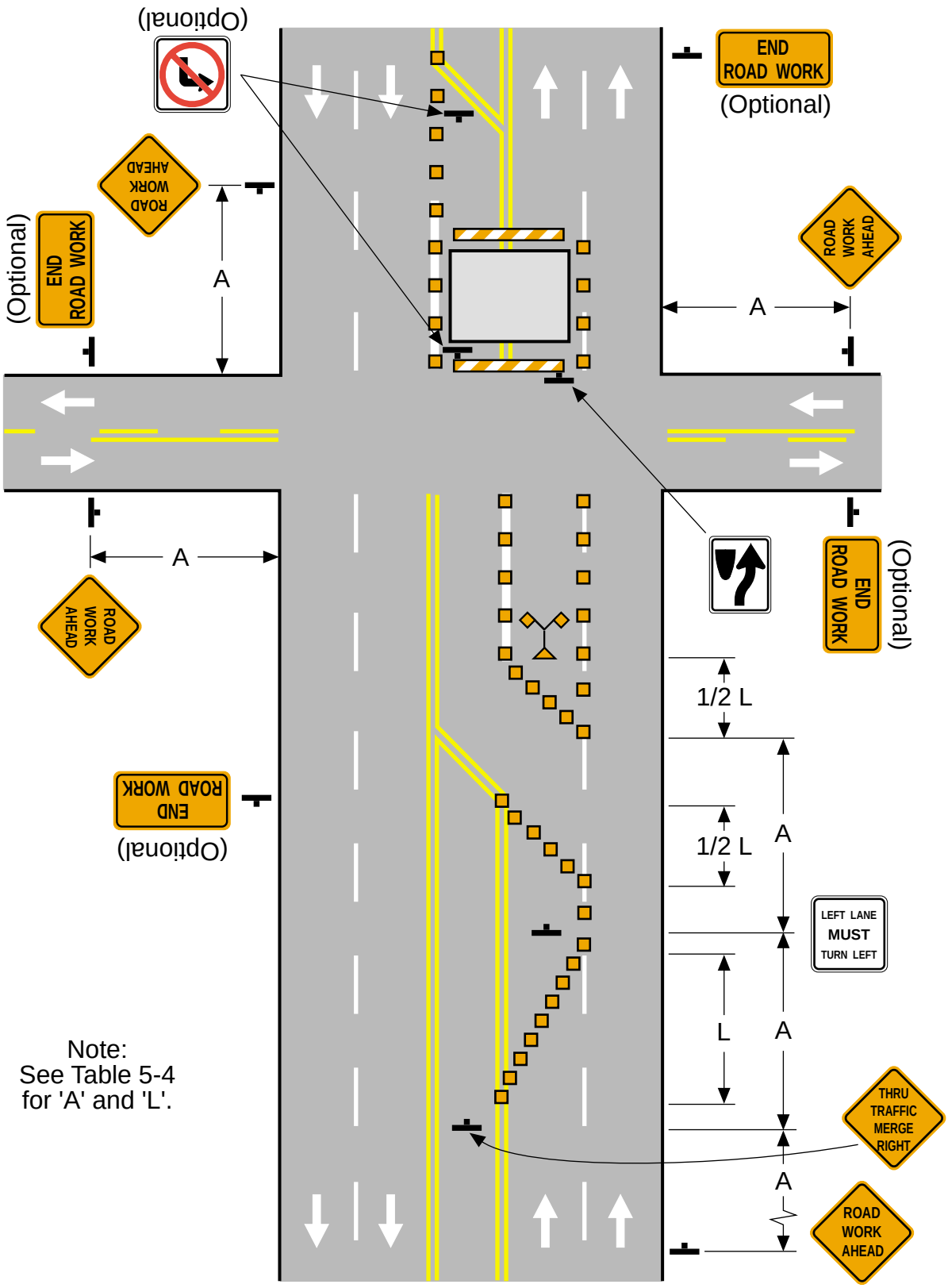
1. The standard procedure is to close on the near side of the intersection any lane that is not carried through the intersection. Therefore, the left through lane is closed on the near-side approach. The LEFT LANE MUST TURN LEFT sign is placed in the median to deter through traffic from entering the left turn bay.

2. If the work space extends across a crosswalk, then close the crosswalk using the procedure and devices shown in Typical Application 5-29.

3. If the left-turning movement that normally uses the closed turn bay is small and/or the gaps in opposing traffic are frequent, left turns need not be prohibited on that approach.

4. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

Typical Application 5-25
Multiple Lane Closures at Intersection



Note:
See Table 5-4
for 'A' and 'L'.

Closure in Center of Intersection

1. 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.

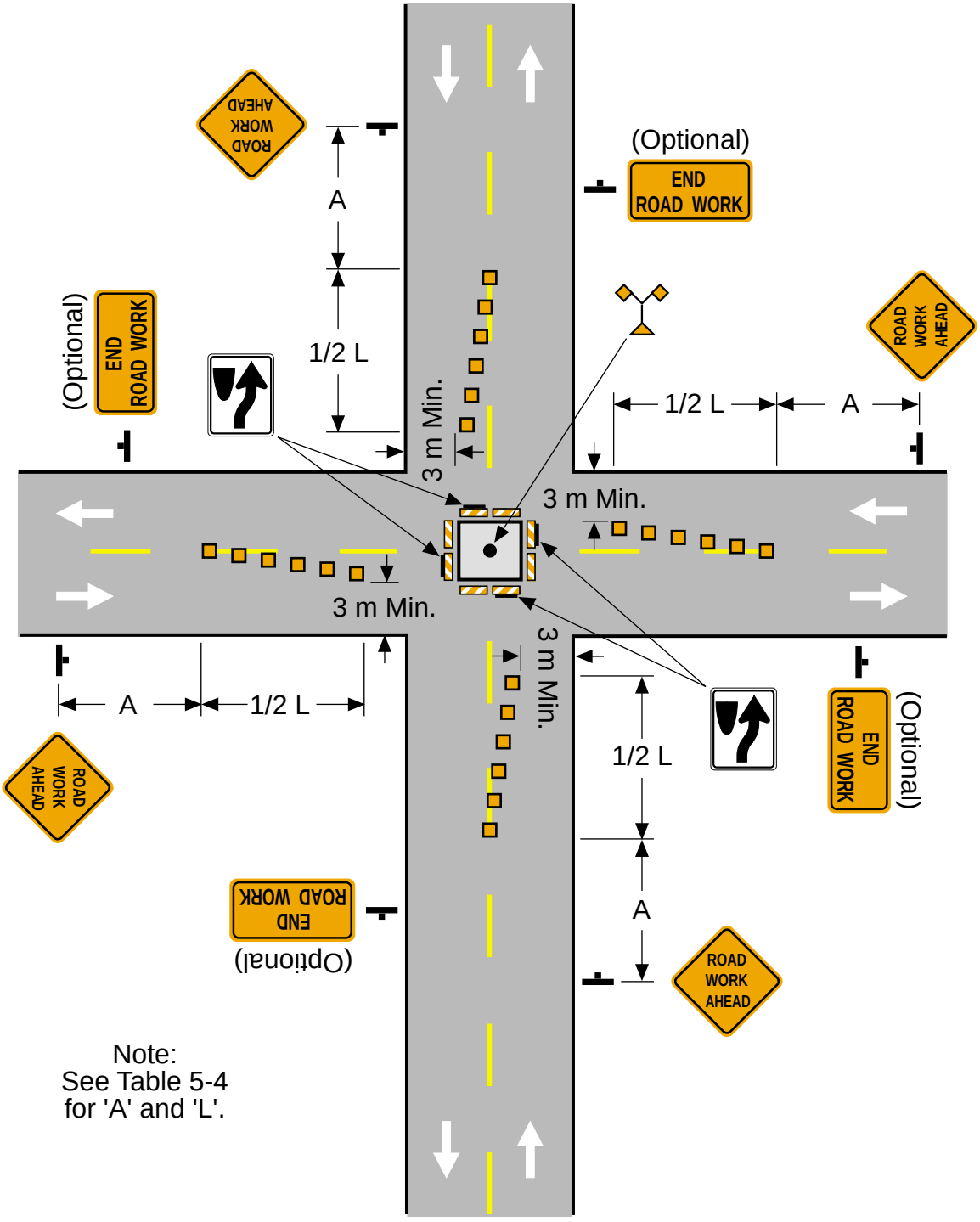
2. A minimum of six channelizing devices shall be used for each taper.

3. For short-duration work operations, on low speed streets, the channelizing devices may be eliminated if a flashing or revolving yellow light is displayed in the work space.

4. A high-level flag tree should be placed in the work space if there is sufficient room.

5. Flashing warning lights and/or flags may be used to call attention to advanced warning signs.

Typical Application 5-26
Closure in Center of Intersection



Note:
See Table 5-4
for 'A' and 'L'.

Closure at Side of Intersection

1. For low traffic volumes and intersecting two-lane streets, one flagger positioned in the center of the intersection may suffice.

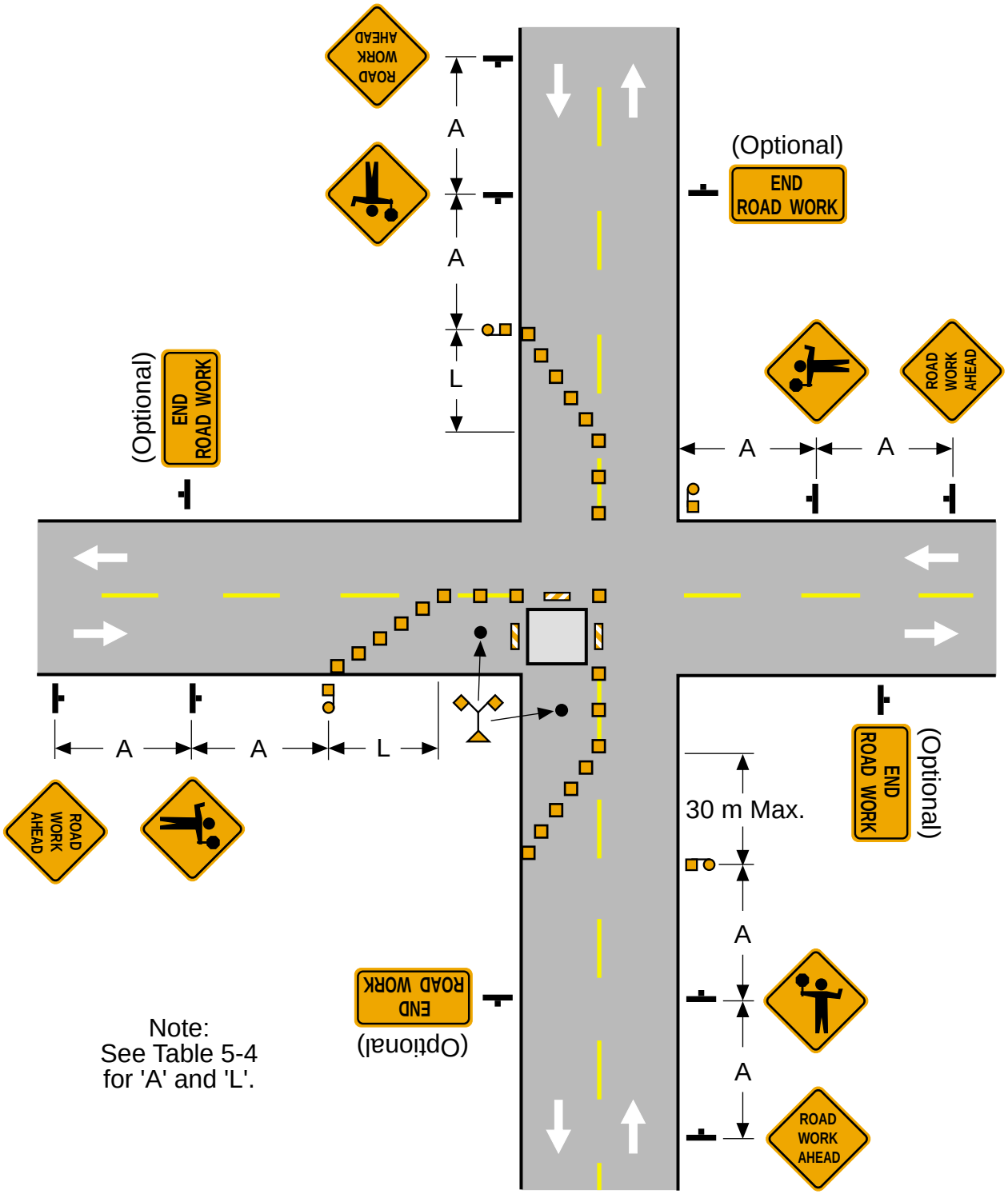
2. For high traffic volumes or when a four-lane street is involved, additional flaggers or law enforcement personnel should be considered.

3. A ONE-LANE ROAD AHEAD sign may also be necessary to provide adequate advance warning.

4. The situation depicted can be simplified by closing one or more of the intersection approaches. If this cannot be done, and/or when capacity is a problem, consideration should be given to diverting through traffic to other roads or streets.

5. Flashing warning lights and/or flags may be used to call attention to the advanced warning signs.

Typical Application 5-27
Closure at Side of Intersection



Note:
See Table 5-4
for 'A' and 'L'.

Sidewalk Closures and Bypass Walkway

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 or ROAD NARROWS signs, as needed.

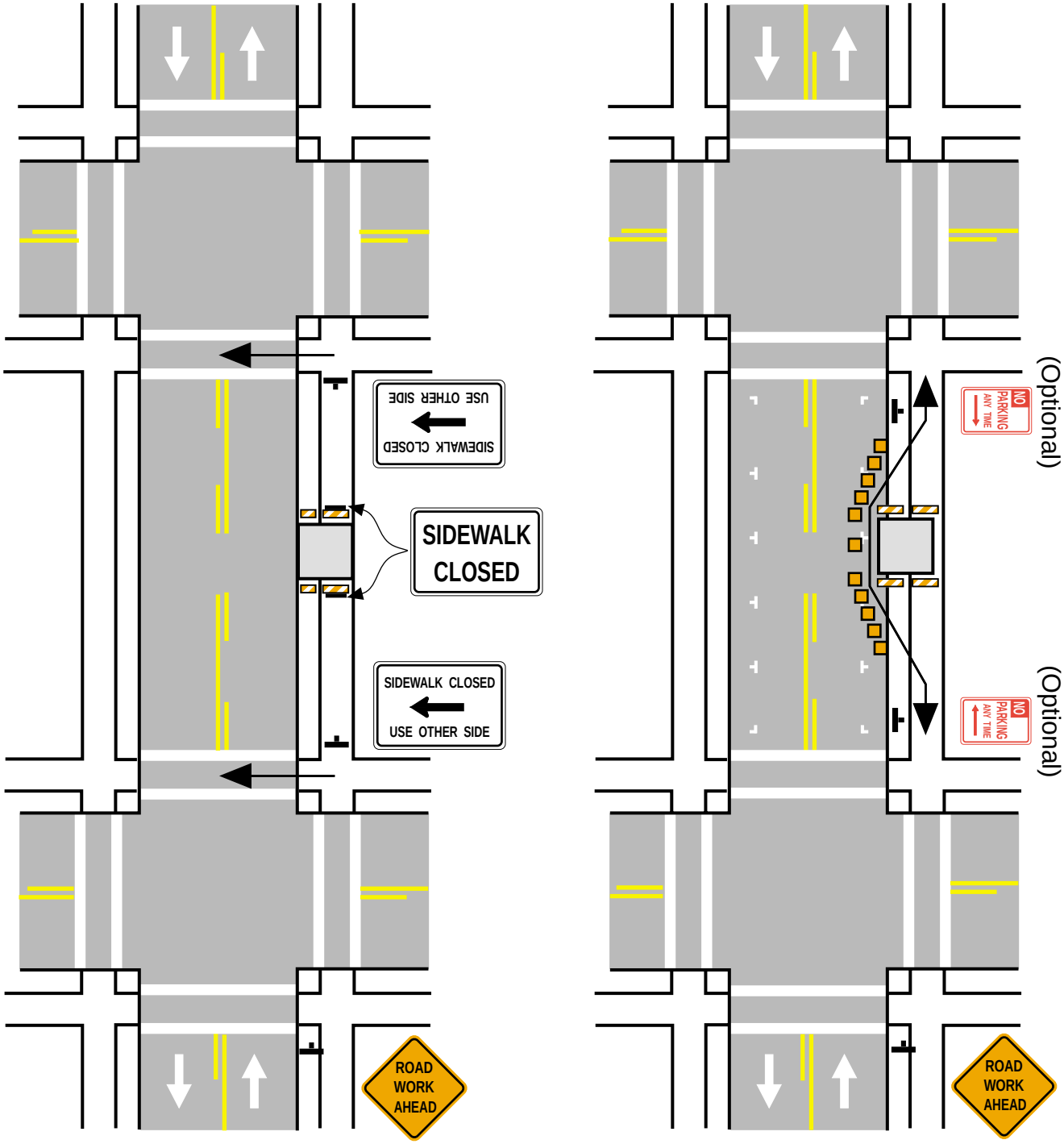
3. Street lighting should be considered.

4. For nighttime closures, Type A flashing warning lights may be used on barricades supporting signs and closing walkways. Type C steady-burn lights may be used on channelizing devices separating the temporary walkway from vehicular traffic.

5. Where high speeds may be anticipated, use a barrier to separate the temporary walkway from vehicular traffic.

6. Signs may be placed along a temporary walkway to guide or direct pedestrians. Examples include KEEP RIGHT and KEEP LEFT signs.

Typical Application 5-28
Sidewalk Closures and Bypass Walkway



Pedestrian Detour

Walkway Provided

Crosswalk Closures and Pedestrian Detours

1. 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 or ROAD NARROWS signs, as needed.

2. Street lighting should be considered.

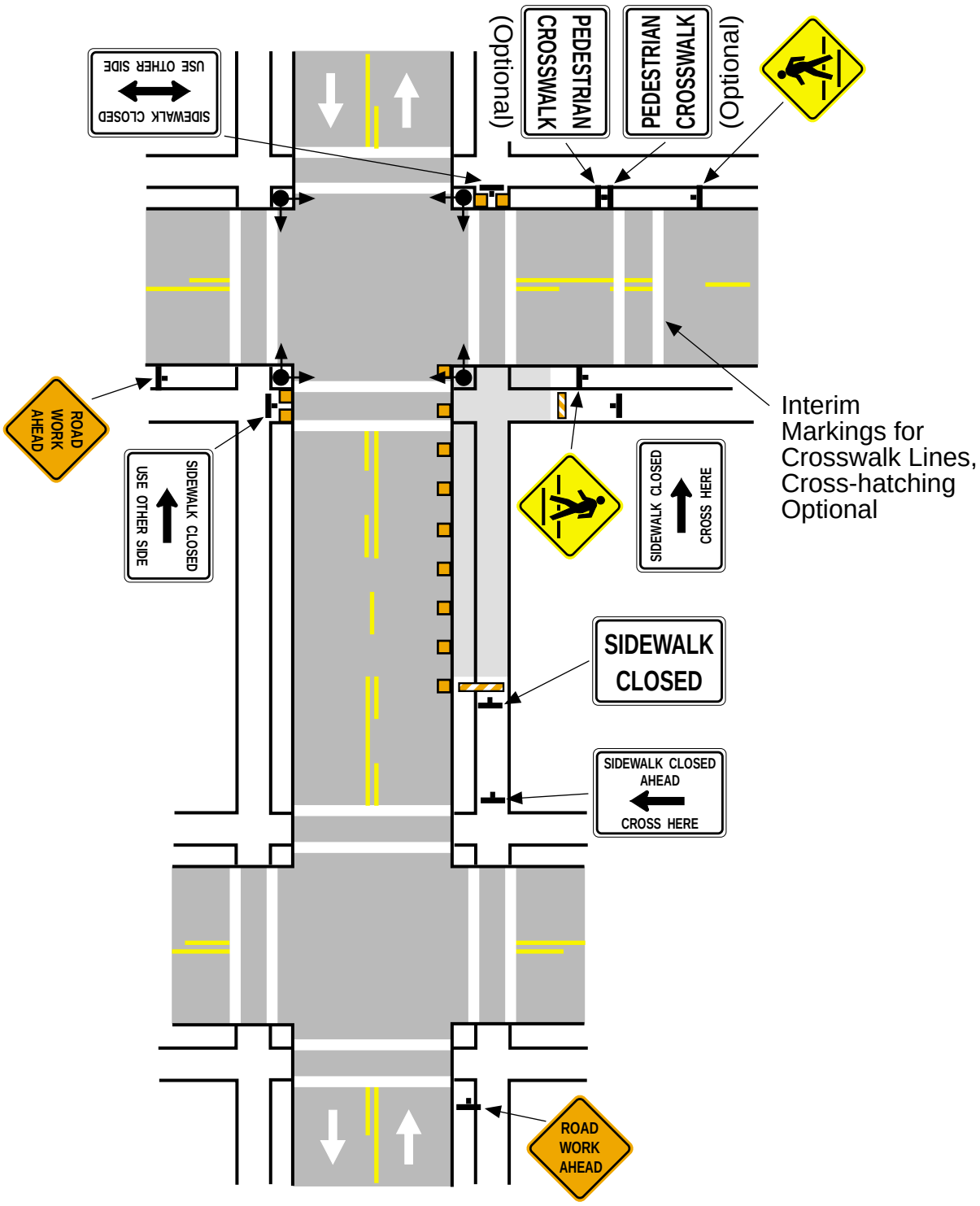
3. For nighttime closures, Type A flashing warning lights may be used on barricades supporting signs and closing walkways. Use Type C steady-burn lights on channelizing devices separating the work space from vehicular traffic.

4. Pedestrian traffic signal displays controlling closed crosswalks should be covered or deactivated.

5. Parking should be prohibited in advance of midblock crosswalks.

6. Midblock crosswalks should be avoided when possible.

Typical Application 5-29
Crosswalk Closures and Pedestrian Detours



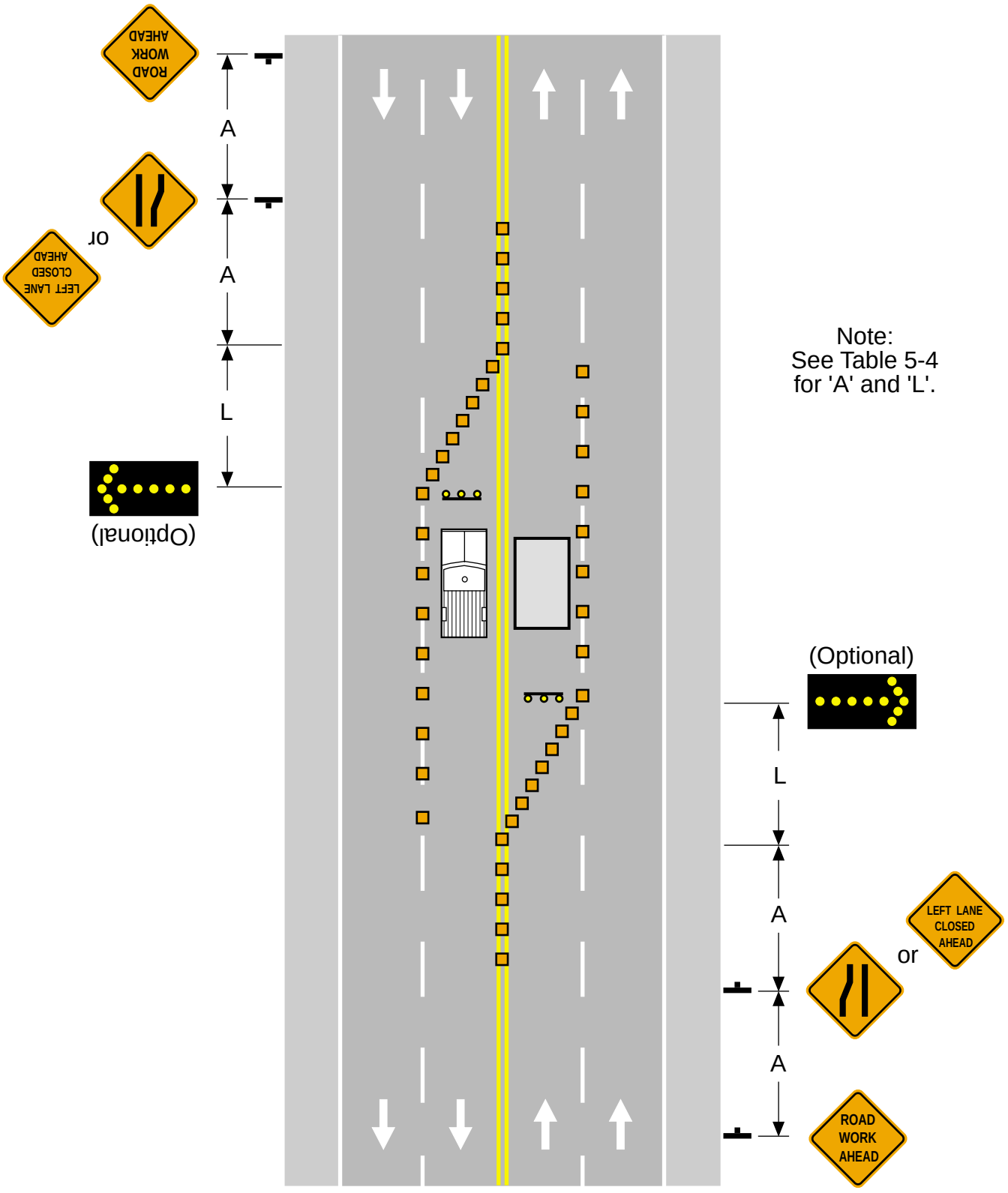
Interior Lane Closure on Multilane Street

1. The closure of the adjacent interior lane in the opposing direction may not be necessary, depending upon the activity being performed and the work space needed for the operation.

2. Additional advance warning may be necessary.

3. This procedure applies to low-speed, low-volume urban streets.

Typical Application 5-30
Interior Lane Closure on Multilane Street



Lane Closure on Streets with Uneven Directional Volumes

1. The illustrated procedure would be used only when the traffic volume is such that two lanes of traffic must be maintained in the direction of travel for which one lane is closed. The procedure may be used during a peak period of traffic and then changed to provide two lanes in the other direction for the other peak.

2. The traffic control devices shown are appropriate for an urban street. Additional advance warning may be necessary.

3. A buffer space should be used in the activity area and to separate opposing traffic.

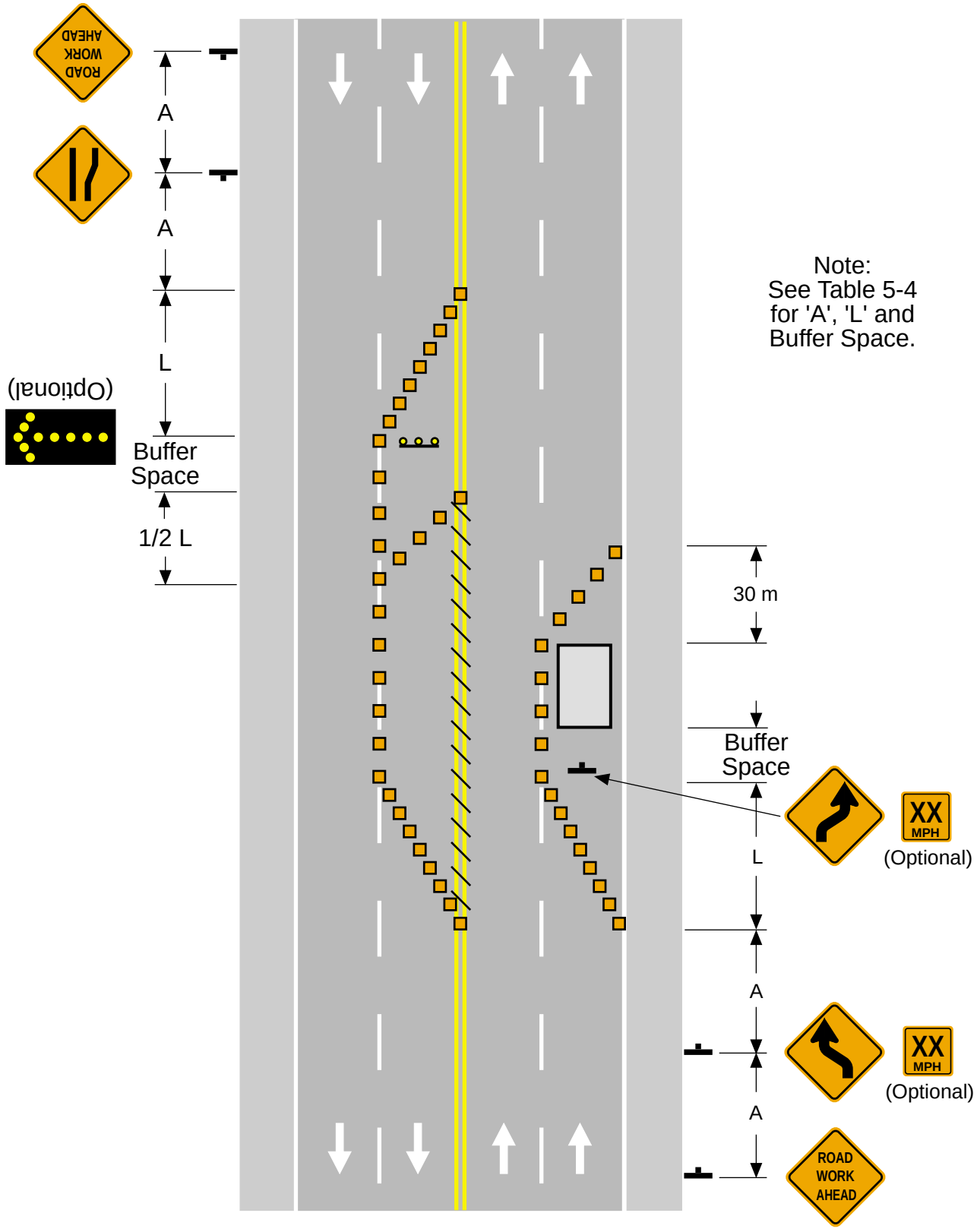
4. Conflicting pavement markings should be removed for long-term projects. (See Section 5-06.3.) For shorter-term projects when this is not practicable, the channelizing devices in the area of conflict should be placed at a maximum spacing of 3 meters. Interim markings should be installed where needed.

5. For higher speeds, add a LEFT LANE CLOSED [distance] sign for traffic approaching the lane closure, as shown in Typical Application 5-32.

6. If the lane shift is short and has sharp curves (50 km/h or less), Reverse Turn signs should be used.

7. Where the shifted section is long, use a Reverse Curve sign to show the initial shift and a second one to show the return to the normal alignment. If the shift involves a short runaround, a symbol showing back-to-back reverse curves may be used. As an alternative side-by-side arrows may be used displaying one arrow for each lane. A supplementary plate stating ALL LANES THRU may be used to emphasize the point that no lanes are closed.

Typical Application 5-31
Lane Closure on Streets with Uneven Directional Volumes



Half Road Closure on Multilane High Speed Highways

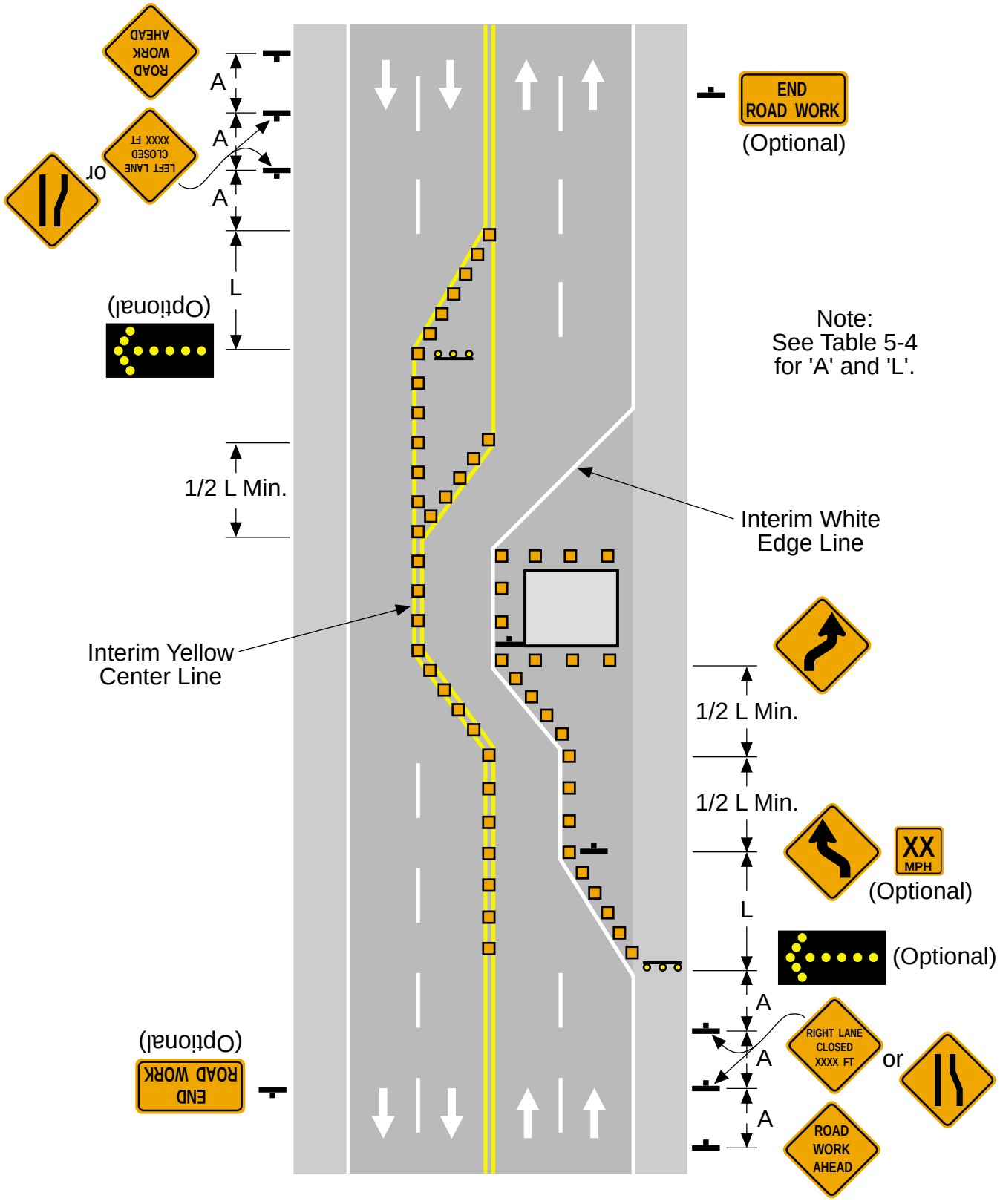
1. The traffic control devices shown are appropriate for a high speed highway.

2. Pavement markings no longer applicable shall be removed or obliterated as soon as practicable. Interim markings shall be used as necessary.

3. Warning lights may be used to mark channelizing devices at night as needed.

4. For intermediate-term situations, when it is not feasible to remove and restore pavement markings, the channelization must be made dominant by using a very close device spacing. This is especially important in locations of conflicting information, such as where traffic is directed over a double yellow centerline. In such locations a maximum channelizing device spacing of 3 meters is recommended.

Typical Application 5-32
Half Road Closure on Multilane High Speed Highways



Lane Closure on Divided Highway

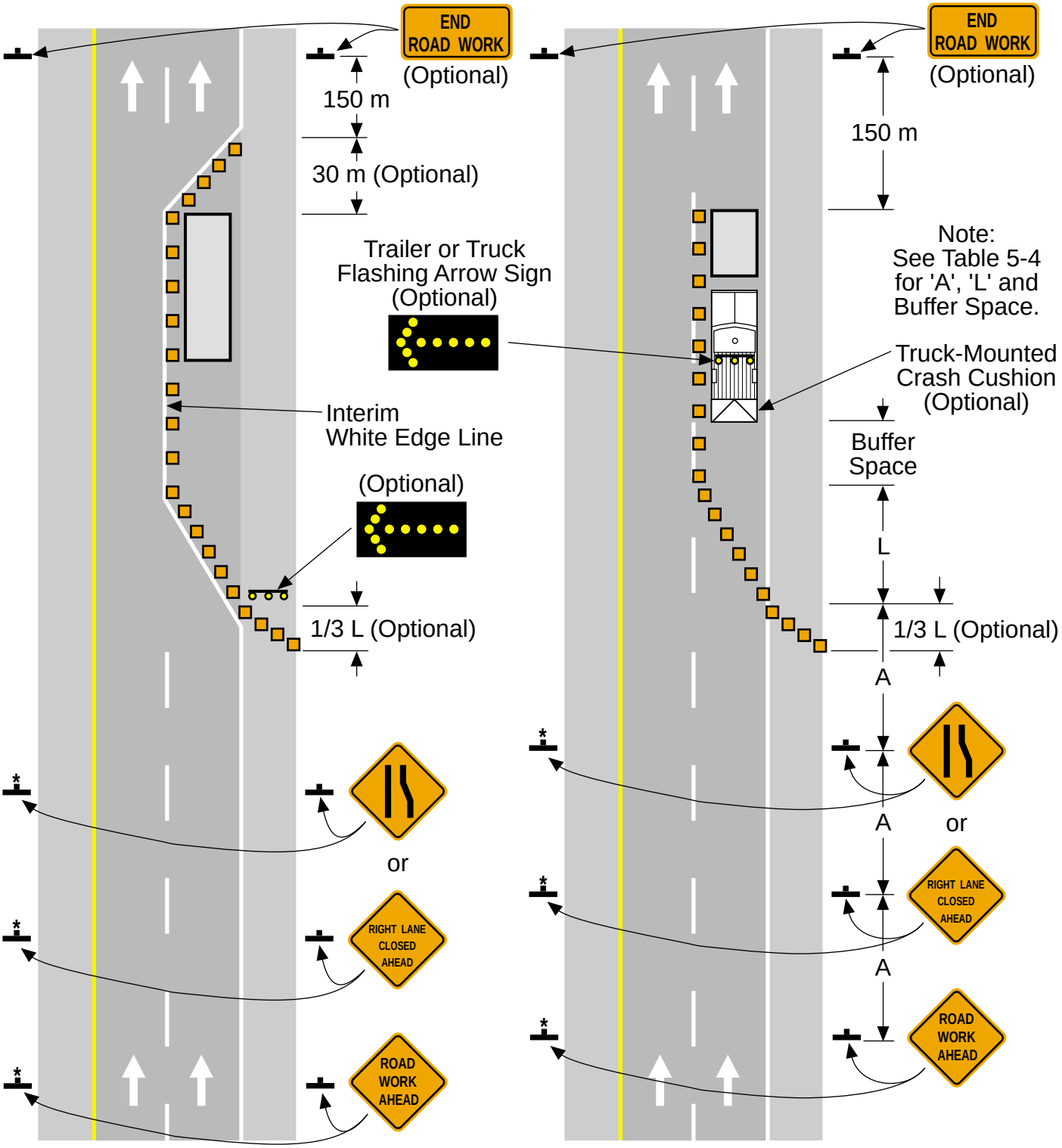
1. This procedure also applies when work is being performed in the lane adjacent to the median on a divided highway. Under these conditions, LEFT LANE CLOSED signs and the corresponding Lane Reduction symbol signs shall be used.

2. When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be erected, as needed.

3. Longitudinal dimensions may be adjusted slightly to fit field conditions.

4. All vehicles, equipment, workers, and their activities should be restricted to one side of the pavement.

Typical Application 5-33
Lane Closure on Divided Highway



Lane Closure with Barrier

1. Additional advance warning may be necessary.

2. The use of a barrier should be based on the need determined by an engineering analysis.

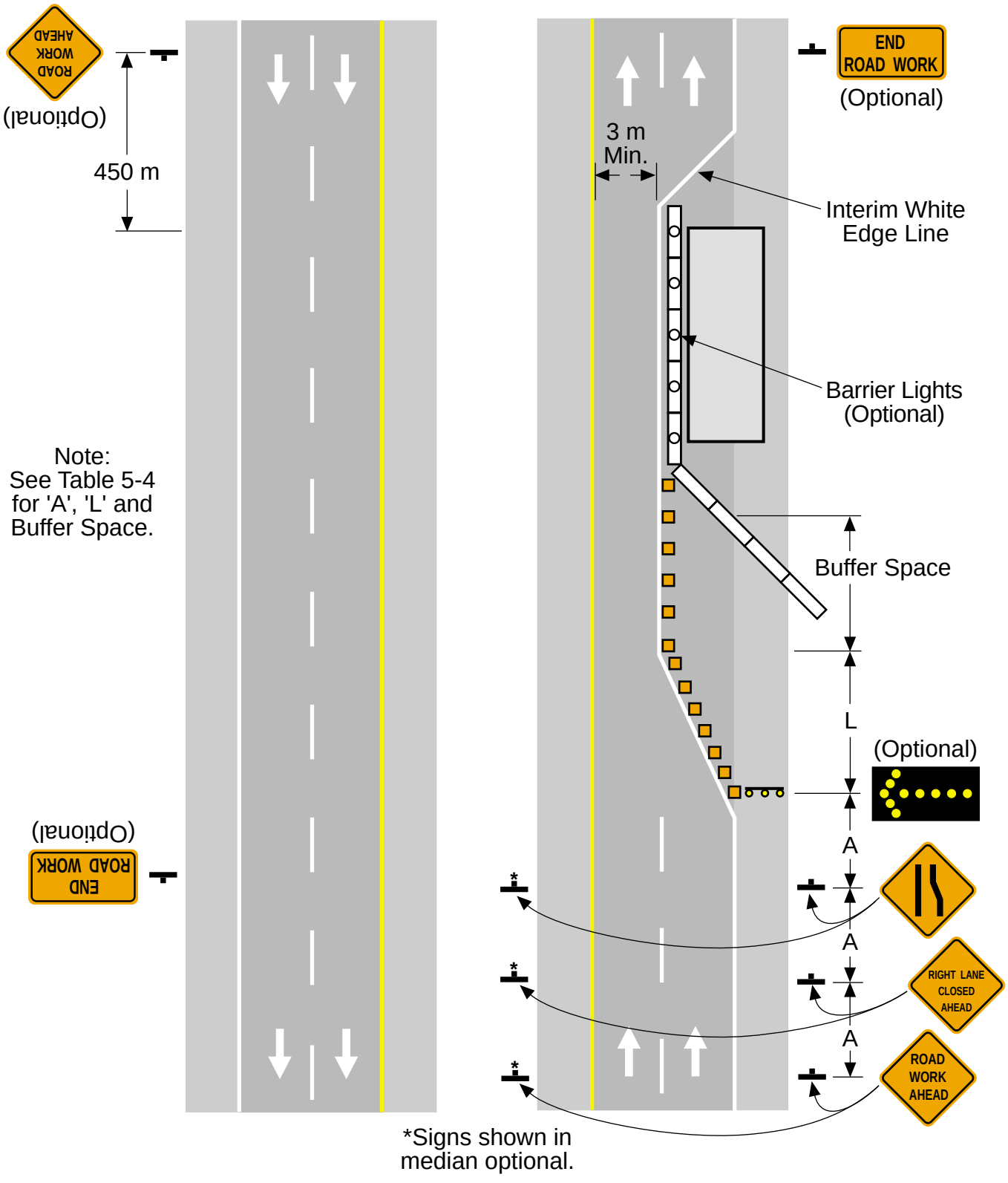
3. The layout of the barrier should prevent vehicles from impacting the ends of the barrier. To accomplish this, the taper and end should be treated as given in chapter 9 of the ASSHTO Roadside Design Guide (RDG) or the Caltrans Standard Plans. Example treatments are connecting to an existing barrier, attaching a crashworthy terminal such as a crash cushion, or flaring away to the edge of the clear zone.

4. An interim white edge line should be installed from the start of the taper to a point beyond the work zone, rejoining the permanent edge line.

5. The barrier shall not be placed along the merging taper. The lane shall first be closed using channelizing devices and pavement markings. The barrier is then placed on a flare beginning beyond the downstream end of the merging taper.

6. Refer to Caltrans Standard Plans for barriers.

Typical Application 5-34
Lane Closure with Barrier



Mobile Operation on Multilane Road

1. Vehicles used for these operations should be made highly visible with appropriate equipment, such as flashing lights, rotating beacons, flags, signs, or flashing arrow signs (FAS).

2. Protection vehicle #1 should be equipped with an FAS. An appropriate lane closure sign should be placed on protection vehicle #1 so as not to obscure the FAS.

3. Protection vehicle #2 should be equipped with an FAS and truck-mounted crash cushion.

4. 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.

5. When adequate shoulder width is not available, protection vehicle #1 should be eliminated.

6. On high-speed roadways, a third protection vehicle should be used; vehicle #1 on the shoulder (if possible), vehicle #2 in the closed lane, and vehicle #3 in the closed lane.

7. Flashing arrow signs shall be, as a minimum, Type B, 1800 by 900 mm (Figure 5-9, Section 5-05.4).

8. Work should normally be done during off-peak hours.

Typical Application 5-35
Mobile Operation on Multilane Road